

Affect and the experimental design of domestic products

Author:

Keulemans, Guy

Publication Date:

2015

DOI:

<https://doi.org/10.26190/unsworks/18442>

License:

<https://creativecommons.org/licenses/by-nc-nd/3.0/au/>

Link to license to see what you are allowed to do with this resource.

Downloaded from <http://hdl.handle.net/1959.4/54966> in <https://unsworks.unsw.edu.au> on 2024-05-01

Affect
and the experimental design of domestic products

Guy Keulemans

A thesis submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy in Design

Faculty of Art and Design
The University of New South Wales Australia

August 2015

Abstract

This research is concerned with the experimental design of furniture and homewares, and their affective relationships to issues of production, consumption and the environment. Most mass-produced domestic objects use standardised designs and materials, which, apart from their often-noted detrimental effects on the environment, also limit the possibilities for expressivity and affective encounter. Experimental design practices can open up spaces for affective relations with domestic objects. This research proposes that a particular process, that of 'repair', can facilitate these encounters. Transformative practices of repair mobilise intensities, which create new possibilities for re-situating our thinking about, and place within, production and consumption. These different modes of repair are conveyed through the practice-based research, which forms the core of this thesis.

Three experimental design groups from the last fifty years – Italian radical design, Dutch conceptual design and critical design – are examined in this dissertation as the context in which this practice-based research can be located. Practices of these groups which implicitly resonate with concepts of affect are identified. Focus is given to works that address issues of environmental concern, such as consumerism, pollution and product obsolescence.

Concepts of affect from the philosophers Gilles Deleuze and Félix Guattari are used to illuminate these relationships and interrogate how domestic objects and their perception might be better understood. The quality of 'anomaly' – objects that seem to exist outside or on the border of their design type – is shown to be pivotal to these affective operations. Concepts of affect are also used to critique dominant industrial design techniques that emphasise the appeal of surfaces and reduce consumer awareness of their products' material ecologies.

Repair is proposed as an alternative technique for production. The traditional Japanese craft of *kintsugi* is used to demonstrate the propensity of repaired objects to embody dual perceptions of environmental catastrophe and amelioration. I discuss in detail three of my own works, which deploy techniques of experimental design and repair to catalyse awareness of processes of production and consumption, and their consequences for the environment.

Table of Contents

Introduction.....	1
A problem of product design.....	1
Deleuze and Guattari's concepts of affect.....	3
Concepts of affect and the practice of experimental design.....	9
Repair.....	11
Chapter Overview.....	16
Chapter One.....	27
Concepts of affect discoverable in the discourse of experimental design.....	28
Italian radical design.....	31
Droog and Dutch conceptual design.....	42
Critical design.....	51
Chapter Two.....	61
Affect.....	65
New materialism.....	70
Anomaly.....	73
Affective relations of the No. 14 chair.....	75
Formafantasma.....	85
Chapter Three	102
<i>Marble and Steel Room Divider.....</i>	<i>104</i>
<i>Kintsugi.....</i>	<i>113</i>
<i>Archaeologic.....</i>	<i>117</i>
<i>Copper Ice Cream Scoops.....</i>	<i>124</i>
Conclusion.....	141
Bibliography.....	147
List of Illustrations.....	167
Illustrations.....	174

Introduction

A problem of product design

A complex product being made is like one of those films of a glass smashing that they play backwards – all the bits come together in the right place at exactly the right time to be assembled into this thing – it's amazing.

(Jonathan Ive, quoted in Thwaites, 2011: 170)¹

In 2009, Jonathan Ive, the head designer at Apple, presented a speech at the Royal College of the Arts, where he described the design of consumer products as analogous to a film of glass being broken played in reverse (Thwaites, 2011: 170-71). This is a seductive analogy because, while it hints at the complexity of products, their design and the industrial production systems from which they are manufactured, it conveys simplicity and transparency to their completion. However, this belies actuality. For example, an Apple iPhone is made from a vast number of different materials, sourced from environments all around the world, processed into hundreds of different components by technologically sophisticated machines – which are themselves manufactured by other sophisticated machines.² The systems of production involved extend widely and deeply into still more interconnected systems – global shipping and supply lines, marketing, logistics, retail distribution and consumption, and, ultimately reclamation, waste or disposal into the environment. These systems are reported to have serious consequences for social environmental wellbeing. Negative social effects and externalities include such things as

¹ At the Royal College of Art's 2009 *Innovation Night*. Ive's analogy is recalled by critical designer Thomas Thwaites in the opening to his book *The Toaster Project* (2011).

² Ive notes that industrial design is more concerned with the design of these processes than it is with the design of a "physical thing" (Ive, in Hustwit et al., 2009).

children exploited in factories (Lee, 2014), wars fought over “blood metal” mines in Africa (Monbiot, 2013), factory worker suicide (Lan and Li, 2014) and consumers going into debt (Papadimitriou, 2014). Environmental consequences are no less dramatic and include many types of pollution, toxicity (Lu, 2014), resource depletion (Monbiot, 2013), and, perhaps most seriously, carbon and greenhouse gas emissions. The latter increases the advance of global climate change – the effects of which include climatic extremes, flooding, desertification and the acidification of the world's oceans (IPCC, 2013; Patel-Pred, 2008). Such problems are newly urgent, but not newly recognisable, having been iteratively predicted and discovered by scientists and researchers for over the last fifty years.

The complexity of such systems and the impact of their problems are not limited to electronic products such as the iPhone, but involve all types of consumer products – including furniture and homewares, which are the focus of this thesis. Moreover, Ive's analogy can be applied to all designed products.³ Its seductive qualities derive from the implication that, at the final point of packaging, all of a product's complexities, problems and socio-environmental contingencies are smoothly wiped away or dissolved. The product becomes dissociated from its production conditions, no longer embedded in a complex world of relations, but self-contained and conceptually transparent like glass. However, any sense of transparency is ironic, because it is when consumer products are finalised – freshly packaged or just removed, scratch-free, from their boxes – that their worldly relations may be least transparent. It is then that glossy, glamorous surfaces tend to hide most about materiality and conditions of manufacture.

The converse of this situation can be considered by the example of Apple products that have suffered accidental damage. During my experiences teaching design courses at

³ While in this thesis I restrict my analysis of designed products and their environmental impacts to within my theoretical framework, there have been many authors whose work has influenced and motivated my concern for such issues, especially as they relate to practices of design and sustainability. They include Tony Fry (1994 & 2011), Cameron Tonkinwise (2011), Stuart Walker (2006), Naomi Klein (2013), Victor Papanek (1972) Gui Bonsiepe (2010), William McDonough and Michael Braungart (2002), and John Thackara (2005).

university, I have observed and photographed numerous cracked mobile phone casings owned by students (figs. 1–8). These students are consumers who, perhaps due to financial or time constraints, continue to use cosmetically damaged phones for some time, provided they still function. In their new, undamaged state, the sensory qualities of the phones' casing – known as 'shells', 'sheaths' or 'shrouds' in industrial design jargon (Herman, 1975: 10; Loewy, 1979: 13) – are mediated by just a few materials, such as glass, aluminium and plastic, which are cleanly joined and have a simple sensibility.⁴ However, in the images of broken phones, the patterns of cracked glass hint at complexity, and in examples in which the casing has broken through, a number of new relations of materials are revealed in the form of interconnected internal circuit boards, microchips, sensors and other components. It can be considered that this expression – a collection of many materials in connection with other materials — is suggestive of the complexity of industrial and social systems needed to produce such a product, but also the complexity, difficulty, or even impossibility to manage such products as waste.⁵ That images of broken mobile phone glass resonate with Ive's description of glass breaking in reverse suggests his analogy may be quite appropriate for product design, but perhaps incorrect in regard to the direction in which the film is stated to play.

Deleuze and Guattari's concepts of affect

The observation that consumer and domestic products are objects assembled from a collection of materials in connection with other materials is the catalyst for developing a theoretical framework based around concepts of affect. I draw these concepts of affect from the philosophical writings of Gilles Deleuze and Félix Guattari. I will argue that there is a need to understand the complexities of production, consumption and their

⁴ In this thesis I use the words 'sensible' and 'sensibility' in the secondary definition of causing sensation or being made apparent to the senses, less than the more common definition of being in accordance with prudence, logic or wisdom.

⁵ The complexity of industrially designed and manufactured products, in which materials are often more or less permanently connected or bonded together in the form of polymer composites impossible or very difficult to reclaim or recycle, has led to their description as "monstrous hybrids" (McDonough and Braungart, 2002: 81, 99 and 106). McDonough and Braungart adapt this term from its original use by Jane Jacobs to refer to institutional hybrids.

environmental contingencies in terms of materiality, and, moreover, that we must understand materiality in complex, relational ways that do not just refer to simple materials themselves. Deleuze and Guattari's concepts of affect help interrogate the sensory expression of materials by finding the connections between material and relational conditions, and explaining how relational conditions are folded back into material as durations and intensities of sensation (Deleuze and Guattari, 1994: 167-9). In this thesis, I will use concepts of affect to show how a better understanding of domestic, consumer products and their material expressions and relations can be developed.

While the study of affect is broad, the concepts formed by Deleuze and Guattari, and other theorists such as Brian Massumi, Nigel Thrift and Jane Bennett, are well suited for the development of this framework due to the way that they promote an exploration that allows for 'connectivity' and 'openness'. Connectivity is to be understood here not just as the connectivity of one material in smooth relation with another, but rather the capacity a material has to form all types of relations with all kinds of things. Such relations can be smooth and ordered, but also rough and chaotic (Deleuze and Guattari, 1987: 260-2; Deleuze and Parnet, 1986: 93). The analysis that I will develop in this thesis traces these connections through and beyond material in order to uncover networks or fields in which affects operate. This is relevant to production and consumption systems and their environmental problems; for example, Betti Marenko recognises the value of uncovering networks of affect for the purpose of understanding consumer-producer interactions (Marenko, 2010: 141 and 145). Deleuze and Guattari see affect as a transformative force in the world, which is sensed as a charge levelled upon a body, place or thing (Deleuze and Guattari, 1994: 154). Massumi argues that affect is experienced, but this experience is not limited to the subjective viewpoints of humans; rather, it is continuously and contiguously happening everywhere (Massumi, 2000: 187), extending to the non-human and inorganic worlds, and all types of environmental systems and ecologies (Bennett, 2010). That all things experience affect, and are transformed by it, means that affect works as a kind of glue, forming connections between any and all things, and always open to forming still newer connections (Massumi, 2000: 187).

Using an affective analysis within the field of design opens a way to explore the human and non-human together as entangled relations, rather than conducting limited inquiries into products in terms of simply how they work or who produced them as discrete objects. The opportunity that affective analysis provides is to grasp the connection and passage between production, consumption and ecological concerns together, rather than as isolated areas of investigation. Returning to the example of an iPhone with a broken screen, concepts of affect can provide an understanding of the material connections between components, their connection to the hands, tools and machines involved in their manufacture and, further still, their broader relations to places, contexts, societies, geologies, all sorts of ecologies and many other things. The sensory expression of a product's materiality creates an experience of its complex ecologies. I will show how concepts of affect can be deployed to illuminate these relations as material expressions that are bodily experienced.

Concepts of affect also illuminate how the experience of material potentialises action – whether personal, social, political or ecological. The relationship between affect and the power to act is an ethical concept that Deleuze and Guattari develop from the work of the Dutch seventeenth-century philosopher Baruch Spinoza. Affects that weaken affective capacities ‘close down’ potentials or possibilities to act, and those that strengthen them ‘open up’ possibilities to act (Deleuze, 1988: 71). The point is openness – a body should strive to become open to the “greatest number of things”, rather than closed to new affective relations and their possibilities (Deleuze, 1988: 71). As argued by this thesis, the significance of affect is to show that designed products have material expressions that potentialise certain kinds of action. Furthermore, it will be shown that the potentialisation of action is itself an operation of affect in which personal, subjective perceptions and experiences coalesce, then propagate, into larger social, industrial or environmental systems (and back to subjective experience).

This follows a process that Deleuze and Guattari describe as operations of micropolitics and macropolitics (Deleuze and Guattari, 1987: 208–31; Massumi and McKim, 2009: 4–6).⁶ They discuss the macropolitics of security, giving the example of national orchestrations of anti-terror policies as being constructed “by and for a micropolitics of insecurity” (Deleuze and Guattari, 1987: 216). They write that even the smallest of affective operations, “micropercepts, unconscious affect” or “fine segmentations” of experience, have the capacity to aggregate together into massed behaviours at the scale of animal, sexual or political classes. Such masses or classes are, however, leaking affects; they are not constrained masses, but dynamically fluid, temporally and operationally defined, and liable to deform or disperse should their binding intensities abate (Deleuze and Guattari, 1987: 213–14).

A note on terminology: in this thesis, I use the term 'concepts of affect' to describe the conceptualisations of affect, by Deleuze, Guattari, Bennett and others, as they concern the interconnectedness, transformation and operations of things in the world. The term 'affect' itself is used to refer to the transformative potentials that Deleuze and Guattari describe as working through matter and material upon bodies. When I use the adjective 'affective', I am referring to the presence and operations of these transformative forces and intensities. However, it is worth clarifying that these are not emotions, feelings, or what Deleuze identifies in Spinozist philosophy as 'affections', which are the effects of affect (*affectio*), but not affect itself (*affectus*) (Deleuze, 1988: 49). An apt illustration of this difference can be found later in this thesis, when I refer in Chapter Three to the affectivity of earthquakes and other cracking forces in my discussion of Japanese ceramics. I refer to those forces of affect that move through material – through the earth, ground, clay or glaze – and that operate upon the body to become realised in sensation and perception, but these forces are *not* the sensations or perceptions themselves. The sensations then might be entirely material, captured in form as the aleatory line of a crack, or experienced bodily, entirely autonomic and jolting, or characterised by

⁶ Macropolitics is anything beyond individual, subjective politics. It not limited to the definition of politics as concerning governance or relationships between individuals in a society, but rather alludes to a conceptually objective, top-down perspective encompassing sets of relations beyond the individual (Massumi and McKim, 2009: 13, 19).

emotional qualifications, such as fear or shock, or, alternatively, joy or hope. The sensations may also be those that spark complex perceptions, such as the need for resistance or preparation. These are not affects (*affectus*), but are effects of affect (*affectio*). The important aspect to consider is that affect, though directly unknown, is indirectly known by its transformative power as captured in sensation and by its capacities to potentialise new perceptions, contemplations and the opening of possibilities for action within the spheres of production and consumption.

These spheres of production and consumption are described generally and broadly. Producers are considered as the persons or organisations that produce the materials, forms or objects under discussion, by way of design, manufacture or other method. When needed, I discuss specific types of production, such as mining, craft or industrial mass-production. Likewise, I identify specific producers, such as chair makers or metal foundries. Furthermore, I discuss how users and consumers also produce, which they do through their capacities to create, modify and transform material objects. The passage of relations between objects and the environment experienced and negotiated by consumers is at the centre of my research, though I contend that such relations do not necessarily potentialise appropriate responses (and sending objects to landfill is an example of such an inappropriate response). This thesis posits, however, that the practice of repair is an appropriate response, a significant one, that materialises a mode of autonomous production distributed through what is typically perceived as the consumer sphere. Similarly, producers are also consumers – of energy and materials needed for production at the institutional scale, but also at the level of the individual. The factory manager uses and consumes products in the same fashion as his neighbour. This is also true for the designer, who is a user, consumer and producer all at once, and this suggests that they should be especially cognisant of the operation of their activities across spheres of production and consumption. Making such cognisance an active force is part of the practice of this research. It is possible and warranted to understand the distinction between these spheres as loose.⁷ Affect itself does not discriminate – I will show that it

⁷ Though loose, perhaps the important distinctions to make are those of scale and organisation, in which large, hierarchically organised mass-producers have more responsibility to reform their practices than unorganised consumers *because* they have the capability to do so.

operates through production and consumption spheres in a manner that blurs their boundaries and modulates their interconnections and relations. The concern for affective relations between producers and consumers, however, is not a concern for *determining* behaviours or actions; for example, the architect Farshid Moussavi notes that creative practitioners cannot use affects to limit or control. Instead, affective operations may only influence actual experience or any particular course an action may take (Moussavi, in Nico, 2012).

In this thesis, I discuss the 'environment' as the liveable world of shared and intersecting ecologies that is impacted by pollution, waste and climate change in their many specific and negative manifestations. I discuss environmental effects as the direct or indirect consequences and contingencies of such circumstances, that include, but are not limited to, such things as river toxicity, anthropic greenhouse gases, deforestation and pollution diseases. However, it is a limitation of this thesis that I restrict my discussion to those specific problems that present in relation to the experimental design practitioners, work and discourse examined. For example, I discuss the issues of copper toxicity, beech tree deforestation, ceramic production-related lung diseases and fossil fuel powered shipping because such issues concern the works and case studies of this thesis. These works I will introduce shortly. It is, however, worth noting that just as production and consumption can be broadly understood, so too can the environment in regard to its material and ecological relations. Where appropriate, I reflect on the scientific and economic understanding of specific environmental issues, such as copper mining and marble transportation, as arising from systems of production and consumption in which my practice based research engages. Doing so, within the framework of Deleuzian-Guattarian concepts of affect, locates my practice among the broad ecologies of the material world and its expression in sensation and perception. An understanding of these issues and such ecologies and their sensory expressions is developed progressively through the thesis in relation to design. I contend that it is in this material practice of design and its potential to transform the world that the concepts of micro- and macropolitics are synthesised with concepts of affect. I intend to demonstrate that together they illuminate how material relations between production, consumption and environment can be made

sensory within a designed product, and then, mobilised by perception and embodiment, flow back and potentialise changes within socio-environmental ecologies of production and consumption.

Concepts of affect and the practice of experimental design

The idea that designers influence the perception of their work through the manipulation of materials, or factors dependent on materiality such as shape, colour, form and other aesthetic qualities, is not new in design. In this thesis, I survey select groups of design practices for examples of the ways in which affective or affect-like concepts might be implicitly at work. These examples are limited to works of experimental design that embody a challenge to the normative systems of production and consumption and, furthermore, have a direct or indirect relationship to environmental concern.

Accordingly, I have limited my analysis to three experimental design groups from the last fifty years: Italian radical design from the late 1960s to mid-1970s (Branzi, 1984 and 1988; Coles and Rossi, 2013; Sparke, 1988), Dutch conceptual design from the early 1990s and 2000s (De Rijk, 2010; Ramakers, 1998 and 2002; Simon Thomas 2008; Zijl and Boyer, 1997), and critical (or speculative) design from the late 1990s onwards.⁸

In this thesis, I use the term ‘experimental design’ to refer to collective practices of these groups and others, including my own practice. In doing so, I follow the broad use of the terms “experimental” and “experimental design” in the literature to refer to non-scientific techniques and methodologies in design. This includes reference to the experimental design practices of: Italian radical design (Folkmann, 2013: 203; Lobsinger, 2012: 191; Ramakers, 2002: 171, Spencer, 1991: 151); Droog (Brower et al., 2009: 62; Escallon, 2010: 34, 38) and Dutch conceptual design in general (Rock, 2004: 80); and recent critical and

⁸ ‘Critical design’, a term developed by Anthony Dunne and Fiona Raby in the 1990s for its critical approach to normative production systems, has more recently been discussed under the term ‘speculative design’ for its focus on speculative future scenarios. In this thesis I refer to it by the original designation, following from Dunne and Raby’s original definition (Dunne, 1999) and the definitions provided by Matthew Malpass in his more recent taxonomic study of critical design methodologies (Malpass, 2009).

speculative design practices (Hallnäs et al., 2001: 447; Lowry, 2008: 4).⁹ Common to many works from the groups discussed in this thesis is a concern for what Katherine Moline calls the explorative and reflexive practices of experimental design, which embody critiques or challenges to normative, institutional and historical design practice (Moline, 2014: 8–10; Moline, 2006).¹⁰ As will be seen in this thesis, experimental practice has also been recognised in examples dating as far back as the nineteenth century – as in the case of the furniture design of Michael Thonet (Oates & Seymour, 1998: 166; Vegesack, 1996: 83) – and continuing up to the contemporary practice of Formafantasma (Tan, 2014). The role of experimentation in design has also been recognised in practice-based design doctorates (Yee, 2010). Thus, the term is appropriate for describing works that illustrate the argument of this thesis, including my own practice, that might otherwise be situated within the practices of conceptual and critical design. However, it is not constrained by its use here, and it is a limitation of this thesis that I cannot assess other groups and practices whose criteria are sympathetic or crossover with experimental design, such as rhetorical design (Buchanan, 1995), social design (Margolin & Margolin, 2002; Papanek 1972) and adversarial design (DiSalvo, 2012).

The choice to focus on experimentally designed furniture and homewares is partly driven by the understanding that domestic objects may have long-lasting and intimate connections with their owners and users. Such relations are mediated by bodily senses, including vision, but also those felt tactilely or proprioceptively in or on the body. Acknowledging that design is often identified as a visual art, concepts of affect nonetheless de-privilege vision as the primary sensory mode. In my analyses, I refer to those sensations and perceptions that flow from touching and holding domestic objects or otherwise experiencing them bodily. My thesis seeks to open up a space in which one might consider the ways in which the affective operations of domestic objects could offer different forms of potentialising action. Specifically, the concern is how they might

⁹ Though Dunne and Raby distinguish experimental design from critical design by way of the concern in experimental design for “medium” (Dunne & Raby, 2001: 58).

¹⁰ Moline clarifies the colloquial use of the word experimental in the term does not refer to scientific practice, but draws from use referring to new directions in visual art in the 1970s (Moline, 2014: 9)

contribute to less environmentally damaging effects through long durations of use and experience in the home. Deleuzian-Guattarian concepts of affect have been deployed for the analysis of some specific creative arts in relation to the environment – for example, Elizabeth Grosz's 2008 analysis of Aboriginal painting (Grosz, 2008). Further, there is a rich discourse on the role of affect in other creative arts in general; for example, in film (Colman, 2011: 79-88; Bogue, 2003: 65-105; Pisters, 2003; Deleuze 2005a and 2005b), painting, music and writing (Bogue, 1996: 259-69; Deleuze, 2004; Deleuze and Guattari, 1994: 163-199). Yet, I can suggest most people have their homes filled with more objects of design than they do artworks, and may engage with domestic objects on a daily basis more than they might do with cinema, for example. While acknowledging that the affects of different creative works have different qualities and intensities, the array of day-to-day objects embedded in our routines – utensils, furniture, textiles, crockery, ceramic-ware, even door or drawer knobs and other interior fittings – nonetheless present an untapped opportunity for environmentally concerned affect-based research.¹¹ This is an opportunity for designers to develop new forms of practice. Though necessary, it is not enough for domestic objects to be sustainably produced (whichever environmentally responsible production methodology a designer may choose to follow). Rather, as my thesis proposes, products should embody a material expression that pulls consumers (and producers and designers) closer to an awareness of environmental conditions. It has been remarked in news media that contemporary global popular cultures (of films, music and literature) have failed to adequately embody the struggle against climate change and environmental degradation (Merchant, 2013). I perceive this is also the case for most product design, and the purpose of this thesis is to explore the alternative.

Repair

Through the duration of my research, my practice has sought to investigate the sensory capacities of a particular alternative – that of 'repair'. For my practical projects discussed

¹¹ The discussion of Jonathan Ive's analogy that opens this thesis might suggest an investigation into the design of consumer electronic products; however, this is not my practice and the same issues raised by Ive's analogy appear in the discourse of experimentally designed domestic objects, including the kind of furniture and homewares within my own practice.

later in the thesis, *Marble and Steel Room Divider* (2013) (figs. 9–16), *Archaeologic* (2011–14) (figs. 17–22) and *Copper Ice Cream Scoops* (2012) (figs. 23–26), I developed novel techniques for repairing domestic objects. In my studio practice and in professional relationships with industry, this required experimentation with materials that can break or deform (marble, ceramic and copper), but also bond (glues, polymer resins and molten metal). Additionally, I experimented with materials and technologies of design and presentation, both physical, such as the frame, pulleys and ropes of *Marble and Steel Room Divider*, and digital, in regard to photographic documentation and experimental video. The virtue of studio practice is that it facilitates an intimate understanding of the sensorial or perceptual qualities of materials at hand. This is particularly the case when pushing material to structural limits; for example, when it became necessary to break a material in order to experiment with its repair, or tests the limits of its repair.

Outside my studio, the research of industrial practice and the sometimes tricky relationships I formed with industry triggered consequential discoveries. My dealings with stonemasons, mould-makers, ceramicists and metal foundry managers indicated that processes of repair can be poorly perceived by those in industrial production. This general disinterest in repair can be explained by repair practice typically occurring in the post-consumer sphere, or by post-consumer service industries. However, other factors are clearly at work, which are recognised in the design literature as ‘logics of production’ (Branzi, 1984: 47–48, 55). The institutionalisation of an attitude in which repair is counter to normative industrial practice became a concern of this thesis. When, for example, several metal casters told me that the experimental approach I proposed for *Copper Ice Cream Scoops* was sure to fail, I was enthusiastic, but they were disinclined. Developing some of these projects required tenacity to push manufacturers to work against convention. In doing so, I became aware that my activities could be systemically disruptive, with similarity to the materially disruptive practices within my studio, and this orientated my theoretical inquiries. A pivotal moment was in understanding normative industrial practice as *hylomorphic*, which, for the purposes of this thesis, concerns practices of standardisation limiting the sensory expression of material (Deleuze and Guattari, 1987: 409–11). ‘Hylomorphism’ is the imposition of form onto

material, and, when applied in practice, such as in the example of moulds and the practice of shroud design, it tends to set such limits at surfaces (Thrift, 2010: 289–308). Given that hylomorphic practice is dominant in production and consumption systems with socio-environmental repercussions (De Landa, 1997 and 2004: 21; Deleuze and Guattari, 1987: 369; Protevi, 2001: 8), my task became investigating experimental design techniques that modulate material expressions between, and in excess of, hylomorphic limits. I also recognised such practices – uncovering an otherwise hidden materiality – embodied in the works of other experimental practitioners, such as Formafantasma and Thomas Thwaites.

It is illuminating to follow experimental and transformative repair practices that go beyond restoring function to broken products, and rather transform an object's affective relations, due to their literal framing of broken surfaces. Crack, voids and surface irregularities are explored in my practice as features that expose material conditions and break or go beyond hylomorphic limits. The repair of such features, the reconnection of surfaces with glue or metal and the application of optical effects and devices of design, fill the continuous middle between such limits. These processes demonstrate that complex and powerful sensory compounds become embodied by transformative practices of repair.

A key contribution of this practice-based research project is that the sensation of cracks and damage in domestic objects, and the expressions of their repair, have affectivities that transform the perception of objects. I have attempted to theoretically engage with the complex compounds of sensations and perceptions that flow from broken and repaired objects, and I argue that damaged things, including damaged products (but, more broadly, also systems damaged by social or ecological calamity), can be experienced as an obstacle: a weakening of the capacities or potential for action at micro- and macropolitical levels. This concerns Deleuze's framing of the Spinozist concept of affect in which weakening affective capacities close down potentials for action or response (Deleuze, 1988: 71). In other words, an expression of affects that closes down rather than opens up possibilities for living. I will discuss the perception of damage in consumer

products, that is often imagined as a finality without recourse. In paradigmatic practice, such perceptions are accentuated by design techniques such as built-in obsolescence, in which consumers, confronted by a broken product, may see no options other than replacement.¹² However, in Chapter 3, I discuss the traditional ceramic repair craft of Japan, known as *kintsugi*, that illustrates a way in which processes of repair – the joining and decoration of cracks with gold and silver – preserve the affective potency of damage as a result of concussive forces shared with the geological world, but ameliorate their most sensational encounter via micropolitical affects that are contingent to the application of those metals. The following analysis of my works *Archaeologic* and *Copper Ice Cream Scoops* extends the analysis of this process to show how new relations of contemporary and environmental significance generate and potentialise further possibilities for repair or restoration. I will show that when repair is embedded as an extant, material capacity, micropolitical affects of damage and repair may aggregate at the macropolitical level. I will argue that this is significant at this point in history, not only because it can strengthen the awareness of imminent environmental catastrophes, be they natural (such as earthquakes) or effects of anthropic climate change, but because it facilitates the development of repair culture and indicates that there are conceivable and practicable possibilities, within the capacities of design, to improve, fix or repair the world.

This thesis does not attempt to comprehensively assess the many other styles or typologies of repair in the world, though they also have, or may develop, great potential for solving environmental problems of production and consumption. Repair is an endeavour intrinsic to human culture. A number of museological artefacts dating from antiquity to the nineteenth century, including an ancient Egyptian coffin, Japanese ceramics, a Native American baby's cradle and George Washington's last will, all show evidence of repair over the course of decades and, in some cases, centuries (Portell, 2003). This illustrates the significance of repair as a historical practice that maintains objects in varied settings ranging across domestic and political contexts. Today, in developed

¹² Practices of built-in or planned obsolescence have been identified as key contributors to material waste, pollution and environmental destruction. For a comprehensive analysis, see Giles Slade's *Made to Break – Technology and Obsolescence in America* (2006).

countries, repair is associated with 'do-it-yourself' (DIY) home maintenance and production culture – an association that dates from at least the nineteenth century (Mitchell, 2011: 71).¹³ This thesis is not focussed on the broad historical discourse on repair, though some aspects and modes of repair, and their decline, are contextualised in Richard Sennett's *The Craftsman* (2008).

There is a contemporary interest in repair; for example, in the form of 'fix-it' clubs and websites that often focus on the repair of electronic products (Vince, 2012). These are complemented by the contemporary movement for 'hacking' and 'modding' – the practice of accessing and modifying the functions of consumer electronic products (Johnston, 2013). Both interests counter specific design practices that arose in the twentieth century: built-in obsolescence and 'black-boxing'. In the former, the early obsolescence of a product is planned for the purposes of cost or profit, while black-boxing (a term originally used in computer science and now known in design) refers to when the functional structure, construction methods or internal components of a product are hidden from consumer view or access. Such practices deprive users from the full capacities of the product to be understood, serviced, repaired or modified (Mitchell, 2011: 110–16). In the second chapter of this thesis, I will touch upon these issues as they relate to expressions of hylomorphic practice; however, I do not deal with such practices in depth, because the focus of this thesis is on experimental design, transformative repair, and their unique capacities to potentialise shifts in the perception of environmental aspects of production and consumption. While hacking and modding can be considered experimental design practices, they are not necessarily concerned with repair, and while fix-it clubs and websites can be considered repair, they are not necessarily experimental, nor transformative, in regard to material practice. Broken parts are not typically repaired at the component level, but rather replaced, and this makes the contemporary repair of electronic devices, in some respects, replacement rather than repair.¹⁴ The discourse as it exists for those contemporary practices concerned with experimental repair is sparse. A notable event was Platform 21's workshop, manifesto and series of exhibitions titled

¹³ DIY culture continues today in the form of the 'maker movement', embodied by such things as Make Magazine and its website, and often concerned with distributed production technologies such as 3D printing (Make Magazine; <http://makezine.com/>).

Repairing (2009–2010), for which I contributed several works (van der Zanden, 2011; Schmidt and Hendriks, 2010; Sommariva, 2009).

An observation that has motivated the research for this thesis is that repair can be stigmatised as second rate. There is a concern for repair outcomes to be 'like new', in which a repair restores functional use and then conceals the evidence of repair.¹⁵ This is usual in motorcar repair, for example. However, this is not to say that the macropolitical effects of such repair are not transformative, and it is a concern of this thesis that all styles and typologies of repair become both de-stigmatised and more widely practiced. I propose that the unique capacities of experimental design may catalyse and contribute to such a shift and make repaired objects more accepted in mainstream design, addressing issues that arise from production and waste.¹⁶

Chapter Overview

Through the next three chapters, this thesis iteratively explores alternatives to normative design practice through the framework of Deleuze and Guattari's concepts of affect. While concepts from their philosophical works have been utilised in product design before, notably by Bernard Cache (1995) and Greg Lynn (2004), there is an absence of Deleuzian-Guattarian concepts of affect in the practice of product design. However, there are ideas and practices within the field of experimental design that resonate with

¹⁴ This is not to denigrate its value, and it has been observed that electronic products can be restored to working order just from the simple act of opening, disassembling, cleaning and reassembling them (and with parts cannibalised from other non-functioning devices, if necessary) (Mitchell, 2011: 123).

¹⁵ This stigma for repair is even observable in museological practice, in which repair is discussed as negatively impacting the significance of an archaeological object (Portell, 2003: 377).

¹⁶ While beyond the scope of this thesis, it should be mentioned that a logical extension of some sustainability frameworks, such as McDonough and Braungart's *Cradle to Cradle* (2002) is that enhanced recycling may do away with the need for repair. From the perspective of this thesis, even 'perfect' material recycling streams in theory do not address problems of hyper-consumption nor the dominance of the hylomorphic model of production. Regardless, in practical terms there are problems with recycling, such as energy costs and iterative material degradations. Repair is a especially pragmatic solution for those materials, such as thermoset cross-linked polymers and their application as composite materials, that are currently difficult to recycle.

concepts of affect – even if the theorisations of these ideas and practices do not refer to affect explicitly. Such research, as I will show in Chapter One, tends to show concern for the experience, emotion, perception and sensation of designed products. The content of Chapter One serves to illustrate, firstly, how experimental designers concerned with issues of production and consumption and their environmental contingencies have mobilised the sensory qualities of products. Such practice contextualises the environmental concern of my own practice and locates its place within the discourse of experimental design. Secondly, this historical investigation helps to reveal a gap in the analyses of earlier designers, where a rigorous application of concepts of affect might add to our understanding of how experimental design can generate environmentally focussed methodologies and practices.

The particular examples from the three experimental design groups under discussion were chosen because they address relationships of design to production, consumption and the environment. Together, they draw a selective map of experimental product design concerned with these relationships. I intend to show that in their works, practices, and terminology, as well as in the scholarly literature discussing these groups, there are similarities (or significant dissimilarities) to Deleuze and Guattari's concepts of affect. While I suggest that, overall, little has been explicitly noted in the literature about the role of affect in these groups' practices that might help us reconsider the ways they approached the issues of production, consumption and the environment, I argue that designers from these groups have practices that are implicitly affective and relevant to such issues.

The analysis of each group imparts discoveries about the role of experimental design practice that drives the argument of this thesis forward. Italian radical designers, such as Andrea Branzi and Ettore Sottsass, were cognisant of the way the aesthetics and sensation of designed products modulated consumerism; moreover, they were aware of how such qualities were exploited by industry and business in an ongoing process normalising the environmentally destructive capacities of production (Branzi, 1984: 47-8, 54-5; Radice, 1993: 109). The Dutch conceptual designers were concerned with the

expression of non-theoretical concepts in their work (De Rijk, 2010: 172, 174), which, I argue, are mobilisations in which affect gives force to innovative strategies that attempt to circumvent, subvert or alter the relations between designers, producers and consumers. For example, Hella Jongerius' generative strategies, whereby she manipulates manufacturing conditions to produce unexpected or randomised effects, is of particular interest to this thesis for suggesting novel techniques that might potentialise change within production contexts.¹⁷ Lastly, the practice of critical designers is assessed for its active role in challenging the standard practices of industry via the proposal of critical or speculative scenarios. I analyse the design of Thwaites' DIY electric kitchen toaster (figs. 32-37) for the way it critically opens up the understanding of complex industrial processes – of the type implicit in Jonathan Ive's quote above – which present a serious threat to social and environmental wellbeing. The analysis of these projects adds insight and contemporary perspective to the conditions that face experimental product designers, such as myself, who wish to make changes to normative practices of product design.

To that extent, the work of Chapter One also locates my own practice (in anticipation of its analysis later in Chapter Three) and contextualises the contribution this thesis makes to the discourse of experimental design – insofar that design practice, research and theorisation all contribute to design discourse (Faust, 2008: 102–5). Just as Chapter One will show how affect is implicit in the discourse of experimental design, the following chapters bring affect explicitly into the discourse. I note De Rijk's claim that there is a general lack of theorisation within Dutch conceptual design, so it is also intended that this thesis contributes some useful theorisation to that discourse (De Rijk, 2010: 172, 174). An argument of this thesis is the role experimental design can have in challenging the paradigms of industrial production, and I will show that this is a role taken up in my own practice and by other designers examined in this thesis, such as Hella Jongerius, Anthony Dunne, Fiona Raby, Thomas Thwaites and Formafantasma. Dunne and Raby, in particular, have identified this role as pivotal for critical design and linked it to Italian

¹⁷ 'Generative' here refers to the processes of a system between designer and product that vary or alter the expression of the product within a series (Fischer and Herr, 2002; Keulemans, 2012). Generative techniques are an interest of my practice, which I develop in Chapter Three through processes of repair.

radical design (Dunne and Raby, 2013: 6). However, as I found during research into the scholarship on experimental design, this link skips over the Dutch conceptual design that lies roughly between Italian radical design on the one hand, and critical design on the other. Hence another purpose of Chapter One is to connect and strengthen the understanding of how affect is an implicit concern for all three groups in regard to their strategies for addressing production and consumption paradigms.¹⁸

Yet, *how* the strategies of these three groups may work to potentialise changes to production and consumption is not fully clear from the scholarly literature about these designers. A role for affect resonates through reference to aesthetics, sensation and perception, emotion and changing states of being, among other sensory-related aspects, but without rigorous theoretical discussion (such as that which has been devoted to affect in painting, cinema, indigenous art and literature, for example). While researchers such as Nigel Thrift, Tom Roberts and Betti Marenko have discussed operations of affect in normative product design (Thrift, 2010; Roberts, 2012; Marenko, 2010), and while such research guides the argument of this thesis, to my knowledge, there is a gap in scholarly analysis regarding how affect operates in the *experimental* design of consumer and domestic products. It is this gap in knowledge that I begin to address in Chapter Two.

Chapter Two begins by explicating the key concepts of affect significant to experimental design. In regard to terminology, I refer to Deleuze and Guattari's *concepts of affect*, instead of using the more widely used term *affect theory*. I do this for a number of reasons. Firstly, this is because of the regard that Deleuze and Guattari have for concepts as creative tools that create, activate and open up thinking, and serve the purposes of

¹⁸ My own interest in the intersections between these three groups derives from undertaking my Master's degree at the Design Academy Eindhoven (DAE) under the tutelage of Gijs Bakker and others active in Dutch conceptual design, including Bas Raijmakers, a former doctoral student of Dunne and Raby. During this time I contributed works to a reconstruction of an Ettore Sottsass exhibition at the Marres Centre for Contemporary Culture (Smits and Beumer, 2009; van de Kroef, 2010). Alongside me as Master's students at the DAE was Simone Farresin and Andrea Trimarchi of Formafantasma who had previously done their undergraduate study under the tutelage of Gilberto Corretti and Paolo Deganello of Archizoom, informing the development of their critical practice (Trimarchi, personal correspondence, 30th October 2012).

“artists and scientists” as well as philosophers (Stagoll, in Parr, 2010; 53–54). Given that their concepts of affect have been rarely used to interrogate experimental design, I see value in keeping their use and discoveries open-ended. My use of the term makes this concern explicit. Secondly, it has the benefit of indicating that my explication of affect is limited to particular concepts from Deleuze and Guattari (and from those who develop their work) that I believe have relevance to matters of design and the environment. This distinguishes my theoretical framework from the many other applications of theories of affect in the humanities and social sciences. That there are so many different theories of affect, in disciplines such as psychology and cognitive science, may be the result of what Melissa Gregg and Gregory J. Seigworth assess as the intersubjectivity of affect and its capacity for multiple readings that resist the stratification or concretisation of knowledge (Gregg & Seigworth, 2010: 3–4). It is not necessary to describe such theories here, but Gregg and Seigworth detail them in the introduction to their book *The Affect Theory Reader* (2010). However, it is worth mentioning that the specific concepts of affect that I deploy have some distinctions from the general qualities of such affect theories. For example, they are concerned with matter and material, at both the philosophical and practical levels, and they are not limited to the human universe, extending across the entire material world, both organic and non-organic.¹⁹ As previously mentioned, these qualities distinguish affect from such things as emotions and feelings that are implicitly or explicitly human or animal (these topics are more fully addressed in Chapter Two). Emotions are, however, expressions of affects at the level of the subject or self, and such expressions diffuse into social registers by affective means (Gregg & Seigworth, 2010: 8). This results in an imbrication of emotion and affect within the study of sensation and perception. For this reason, concern for emotion in design becomes a signal of concern with affect in experimental design in relation to issues of production, consumption and the environment in Chapter One. This is a translation from one discursive context to another, using the vocabulary of affect and giving focus to material forces and capacities. It is also worth noting that this thesis uses the term ‘concept’ in its general definition as

¹⁹ While I closely adhere to the concepts of affect developed by Deleuze and Guattari (and from the researchers they influence), my focus is sympathetic to broader movements in the affect theory community – in particular, those that develop affect as a tool for opening up social and political spaces for critical interrogation (Figlerowicz, 2012: 7).

an idea or object of thought, and not in the ontological definition of concept that Deleuze and Guattari develop in *What Is Philosophy?* (1994), although I reference that book for its discussion of affect.

The explication of concepts of affect in Chapter Two then continues through the use of two main case studies: the *Thonet No. 14* chair by Michael Thonet (1859) (fig. 27) and *Botanica* by Formafantasma (2011) (figs. 28–31). The *Thonet* chair was an experimental, innovative product at the time of its development, and thus fits within the concerns of this thesis for experimental design. However, the *Thonet* chair is also a widely known, mass-produced piece of furniture used in and outside the home for decades. While the focus of this thesis is on experimental design that has often limited public availability or access, the ubiquity of the *Thonet* chair indicates that the concepts of affect I deploy are also suited to the interrogation of widely used, mass-produced objects. The *Thonet No. 14* chair case study explores the extent to which concepts of affect can open up the relations of design development, manufacturing and use, through to the impact of product design on society and the environment. As a commercial and domestic product more-or-less continuously manufactured for 150 years, the *Thonet No. 14* chair offers a rich discourse for an affective analysis. This analysis examines the role of this particular chair, and the role of some of its alternate versions, such as the *No. 18* chair (1876), in transforming the social and environmental relations of the Industrial Revolution – including its effect on deforestation, circus subculture and macropolitical concerns, such as labour relations and cafe culture. The opportunity created by the concepts of affect I deploy is to grasp the connection and passage between production, consumption and ecological concerns together, rather than as discrete areas of investigation. For this purpose, I refer to Jane Bennett's concepts of new materialism, developed from the work on affect by Spinoza, Deleuze and Guattari (Bennett, 2010), to suggest the scope of horizontalised relations between the human, organic and inorganic worlds.

For the analysis of Formafantasma's work, I extend my theoretical framework, using additional concepts of affect developed through the work of Deleuze and Guattari. This includes the concept of affective 'depth of field' from Deleuze's books on cinema

(Deleuze, 2005b: 106-9), and 'machinic phylum', a concept from Deleuze and Guattari's *A Thousand Plateaus: Capitalism and Schizophrenia* (1987: 335, 395-398, 407-11). Deleuze remarked that he considered concepts as toolboxes (Deleuze and Foucault, 1977: 208). The concept of machinic phylum in this regard is a tool for uncovering the continuous modulation of expressive forces moving through material. In contrast, the logic of hylomorphism is a toolset that divides form from materiality. I will examine this aspect of hylomorphism in regard to its dominance in the practice of contemporary design and production and its complicity in environmental destruction. I note that such design and production paradigms include black-boxing and the associated practice of shroud design that also hides internal parts from view or access.

However, just as the affects of domestic objects can hide relations to the detrimental effects of industry, so can design reveal these relations. To expand upon the concept of connectivity afforded by affect, Chapter Two investigates the concept of the *assemblage*, that concerns relations between individuals, products, the environment and systems. These relations are not things, but movements from one thing to another – passages that flow through affective fields or networks. It will be shown that such movements flow through materials, and when a subject, such as a user, designer, producer or consumer, becomes immersed in an affective field via sensory engagement with the materiality of a product, an assemblage may form (Deleuze and Guattari, 1987: 73, 503). Assemblages are particular formations on affective fields in which there are "productive intersections" between actions and affects (Buchanan, 2015: 390). As an example, when a product breaks or stops working its user may be pulled into an assemblage that urges some kind of action. That action might be disposal, an action that subsequently expresses an affect of wanting or needing. This might compel an action in response, such as re-purchase of the same or similar product. I argue, however, that such relations between action and affect can be disrupted by particular kinds of design that have potential to create new relations and shift or transform the assemblage in ways that reveal conditions of materiality, production and environment. This potential is contingent on qualities of 'anomaly'.

The concept of anomaly, which Deleuze and Guattari introduce in *A Thousand Plateaus* in their description of the great white whale from Herman Melville's *Moby Dick* (1851), is examined as an operator that potentialises shifts in relations to form new assemblages (Deleuze and Guattari: 1987: 245–46). Chapter Two indicates the importance of creative production in facilitating such operations, and I argue that experimental design, in particular, mobilises anomalous qualities for the production of new sensations and perceptions. I describe anomalous experimentally designed objects as being positioned between two or more affective fields, sharing some characteristics from each, and strengthening the connection between them. This potentialises assemblages and creates new passages across diverse affective fields. Formafantasma achieve these new passages in *Botanica* by deploying a range of material anomalies that result from the use of historical plant and animal-based polymers. The contemporaneously perverse use of such materials produces unexpected visual and haptic sensations in the form of their products – including cracks, voids and surface irregularities that work against hylomorphic practice. Such anomalies alter the perception of polymer plastics and create the perception of an alternate history of industrial production, potentialising a transformation in relations with environmentally destructive petrochemical culture. In Chapter Three, I continue to explore how anomaly works in this way, and how experimental designers can deploy it as a device to shift the perceptions of products and their environmental contingencies, especially in regard to such things as their production conditions, material obsolescence, durabilities and repairabilities.

In the same chapter, I introduce my design practice through three works that deploy or present repair techniques in different ways. These works are representative of my practice in that they span both exhibition and use contexts. Though they may challenge normative perceptions of domestic products, they are, however, at the same time designed to be functional. This distinguishes them from the prototypes of some other experimental designers for example works by, Dunne and Raby. Despite this distinction, like Dunne and Raby I consider exhibitions a powerful site for engaging an audience via testing and challenging public perception (Dunne and Raby, 2001: 65). I could observe or deduce the audience's experience of my work during exhibition as a result of this

strategy. In some cases this strategy is overt, as with the *Marble and Steel Room Divider*, which has different modes of presentation for home use and exhibition display. All the works included in this thesis were exhibited at least once, and/or many times in the case of the *Copper Ice Cream Scoops*. The reception to the works during exhibition informed my understanding of their affective power, especially when I could encourage viewers to also handle the works. However because of the informal nature of these encounters I will not rely on them as evidence for the arguments of this thesis, so while I reflect upon them as appropriate, I restrict these reflections to footnotes. Instead, I focus on using concepts of affect to analysis the works through their material properties, capacities and relations, in ways that I will now introduce.

The *Marble and Steel Room Divider* presents an otherwise anonymous industrially repaired marble slab with the intention to highlight the stigma with which broken stone objects are treated in typical producer-consumer relations. The frame that hangs this marble slab for its function as a room divider is designed to open up the viewer to an awareness of industrial marble production, accentuated by the use of anomalous features, such as cleats and pulleys, which embody perceptions of tension, weight and collapse. I explain how such features *load* the sensation of the work, so that the perception of its extended relations to the environmental effects of marble production is potentialised.

As previously mentioned, in Chapter Three a case study of the Japanese ceramic repair craft of *kintsugi* precedes the analysis of my following work *Archaeologic*. The material expressions of *kintsugi*, which include delicate inlay of silver or gold into the cracks of repaired ceramics, is proposed as a historical precedent for the embodiment of socio-environmental relationships between people and the geological world. *Archaeologic* then develops the concept of embodying socio-environmental relations through the anomalous use of photo-luminescent pigments, in which the sensory qualities of *kintsugi* are combined with the affective relations of twentieth-century material technologies.

Throughout Chapter Three, the concept of affect working in different speeds and durations, introduced in Chapter Two, is used to propel the analysis of *Marble and Steel Room Divider*, *kintsugi*-ware, *Archaeologic* and the final work, *Copper Ice Cream Scoops*. I will show how such speeds and durations are significant for their role in the genesis of form from the material world (Deleuze and Guattari, 1987: 511). This is the process known as *morphogenesis*, steered by speeds and durations of dynamic, intensive properties, including “temperature, pressure, and chemical concentration” (De Landa, 2002: 4).²⁰ Affect is discussed in regard to this process, in which the ecological is folded into the experience of material and form as sensation. Deleuze and Guattari state that sensation is preserved in the durations of materials, from which perceptions arise (Deleuze and Guattari, 1994: 166). Through my practice, I illustrate how designers can mobilise timescales, speeds and durations of creation, sensation and perception, as both theoretical tools and practical concepts, connecting the experiences of material to environmentally significant conceptions of the past and future. For the *Marble and Steel Room Divider*, this includes an explanation of the geological formation of cracks; for *kintsugi*, an explanation of morphogenetic concussive forces; and for *Copper Ice Cream Scoops*, the intensive forces that influence the casting of metal. Speed and duration are significant in the practice of metallurgy, both by themselves and in their effect on temperature and pressure, and De Landa explains that changing the speed or duration of one factor in relation to another has consequences for the production of “new design” (De Landa, 2002: 97).

Copper Ice Cream Scoops additionally develops the experimental methods of transformative repair via intervention in the normative hylomorphic process of lost-wax casting. The flawed and anomalous products that result from this process resonate with the scale and history of metal mining and, furthermore, necessitate a kind of repair prior to, rather than following, consumption. I argue that this feature embeds a potential to draw users towards a greater awareness of material durabilities and repairabilities in

²⁰ ‘Morphogenesis’ is a term borrowed from biology referring to embryology, but Deleuze and Guattari use an explanation of its processes to derive ontological principles of form-creation beyond the biological, to which Manuel De Landa then applies the term (Deleuze and Guattari, 1987: 57–59).

general, shifting relations to potentialise beneficial socio-environmental possibilities for action.

An in-depth discussion of the practical outcomes of such possibilities for action are beyond the scope of this thesis, but could include strengthening or evolving the repair crafts and industries, an increase in more distributed or horizontalised producer-consumer relationships, or a reduction in the development or acceptance of design techniques such as built-in obsolescence, black-boxing or shroud design. While acknowledging that normative design paradigms may be difficult to alter or circumvent in industrial practice, at the end of this dissertation, I will reflect briefly on current design practices and the future directions for research and experimental design of domestic products in regard to these possibilities.

With the current level of concern for the environment, prompted by global climate change, resource depletion and increasing levels of waste and pollution, it is reasonable to suggest that a new approach to the design of domestic products is needed. In this thesis, I will propose that by bringing concepts of affect drawn primarily from the work of Deleuze and Guattari to the understanding of experimental design, new approaches become possible. These concepts provide a rich interpretative framework with which to develop new contemporary design practices focused on issues of production, consumption and the environment. My work attempts to fold socio-environmental relations into a sensible materiality through the implementation of experimental repair and design. These relations entangle environmental contingencies – for example, pollution and energy waste – to the extent that a heightened environmental awareness comes about through engagement with the work. From this base of urgency, affects of repair launch and compound with environmental awareness to trigger, potentialise and embody new possibilities for action.

Chapter One

The purpose of this chapter is to explore how experimental design concerned with issues of production, consumption and the environment correspond to Gilles Deleuze and Félix Guattari's concepts of affect. Three experimental design groups are described to illustrate this correspondence: Italian radical design between the late 1960s and the mid-1970s; Dutch conceptual design of the 1990s and 2000s; and the work of critical or speculative design practitioners (operating worldwide) since the late 1990s. Together, these examples draw a selective map of experimental product design practice concerned with the aforementioned issues of production, consumption and the environment. I shall show that these works, criticism, terminology and practices have correlations and affinities to Deleuze and Guattari's concepts of affect. This thesis contends that, until now, design literature has paid little attention, overall, to the role of affect and its relevance for these issues. I aim to show that affect is a productive framework for illuminating these issues in the design practices I discuss, because they are implicitly affective. This chapter will briefly introduce Deleuze and Guattari's writings on affect in order to understand how domestic product design can be understood in new ways. Later, Chapter Two will articulate their concepts in depth. Following this, Chapter Three will provide a deeper enquiry into the role of affect in experimental product design, considering my own design practice.

As noted in the Introduction, my use of the term 'concepts of affect' has no specific relation to Deleuze and Guattari's ontological use of the term 'concept' in their book *What Is Philosophy?*, and neither use has specific relationship to the practice of conceptual design discussed in this chapter. I use the word 'concept' in concepts of affect in its general definition, while 'conceptual design' is a name referring to mainly, but not exclusively, Dutch practitioners associated, loosely or not, with the organisation Droog in the 1990s and 2000s. Droog co-founder Renny Ramakers had a concern for the

importance of communicating concepts through product design (Ramakers, 1998: 9), as did co-founder Gijs Bakker (Meroz, 2014: 179).

The examples I choose for my discussion of radical, conceptual and critical design in this chapter have been selected because of the particular way they address the negative impacts of production and consumption on the environment. Italian radical design of the 1960s responded to a nascent awareness of the relationship between population growth, pollution energy use and the global dissemination of consumer culture (Antonelli, 2011; Sparke, 1990: 200). The subsequent Dutch conceptual design addressed the problems of mass-produced, post-consumer waste and industrial decline in the Netherlands (Simon Thomas: 2008: 197, 208–209). Most recently, critical design has presented global environmental concerns through speculative future scenarios for products that attempt to entice or shock the audience with alternative visions for consumption, production and living (DiSalvo, 2009: 53; DiSalvo et al., 2011: 186). While the scope of experimental design from these three groups is much broader than these topics imply, the selection here is based on their proximity to such concerns. I have also included examples that resonate with my own affect-aware design practice, which aims to bring about closer relations to environmentally ethical modes of production and consumption, with a particular focus on homewares and furniture. This focus is motivated in part by my commitment to designing domestic objects that can prompt long-lasting and intimate connections with their owners and users within the home. Through this research, I aim to show that such connections or relations, while impossible or impractical to prove, can potentialise operations of affect.

Concepts of affect discoverable in the discourse of experimental design

In this chapter, I use terminology related to aesthetics, sensation and perception of materials, forms and objects as a practical guide to indicate when a work or topic of discussion may facilitate a reading relevant to concepts of affect. This is partly necessary because the actual term “affect” is infrequently used or omitted in the literature I examine. Nevertheless, there are particular modes of thought in the literature examined

that correspond to concepts of affect. For example, a concern of Italian radical design was to transmit sensation. My argument is that, while such design may not work in ways that explicitly deploy concepts of affect for purposes relevant to production, consumption and the environment, they implicitly use or deploy them. To recognise this implicit use and to perceive the sympathetic ideas that exist in the historical discourse of experimental design, an introductory overview of Deleuze and Guattari's concepts for affect is required. In the following paragraphs, I introduce key concepts of affect concerning connectivity, transmission of sensation, assemblages and the construction of perception regarding time. However, for the purposes of this chapter these descriptions are only brief. Later in Chapters Two and Three I will explore these concepts in detail.

Deleuze and Guattari define affect by its qualities of openness and connectivity. Affect connects material through sensation to human and non-human experience and back again to matter, and has a glue-like capacity to bind all sorts of experiences, things, sensations or perceptions together (Deleuze and Guattari, 1994: 169; Smith, 1996: 40–41; Massumi, 2002: 217). In this chapter, I attempt to show how the three groups under discussion have an approximate understanding of such connectivity. For example, Italian radical design was concerned with the way the sensory experience of designed products could bind users into consumption patterns. For Deleuze and Guattari, affective connectivity is modulated by intensities of sensory experience (Deleuze and Guattari, 1987: 260–262; Deleuze and Parnet, 1986: 93). Concepts such as this indicate there is an implicit operation of affect in domestic objects and suggest that experimental design is concerned with affective connectivity, even if this is not directly evident from the explanations provided by the designers and their critics.

Another concept of affect concerns the flow and transmission of sensation through materials that bind us to sensory qualities (Smith, 1996: 40–41). Materials present a composition of forces, which pull us into a relation with objects. However, people are not required for the transmission of affect, since it also works at the non-human level; for example, there are affective relationships between materials and objects, or between animals and their environments. Together, affective relationships bind into networks or

fields. Deleuze and Guattari develop the concept of 'assemblage', which can be perceived as a totality that coalesces or emerges from an affective field (Deleuze and Guattari, 1987: 73, 503). The term takes the concept of affect beyond a set of experiences or sensations, and pulls the subject towards possibilities for action. When assemblages include humans, an object, such as a designed product, through the sensory qualities of its material, can activate a passage between experiences of use and practices of production or consumption. In doing so, assemblages place people in transformative relation with the world. A significant aspect of this transformative relation is how affects flow through material to modulate the perception of time, continually shaping and re-shaping the imagination of the past, present and future, and subsequently the experience of the world (Deleuze, 2005: 99–109). This aspect has relevance to the speculative scenarios of critical design in particular, which will be discussed towards the end of this chapter.

The resonances to concepts of affect uncovered in the literature are explored as unique to each group under discussion. Within the framework of this thesis, the concerns of Italian radical design can be understood as based in materiality. As I will detail, designers such as Ettore Sottsass and Andrea Branzi were interested in the way the shape and form of products modulated an aesthetic flow from producers to consumers. The literature on Italian radical design is rich in references to sensation, perception and other terms implicitly suggesting affect, and so receives the most attention in this chapter. For Dutch conceptual design I argue that affective concerns presented as an interest in the communication of concepts. These are examples of Dutch conceptual design where the chosen concept *is* affective transmission but, more significantly – as I will argue, using the example of Hella Jongerius – conceptual communication *in general* can be understood as a materially embedded affective transmission. The concern for affect has become more explicit in critical design discourse due to work of theorists such as Carl DiSalvo, Ezio Manzini and Victor Margolin, who call for a social form of design concerned with the proposal of speculative scenarios (DiSalvo, 2011; Manzini, 1992; Margolin, 2007). These theorisations correspond in some ways to Deleuze's concept for how affect operates to construct an imagination of the past, present and future. This is illustrated in relation to matters of production, consumption and the environment at the end of this chapter

through the example of *The Toaster Project* (2011) (figs. 32–37) by critical designer Thomas Thwaites.

Italian radical design

Italian radical design developed as a response to the rising consumerism that resulted from rapid economic changes to Italian society during the 1950s and 1960s (Sparke, 1990: 186–190). After World War Two, manufacturing boomed, particularly in Milan’s furniture and homewares industry (Branzi, 1984: 45).²¹ The designer and theorist Enzo Mari describes these changes as an acute transformation for a country formerly “filled with mules and donkeys [on] dirt roads” (Mari in Bosoni, 2006: 336). In other words, Italy quickly changed from an agricultural economy to a consumer economy. By the late 1960s, however, the economic effects of the boom years had led to social unrest, resulting in protests and strikes (Branzi, 1984: 47–48). While these protests were initially focussed on working-class labour conditions, young designers, suspicious of their parent’s consumption and social politics, extended the field of protest to include issues of consumerism and environmental wellbeing (Sparke, 1990: 186–90).²² These designers proposed a wide range of different approaches and arguments to tackle such issues, but shared enough commonality to create a “radical bind” (Lang and Menking, 2003: 14). This became known as Italian radical design and was characterised by experimentation, ideological activism and critiques of aesthetics, consumerism and the environment (Sparke, 1990: 200).

For Italian radical design, the relationship between aesthetics, industry and consumerism was a core concern in which industry was perceived to be engaged in socially and

²¹ The expertise in product prototyping and manufacturing, especially around Milan, was utilised by Italian radical designers for industrial and experimental prototyping (Bosoni, 2006: 18). Italian firms of these years were especially efficient in prototyping and small-to-medium production. Firms specialised in particular areas and collaborated heavily with other manufacturers. This was due to unique economic conditions in Italy at the time. Lack of capital prevented them from investing into tooling for broader or more integrated services (Spark, 1990: 196–198).

²² Such events were reflective of the broader political unrest happening throughout Europe by 1968.

environmentally problematic production. An early view on consumerism, articulated by Ernesto Rogers in his first editorial for the Italian design journal *Domus* in 1946, advocated for a more critical and philosophical understanding of domestic products. He explained that the design of a house is not just a problem of design, but a “problem of limits” set by culture (Rogers, in Mekinda, 2012: 167). The design of a house is the process of adjusting to such limits through the adoption of styles and techniques that go beyond design as merely the production of objects and instead establish a morality for building a better society (Rogers, in Mekinda, 2012: 167). By the mid-to-late 1960s, a selection of designers, including Branzi, Superstudio, and Alessandro Mendini, began to question the limits of design and, in particular, the use of aesthetics by industry and business to articulate social relationships. In short, they advocated for design to be less dependent on industry and to become more active, ethical and social. They no longer saw industry as a cultural conduit that introduced aesthetics into society through styles and techniques (“by stealth”, as Branzi suggested) (Branzi, 1984: 48). Rather, they saw it as an entity with its own internal, unbalanced logic of over-production that led to excessive consumption bereft of meaningful social or political dimension (Branzi, 1984: 47–48, 55).²³ That this could be construed as a political problem requiring a political response was reflected in journals such as *Domus* and *Casabella* (Grima, Mendini and Sacchetti, 2013: 9–10). For other designers and theorists, however, the problem (and solution) to consumerism was to be found in aesthetics. Mendini noted that the study of “the sociology of consumption, and the laws of consumption as the process of obsolescence” was aligned with a study of the “principles of aesthetic communications” for the understanding of how industry drives consumption, while Sottsass was motivated to produce work that repurposed spiritual and Pop art concepts to reflect on consumer culture (Mendini, 1972: 373).

As a practitioner with the group Archizoom, Branzi created an aesthetic expression of his concerns regarding consumption and the environment in the project *No-Stop City* (1969) (figs. 38–41), a series of photographs featuring seemingly random combinations of

²³ Branzi cited the “artificial channels of consumption” constructed by industry through product differentiation as an example of such unbalanced production. He claimed that such differentiation does not serve consumers in any important way, but was nonetheless promulgated by marketing activities to increase business revenue (Branzi, 1984: 55).

products situated in office spaces and reflected in mirrors.²⁴ The use of mirrors transforms the products and their spatial environment into a deep, infinitely repetitive, wall-less, symmetrical tableau. Branzi identified *No-Stop City* as a response to the self-generating conditions of cities that produce, consume and circulate products (Branzi, 1984: 65). Everyday industries produce “cubic kilometres” of city in the form of “mass-produced articles” that often end up as landfill (Branzi, 1984: 66). According to Branzi, *No-Stop City* attempted to reveal the urban environment as a “space filled” with products and furniture (Branzi, 1984: 69). The provocation of the work, then, is to imagine the broader city as a space in which buildings, walls and floors become invisible, exposing a landscape of consumer products stretching to the horizon. Peter Lang describes the use of mirrors and infinite reflection as suggesting a cloud of “simultaneous multiplicities” that undermine the status of consumerism (Lang, in Lang and Menking, 2003: 44). Lang seems to suggest that derivative, repetitious mechanisms of mass production are exposed *ad nauseam*, so that qualities of glamour and uniqueness intrinsic to many consumer products – and that often create consumerist desire – are stripped away.

Concepts of affect concerning openness and connectivity can be used to illuminate this work. While Branzi's concern is the connectivity that exists between producers and consumers – one that is mediated by aesthetic manipulations (and this is not in conflict with Deleuze and Guattari's concept for affect as mediated by materials) — the principle of connectivity also indicates that the subject must be brought into the field of relations that Branzi constructs in this work. It is not just a subjective experience of an abstraction – the repetition of mass-produced objects – that is experienced here, but a subjective experience of each object. These objects include motorbikes, camping tents, a crudely sculpted naked man and naked women, and another image of a woman in a theatrical, circus-styled costume. The contextual experiences of such products and things have expressions of recreation, pleasure, spectacle or freedom, and these may bind the subject into an assemblage connecting such expressions to possibilities for action. Such possibilities are unpredictable, but I contend that the mirroring and duplication of these

²⁴ The members of Archizoom were Andrea Branzi, Gilberto Coretti, Paolo Deganello, Massimo Morozzi, Ali Navai and Cristiano Toraldo di Francia (Pier Vittorio Aureli, 2013: 153).

products, along with the high-intensity colour and patterning of the floors and ceilings, accentuates the sensory intensity of each product's contextual expression just as much as it may transmit an abstract experience of mass production. Despite Branzi's apparently anti-consumerist intentions, the actual experience of the work may not be anti-consumerist in effect.

While Sottsass's practice shared some of Branzi's attitudes on consumerism and aesthetics – indeed, attitudes common to many Italian radical designers – his thinking and techniques demonstrated a strong concern for aesthetic transmission in particular. Sottsass' biographer Barbara Radice contends that he used influences from Pop art, Op art and emerging forms of modern art to problematise issues of consumerism hinged to aesthetic sensibilities (Radice 1993: 63, 109).²⁵ Similarly, Vittorio Gregotti suggested that Sottsass produced work that sought to challenge the values of consumerism and to engage users in ways atypical for capitalist processes of production – primarily by modulating the sensations and emotions invested in objects (Gregotti, in Ambasz, 1972: 330).²⁶ I see Gregotti's observations as implicit references to affect. Sottsass acknowledged his own interest in sensation, remarking that design can “touch the nerves, the blood, the muscles, the eyes and the moods of people” in a practice that activates a “chain reaction” (Radice 1993: 109). From the perspective of this thesis, recognising such sensory transmission – one that flows from objects to people and beyond — resonates with Deleuze and Guattari's conceptions of affect as moving through materials.

²⁵ Branzi noted these influences on Sottsass' work reflected the social characteristics of the time. Pop art, for example, reflected a society “totally taken up by consumption” (Branzi, 1984: 54).

²⁶ The discussion here is primarily concerned with Sottsass' critical approach to consumerism via his experimental practice and aesthetic deliberations, but it should be acknowledged that he was prolific and also engaged in environmentally motivated, but commercially orientated functionalist design concerned with issues such as built-in obsolescence. During his time working for Olivetti, he proposed a “flexible and expandable system” of interchangeable components intended to keep pace with developing technologies (Gregotti, in Ambasz, 1972: 330). In the catalogue for the exhibition *Italy: The New Domestic Landscape* Gregotti describes this system as a result of Olivetti giving Sottsass the opportunity to make detailed studies of the design, production and exchange of mechanical components between a number of firms that produced electronic office products.

An outcome of Sottsass's affective thinking was his experiments with modern art-inspired optical patterns and colours combined with Eastern religious influences, as embodied in his *Superboxes* (1965–68) (figs. 42–45) (Radice, 1993: 109). These large, colourful, freestanding wardrobes covered colour blocks and striped patterns were produced as conceptual proposals for the company Poltronova.²⁷ Many were painted with “violently coloured” wrap-around patterning and photographed away from walls, totemistically, suggesting a capacity to be moved around and viewed from all angles — as with the Indian shiva lingams from which they were inspired (Gregotti, in Ambasz, 1972: 330). This break with the convention of wardrobes being pushed flush against walls, together with their expressive colour, symmetry and patterning, accentuates their sensory intensity. Sottsass described them as “tools to slow down the consumption of existence”, and hinted at spiritual associations, highlighting his own concern for the increasing speed of consumption in modern society (Sottsass, in Radice, 1993: 36). Radice described the *Superboxes* as having an intensity that consumes and dominates the rooms in which they are placed (Radice, 1993: 148). Sottsass said “a room should have a few objects in it, and those objects should be so intense they vibrate” (Sottsass, in Fusselman, 1999). Concepts of vibration and its intensity are also found in Deleuze's conception of affect — where vibration is classed as a primary element of sensation (Deleuze, 2004: 45; Smith, 1996: 45). My interpretation of Sottsass's *Superboxes* is that they work with such intensity and speed that they repel the accumulation of, or assemblage with, their domestic environs or other objects — hence the slowing of consumption to which Sottsass refers. That the subjective experience of the *Superboxes* becomes so totalised suggests the intensity of a ritual of consumption. This interpretation is supported by Ambasz's description of the works as altarpieces for a “domestic liturgy” ritualising the fetish of consumerism (Ambasz, 1972: 20). While the *Superboxes* were only produced in limited numbers, I believe they are significant in embodying an early radical challenge to

²⁷ The style of the *Superboxes* predates his later use of laminates in his Memphis period by about 15 years. Unlike Memphis furniture, the *Superboxes* had limited production. Some are working prototypes and others were produced as scale models. Sottsass goes to some effort to photograph the scale models in a way which expresses a presence at the real scale of furniture. In one image he places small pieces of foam, cut and coloured to look like watermelons, at the feet of the wardrobe (fig. 43). This alters the perception of scale, but the choice of using (fake) fruit as a furniture prop also enhances the otherworldly nature of the furniture.

the form, style and experience of conventional furniture. They disrupt the typical or expected response to furniture as consumer product. Furthermore, they leverage disruption to open the viewer or user to new affects, drawing them into a deep, reflective sensory engagement.

Sottsass was a prolific experimental designer, and a decade or so after the design of the *Superboxes*, he deployed an altogether different aesthetic strategy, claimed to pull the user or viewer *away* from sensory engagement. Here I refer to the work *Ambiente Sperimentale* (1972) (figs. 46–47), his proposal for the seminal exhibition *Italy: The New Domestic Landscape* at the Museum of Modern Art, New York.²⁸ The prototypes and drawings that make up the project present a series of mobile service units, each with differing functions – such as kitchen sinks, stoves, toilets and lounge chairs for reading – which sit on smooth rolling wheels. The units, said Sottsass, could be arranged or re-arranged based on personal needs and circumstance, “like beasts of the sea, [which]...diminish or increase, ...coalesce into colonies [or] dissolve into dust” (Sottsass, 1972: 163–164). Despite the poetry of this description, the products, which appear to be made from grey, rotationally moulded plastic, seem unattractive and cold. Sottsass admitted their form was “brutal” (Sottsass, in Ambasz, 1972: 163–164). However, there was a reason for this; Sottsass explained that the objective of these modular units was to reduce consumerist tendencies by decreasing emotional attachment to objects (Sottsass, 1972: 163–164). Thus, unlike the *Superboxes*, the units of *Ambiente Sperimentale* are banal, not profound, and dull instead of vibrant – the grey, industrial-looking plastic intended to liberate the consumer from attachment to beautiful materials; or, in Sottsass’s words, to catalyse a “deconditioning” from the “possession of objects” (Sottsass, 1972: 163–164). David Crowley identifies this aspect of deconditioning, with its challenge to the normative domestic space and the indulgences of possession, as an early example of “anti-humanist” design (Crowley, 2012: 287). Sottsass himself was cognisant that the work was an aesthetic provocation that challenged what he described as the “psychological and cultural status quo” (Sottsass, 1972: 163–164). While Sottsass’s drawings express a spatial

²⁸ The project is untitled in the catalogue for *Italy: The New Domestic Landscape*, but titled “*Ambiente sperimentale*” in Bosoni’s 2006 book *Il Modo Italiano* (Bosoni, 2006: 278)

playfulness in the way that they flexibly partition their environment, the fridge-like plastic mechanical accordion structure and industrial appearance of the *Ambiente Sperimentale* prototypes are arguably cold and ill-suited to the domestic context.

When considering Sottsass's concept of de-conditioning in relation to Deleuze and Guattari's concepts of affect, it could be argued that it may work to loosen or dilute the glue-like connectivity of affect – and perhaps form an affective relationship with the user that is not fast, intense or vibratory, as in the *Superboxes*, but rather slow and loose, or less capable of totalised subjective binding. However, it can alternatively be considered that its affects assemble a collection of negative expressions – not the ones typically deployed in product design for the subjective production of desire. The results may not decondition the attachment to objects, but provoke a *concern*, due, in part, to industrial characteristics discordant with the desire for comfort typical to domestic settings. In this regard, the work can be considered as disrupting the conventions of domestic product design and consumption. The sensory relationships between design and consumer perception proposed by the work resonate with Deleuze and Guattari's concepts for affect. From the perspective of this thesis, this work substantiates the need for research into the operation of affect in experimental design that is concerned with issues of production and consumption.

Sottsass' designs for *Ambiente Sperimentale* were never produced beyond prototype stage. Indeed, it appears that Sottsass subsequently abandoned the concept for this work, since none of his later published work experiments with the concept of deconditioning in the same way. However, as I shall show throughout this chapter, disrupting expectations of design consumption is a recurring theme in experimental design.

The project *The Continuous Monument* (1969) (figs. 48–49) by Superstudio, a group of Florentine experimental architects, is another significant example of Italian radical design intended to counteract the social and environmental dimensions of consumption.

This work illustrates the different levels at which affect can operate.²⁹ *The Continuous Monument* is a collection of dystopian environmental collages in which an apparently endless, gridded monument extends across the environments of the Earth, dissecting the landscape and dominating human affairs and structures. Superstudio described the work as concerning the “inducement to consume” and the crisis of objects as status symbols perpetuating the dominance of the ruling class (Superstudio, in Ambasz, 1972: 242–251). The work is oppressive by virtue of the monument's size, yet the structure is clean, shiny, orthogonal and regular in appearance. To this extent, the structure is monolithic, but seductive. Superstudio extended the concept of this work to sculpture, installation and furniture (figs. 50–51) – a warning (as they saw it) regarding the generalities of standardisation and a minimalist critique of the market-driven desire for novelty (Natalini, in Glancey, 2003).³⁰ Gregotti describes radical work such as this as expressive of the creative forces that he says “neutralized” the Italian social and political crisis of the time, transforming destructive energies into constructive, imaginative proposals by a “process of aestheticisation” (Gregotti, in Bosoni, 2006: 35). This comment can be interpreted as concerning operations of affect that mediate a transfer of forces from one dimension to another. The concept is that forces from the social dimension – the energies of the political crisis – move through material and into the sensory expression of an object in assemblage with a viewer in the personal, subjective dimension. In *A Thousand Plateaus: Capitalism and Schizophrenia*, Deleuze and Guattari refer to such transmutations as a transition of forces from the macropolitical (expression at the level of

²⁹ Superstudio was composed of Cristiano Toraldo di Francia, Gian Piero Frassinelli, Alessandro Magris, Roberto Magris and Adolfo Natalin (Lang and Menking, 2003).

³⁰ However, the group remained self-critical of their products that arose from their conceptual work. *Misura* (1970), for example, takes the grid motif from their dystopian collages and applies it to furniture in hard, geometric forms. The furniture was critically and commercially successful, but Superstudio themselves believed that they had solved nothing and merely created “a new level of consumerism, and consequently another level of poverty” (di Francia, in Lang and Menking, 2003: 19). I take the phrase “new level of consumerism” here to refer to the manner by which the concept of the furniture, and its exposure through their widely published environmental collages, had become a marketing device to drive sales. Certainly, their lean, grid-patterned, obsessively symmetrical furniture had an affective resonance with notions of perfection or control. It perhaps embodied not so much a warning against the inducement to consume, as intended, but instead an inadvertent appeal to consume.

society) to the micropolitical (expression at the level of the body) (Deleuze and Guattari, 1987: 213).

As curator Paola Antonelli observes, this transfer of affects from the macropolitical to the micropolitical can also work in the opposite direction. She suggests that Italian furniture innovations of the time, such as the inflatable *Blow* chair (1967) (figs. 52–53) and the beanbag, exemplify her concept of “*existenzmaximum*”, by which she means designs that facilitate a broader exploration of mental, physical and metaphysical activity (Antonelli, 2001: 32–37).³¹ She argues that the change in Italian youth culture during the 1960s was a result of an affective change produced by the experience of more open, relaxed spaces and living that such furniture afforded – a circumvention of the physical boundaries defined by regular rooms and chairs (Antonelli, 2001: 32). Antonelli's claim can be framed by Deleuze and Guattari's concept of affect as mediating the transfer of energies from the micropolitical (the process of becoming assembled with the chair and the actions its material capacities potentialise) to the macropolitical (identifiable changes to Italian youth culture in the late 1960s and early 1970s).

By the early 1970s, the material aesthetics of the radical design group shifted towards earthy expressions and DIY techniques, which, importantly for this thesis, indicates a new concern for environmental wellbeing. For example, Italian radical designer Riccardo Dalisi initiated a project to build furniture in collaboration with poor communities in Naples, a form of participatory design described as “*tecnica povera*” or “poor technology” (Branzi, 1984: 81; Margolin, 1989; Rossi, 2013b: 55).³² Superstudio left product design and moved into research, investigating the traditional tools, artefacts and repair techniques of Tuscan farmers (Lang and Menking, 2003: 48; Clarke, 2013: 77). The late radical group

³¹ Antonelli proposes this in response to the term *existenzminimum*, referring to Modernist architectural responses to housing shortages in Germany after World War 1 that attempted to objectively consider the minimum individual needs for “space and consumption” (Antonelli, 2008: 153–154).

³² Branzi notes that this kind of design resulted in specific aesthetics driven by economic factors. The oil crisis and other economic problems produced a downswing in the Italian economy matched by a “reduction in material possibilities” i.e. the lack of means resulted in designers doing more with less and finding new applications of existing “simple technologies” (Branzi, 1984: 96).

Global Tools (1972–1975) had similar interests; they made efforts to uncover “individual creativity” through materials and the use of tools (Raggi, in Lang and Menking, 2003).³³ An interest in DIY manufacturing and tools was evident elsewhere in the radical scene; for example, Mari's *Proposta per un'autoprogettazione* (fig. 54) and Mendini's cover for the 400th issue of *Casabella* (April, 1975), which was an illustration of a toolbox (fig. 55). This concern for materiality also resonated with radical design operating outside the product design sphere, as in the example of Ettore Vitale, who designed political posters expressive of the paper on which they were printed; the “fold” and the “tear” (fig. 56) were two such graphic devices he used to convey the material qualities of paper (Experimental

³³ Global Tools was a response to energies sparked years earlier by the “creative compression” of the 1968 protests Italy and intensified by the 1973 oil crisis that shook Italy and the rest of Europe (Branzi, 1984: 83). The collective was politically leftist and “strongly anti-consumerist”, though the membership included many who designed products for market-driven industries (Adamson and Pavitt, 2012: 23). Their mandate was provide an alternative to the mainstream model of design and find solutions, often DIY, primitive or “primordial” in nature, through a series of open-university style workshops to help both Italy and the individual become more autonomous (Grima, Mendini and Sacchetti, 2013: 9; Branzi, 1984: 83). Their projects attempted to re-invigorate an awareness of materiality have been interpreted as an act against the “de-skilling” of industrial practise (Clarke, 2013: 76). Branzi admits Global Tools was influenced by the counter-cultural American encyclopaedias like the *Whole Earth Catalog*, but notes that there were ideological problems because of it. These manuals were concerned with the learning of survivalist skills codified as the most basic or minimally structured units of information as a matter of expediency and efficiency. This was considered by as a “narrowing of possibilities” and, worse still, a fetishism for frugality and poverty (Branzi, 1984: 84). Internal disagreement over how far creativity can be systematised ended Global Tools in 1975, an event that, among other events, such as the Mendini's editorial team being ejected from *Casabella* magazine, marked the end of the radical period (Sato, 1985: 194). Many of the radical designers involved went on to have successful careers, albeit often more complicit in the functioning of the market than could be predicted from their earlier manifestos, and in particular, differently focussed on aesthetics, which derived from perceptual studies. However, Gregotti notes that “those who had made their names prior to the political crisis of 1968 came through it [the radical period] without serious consequences” so presumably there were some designers who did find their practise difficult after 1975 (Gregotti, in Bosoni, 2006: 34). Katherine Moline has compiled a broad list of Global Tools participants that includes: Andrea Branzi, Riccardo Dalisi, Allesandro Mendini, Gaetano Pesce and Ettore Sottsass as well as Carlo Bachi, Dario Bartolini, Lucia Bartolini, Lapo Binazzi, Giorgio Birelli, Enrico Bona, Luciano Boschini, Alberto Breschi, Remo Buti, Carlo Caldini, Patrizia Cammeo, Nanni Carciaghe, Gilberto Correti, Adalberto Dal Lago, Paolo Deganello, Giuliano Fiorenzuoli, Fabrizio Fiumi, Riccardo Forese, Piero Frassinelli, Paolo Galli, Gigi Gavini, Carlo Guenzi, Titti Machietto, Alessandro Magri, Roberto Magris, Massimo Morizzi, Adolfo Natalini, Roberto Peccioli, Gianni Pettena, Ugo La Pietra, Franco Raggi, Cristiano Toraldo di Francia (Moline, 2012b: 154).

Jetset, 2013: 123). While this thesis is primarily concerned with the practice of product design for the domestic environment, this last example is included because of its manipulation of materials that may be considered destructive, but that I see as accentuating materiality with destructive practice. This quality, along with the capacity for repair it potentialises, is a concern central to my own practice, as I will elaborate in Chapter Three.

Design engagement with repair and the everyday resourcefulness with which objects are modified and adapted was widespread in the 1970s. Works by Global Tools and other Italian radical designs illustrate a desire to understand material qualities and for that understanding to be shared by all, rather than just by design or industry. As material is a medium by which affect potentialises change in the world, as Deleuze and Guattari contend, these projects can be interpreted as part of an anti-industrial, democratic movement, intended to spur creativity and autonomy while resisting consumerism. Such an interpretation is substantiated by arguments from Branzi concerning the deleterious effect of industry on the environment (Branzi, 1984: 55).³⁴

Towards the end of the radical period, some designers and theorists, including Branzi, Mendini and Sottsass, became more interested in a kind of aesthetic richness borne from the intensive use of colour and pattern. Mendini notes that, at one point, his colleagues had effectively abandoned rough or primitive styles, and he observed that their sketchbooks were filled with drawings embracing “color and pictorial signs” (Grima, Mendini and Sacchetti, 2013: 7–11). Branzi and Mendini together studied the use of

³⁴ Such concerns were growing popular outside of Italy too. Examples include designer and theorist Victor Papanek who published his book addressing problems with consumerism and design, *Design for the Real World: Human Ecology and Social Change*, in 1971. In the United Kingdom, the development of the user-centric methodology of “design for need”, which pushed for more responsible approaches to resources, the environment and social needs, without exclusion of the third world or the poor, was proposed in 1976 (as captured in the proceedings *Design for Need: The Social Contribution of Design* for the ICSID conference of 1976. Speakers at this conference included Papanek and Brazil-based Italian designer and theorist Gui Bonsiepe). The acceptance of such concerns continued throughout the 1970s and laid the foundations for what became “ecological design”, then “green design” in the 1980s and then “sustainable design” in the 1990s (Madge, 1993 and 1997).

pattern, light and symbols, and the experience of qualities they felt were previously neglected in design, such as decoration, climate, haptics and “even odours and background music”, which were “bodily” consumed and that they felt should be studied via an understanding of sensation and perception (Branzi, 1984, 97–98).³⁵ These interests found mature expression in Mendini and Sottsass' respective collaborations with Studio Alchymia (in the late 1970s) and Memphis (in the early 1980s), projects that in retrospect became defined as postmodernist. While the formal concerns of colour and pattern are beyond the scope of this thesis, relevant to my analysis are the references to affect in debates about the later works of radical design. Reflecting on these developments in 1984, Branzi notes that perception is an “essentially physical process”, which uses our bodies as “active instruments of cultural elaboration” in order to process the data we sense, transforming it into “experience and culture” (Branzi, 1984, 97–98). These conceptions of perception go some way towards suggesting how sensation, at the level of the body, can be extracted from materials, correspondent to some aspects of Deleuze and Guattari's concepts for affect. Deleuze and Guattari's construction, however, goes further in that it is not limited by the body's capacity to process sensation into cultural or natural experience, but rather works across these divisions. In other words, there are affects that work not just at the human level, but between all sorts of different worlds and ecologies in the absence of human presence or experience, as I will discuss in the next chapter.

Droog and Dutch conceptual design

Dutch conceptual design here concerns activity in the Netherlands largely corresponding with the beginning of the organisation Droog in the early 1990s and continuing to the present. Droog's origins lie in a collective of young designers discovered and exhibited by critic, publicist and curator Renny Ramakers in 1993, before being joined by designer and educator Gijs Bakker. The group has been described as promoting a kind of design characterised by the prominence and visibility of its own concept (Fairs, 2007). While Droog has produced collections addressing multiple topics of interest to experimental

³⁵ These were entirely new research directions for design however. Such concerns, and their basis in the design and form of materials, were at least previously considered by the Bauhaus school, and, in the United States, the architect Richard Neutra (Mallgrave, 2013: 140).

design, including environmental issues such as over-consumption, product obsolescence and sustainability, Ramakers has insisted that the only consistency is the clarity of the “concept” (Ramakers, 1998: 9), and rejected the idea that Droog is a collective with a fixed vision or ideology (Ramakers, in van Zijl, 1997: 105). However, there are aesthetic consistencies, if not ideological consistencies, in Droog designs. In particular, Paola Antonelli noted its shared expression of intellectual dryness, humour, austerity, experimentalism and provocation (Antonelli, in Ramakers, 1998: 12–15).

There are multiple explanations for the origins of the dry aesthetics that characterise early Droog products. Design historian Mienke Simon Thomas writes that Dutch conceptual design was a natural development of neo-modernism, a European movement important in the Netherlands, which, through the influence of practitioners like Bakker, experimented with found objects and limited production outside of mainstream industry (Simon Thomas: 2008: 197, 208–209). Ramakers and Bakker assert that Droog initially formed to critique luxury, evidenced by works reacting against the excesses of the postmodern Memphis period of extravagance – i.e., the interest in colour, pattern and decoration that developed in the 1980s after Italian radical design (Bakker, in Fairs, 2007). Antonelli expands on this argument, claiming that the resulting aesthetic of austerity was a cooling, minimalist and moral response to the “redundancy” of the hyper-energetic design typical of Memphis, Studio Alchymia and the design they inspired (Antonelli, 1998:

13).³⁶ Timo de Rijk recognises Ramakers's and Bakker's positioning of Droog as a logical successor to post-radical Italian design for reasons of promotion, but proposes that the look and feel of the early Droog pieces was simply a matter of economic necessity – the designers used found objects and chose DIY techniques because they could not afford industrial manufacturing (de Rijk, 2010: 174–178). This argument is supported by Marcus Fairs' commentary which refers to the decline of manufacturing in the Netherlands in the 1980s and the practice of Bakker, in his teaching positions, to encourage his students to work with what they had available and what they could afford, rather than wait for rare industrial commissions (Fairs, 2005). By the 1980s, Bakker's understanding of aesthetics and the imbrication of design with business has resonance to Italian radical perspectives, such as those of Branzi. Joana Ozorio Almeida de Meroz notes Bakker perceived aesthetics as following from concepts that, for design in close relations with business, problematically become concepts for making profit. Therefore, Bakker contended that designers needed to invent new concepts separate from the influence of industry (Meroz, 2014: 179). This background is significant for my purposes in one particular aspect; early Dutch conceptual design, like some Italian radical design, can be understood as anti-industrial, with an intention to mobilise interest in approaches to design that circumvent or disrupt mass-production with DIY and alternative production systems. This

³⁶ Dutch conceptual design may not be as diametrically opposed to post-radical design as Ramakers might claim. Mendini's *Redesigned Chairs for the Modern Movement*, for example, pre-figure the later Dutch conceptual focus on the modification of archetypes. Camilla Escallon argues that Droog was a progression of Sottsass' sensory concerns and are equally postmodern (Escallon, 2010: 5, 101-2). Ramakers is selective in her use of quotes to substantiate her claim that Droog was the answer to ethical failings of Memphis and Studio Alchimia. She quotes Mendini discussing design that is “self-wounding”, correspondent to “a situation in which designers are unable to provide any answers” (Mendini, quoted in Ramakers, 1998, originally from Sato, 1986: 146). However, in Kazuko Sato's 1985 monograph on Studio Alchimia, Mendini is talking specifically about the *Banal Objects* series exhibited in Linz in 1980, a collection designed to challenge the established reading of commercial products through graphic disruptions. It is not clear that Mendini considered his comments relevant to Alchimia as a whole. Likewise Ramakers criticised Memphis for taking an overly conciliatory approach to industry and the problems of consumption. Sottsass is quoted from Richard Horn's monograph on Memphis (1985), suggesting design should come “to terms with obsolescence”, maybe even “accelerate it” (Sottsass, quoted in Ramakers, 1998: 31, originally from Horn, 1985: 22–23), but Horn himself interpreted Sottsass as joking. These quotes certainly conflict with previous radical positions on consumerism, and Horn acknowledged their pessimism, yet speculated Sottsass was intentionally challenging the assumptions of what comprises good design (Horn, 1985: 22–23).

proposition can be read from the early Droog products that incorporate playfully arranged found or recycled materials, such as Tejo Remy's graduation work *Chest of Drawers* (1991) (fig. 57).

More generally, however, I contend that Dutch conceptual design practices, while privileging the communication of concepts, is an affective practice, in that the transmission of such concepts is mediated through materiality. Deleuze and Guattari's interest in conceptual art is relevant to this – they contend that in conceptual art, the concept does not *substitute* sensation, but is instead concerned with the creation of sensation *from* the concept (Deleuze and Guattari, 1994: 198–199). Deleuze and Guattari note there is a distinguishable difference between using concepts of affect, sensation or perception in conceptual design practice (which Deleuze and Guattari call the “concept of sensation”) and, on the other hand, arguing that concepts in conceptual design are themselves affectively sensed (which they call the “sensation of concept”) (Deleuze and Guattari, 1994: 199). This distinction provides two ways to understand Dutch conceptual design. While the *concept of sensation* is applicable to particular works that refer to affective or sensory qualities in their conceptual intent or interpretation, a *sensation of concept* may apply, within the Deleuzian and Guattarian framework, to much, if not all, of the Droog catalogue.

Remy's *Chest of Drawers* illustrates the *concept of sensation*, in which concepts that resonate with operations of affect are made explicit by intent or interpretation. Its arrangement of 20 second-hand drawers tied together with a furniture removal strap makes sensible the post-consumer life of objects. For some commentators, and Remy himself, the key concept of the work concerns memory, sensation and the transmission of meaning. Simon Thomas describes early Droog products in general as “meaning givers”, and Remy and others note the metaphorical use of memory in the design of the chest (and indeed the work is also cited in the literature by the longer title “*You Can't Lay Down Your Memories*” *Chest of Drawers*) (Simon Thomas, 2008: 224; Centraal Museum, 2000: 10; van Zijl, 107). It can be proposed that the drawers capture memories – previously disparate experiences of use by former owners – and bring them together into sensation

by way of a haphazard arrangement. In this light, *Chest of Drawers* deploys the affect-resonant concerns of memory and sensation as a concept through the practice of design, and therefore has a *concept of sensation*.³⁷

Deleuze and Guattari's converse term *sensation of concept* can be illuminated in reference to Hella Jongerius' *Soft Urn* (1994) (figs. 58–59) which reproduces an old stone urn in soft polyurethane (PU) rubber. The work is concerned with the relationship of vases and urns to the design and history of vase and urn production. Features of the original urn are retained in the work's mould and become features in the cast, in addition to marks derived from the part lines of the mould (Ramakers, 2002: 158 and 1998: 19; Walrecht: 2002: 7). Ramakers describes the cracks as communicating the history of the original urn, and the part lines the method of manufacturing (Ramakers, 1998: 19). In separate publications, Ramakers, Bernadine Walrecht (Walrecht: 2002: 7), and Jongerius and Louise Schouwenberg (Jongerius and Schouwenberg, 2003) discuss the use of PU rubber in regard to how it creates a conceptual connection to the world of urn archaeology, history and manufacturing. However, explicit reference to the sensory qualities of the rubber is absent in this literature, and the material capacities of rubber are not sufficiently explained by reference to the sensations or perceptions they capture or convey. Within Deleuze and Guattari's framework, there is no *concept of sensation* embedded in the work. Nevertheless, the concepts of the work are perceptible and sensory; the urn has a *sensation of concept*. This is because the concept of the work is still made sensory by its material capacities in ways that I will now explore.

Ramakers has noted that, unlike most ceramic urns, the part lines on the *Soft Urn* have not been smoothed away, which accentuates the conceptual link to urn and vase manufacturing (Ramakers, 2002: 158). The different material properties of PU rubber, as opposed to clay, would have made that task practically impossible; thermosetting plastics such as PU tend to fully set within the mould, unlike clay, so part lines cannot be wiped away upon release from the mould. PU rubber does not have a granular structure like clay

³⁷ This interpretation does not limit the affective sensations of the work. I would also say that the furniture recalls a mindless exertion of production and consumption systems at work in the world; a bodily experience of chaos transmitted by the irregular arrangement of drawers.

that enables wet wiping or dry sanding. Rather, PU rubber is a cross-linked petrochemical polymer with a dense elasticity that resists refinement by cutting or abrasion. Herein lies the ingenuity of Jongerius's design; the material substitution of PU for clay prevents the practice of a normative industrial technique of presentation that would typically hide production information. I argue that this material substitution not only accentuates the link to urn and vase manufacturing, but also it is the primary reason that the link is discernible in the first place.³⁸ In *Soft Urn*, the PU rubber expresses its capacity to assertively capture and lock in artefacts of the mould, bringing their presence into the sensory world as affects and percepts.³⁹

Despite a lack of explicit engagement with concepts of affect in her design of *Soft Urn*, Jongerius is however a designer concerned with sensory issues. For the purposes of this thesis, I consider that Jongerius' conceptual mode of design *is* an affective mode. This is supported by dialogue between Schouwenberg and Jongerius when they discuss designed objects (in general) as having an affect-like saturation of “references” that can be “undressed” to reveal relationships, and when they discuss the process by which designers accumulate a “database of impressions” to understand how people bond with objects (Jongerius and Schouwenberg, 2003). Jongerius proclaims her concern for the world of sensation in her considerations of colour, dimension and form, and in how she allows materials to guide her design process – actions that she regards mark her out as a “blatant aesthete” (Jongerius and Schouwenberg, 2003). However, Schouwenberg questions whether these interests “undermine” her conceptual narrative, and Jongerius agrees that

³⁸ This might suggest that Jongerius was calculated in her material choices, but de Rijk indicates that aesthetic techniques deployed in Droog products, such as the material substitution at work in *Soft Urn*, were naive mobilisations appropriated from Surrealism (de Rijk, 2010: 172–177).

³⁹ The use of PU rubber also creates other affective encounters and Camila Escallon contends it is the unexpected rubbery softness of the rubber to the touch, rather than the link to historical vase making, that dominates the perception of the urn (Escallon, 2010: 71) and this perception is reflected in some of its marketing images (fig. 59). She notes that while vision is framed by eyesight and can be turned off by blinking, the sense of touch has been argued to be unbounded within the body (meaning that we have no bodily action comparable to blinking which can turn it off) (Escallon, 2010: 71). Escallon derives her claim from Richard Sennett, who indicates the bodily capacities of touch have been a long-running concern within medical discourse (Sennett, 2008: 159).

the concept must be the foremost concern (Jongerius and Schouwenberg, 2003). This conflict is raised in their conversation, but not theoretically interrogated. De Rijk observes that, despite the emphasis on concepts, Dutch conceptual design is not concerned with theoretical matters (De Rijk, 2010: 172, 174). From the perspective of this research, the absence of theoretical reflection on sensation or affects in Dutch conceptual design discourse omits much that is pertinent to how design operates. I see value in reflecting on experimental design within a framework of affect to better understand how such issues interrelate production, consumption and environmental concerns. Clearly, Droog products have relations to issues of production, consumption and the environment, but the emphasis on conceptual expression dominates the discourse to the extent that, in my observation, references to sensation, memory and perception, or other terms related to affective thinking, are subjugated to conceptual concerns.

Other works by Jongerius demonstrate the generative capacities that I see as an important thread in experimental design and that have the potential for affective impact on fields of production, consumption and the environment. In Chapter 3, I will discuss this potential in regard to generative practices of repair, but, it is worth discussing the precedent set by Jongerius' generative design strategies here. The term *generative design* encompasses a wide range of different design processes that use a generative system

between designer and product (Fischer and Herr 2002).⁴⁰ Such a system or device acts to vary the expression of the product; an early example from Jongerius' practice is the *B-set* ceramics (1997) (fig. 60), in which kiln temperatures were set so that plates and vessels randomly warped during firing, creating non-identical objects from a mass-production system (Jongeriuslab, 2014; Keulemans, 2012: 87). This work indicates a sensitivity to the capacity of material in relation to intensives forces, such as heat and duration, to generate its own form. As will be discussed in detail in Chapters Two and Three, these capacities are of significance to Deleuze and Guattari for their challenge to the hylomorphic model of production (Ingold, 2010: 94; Deleuze and Guattari, 1987: 368, 407–11). The processes of Jongerius's *B-set* can be understood as expressing this challenge in the form of an intervention into the standard practices of industry.

Intervention into industrial production is also evident in later works, such as *Non-temporary* (2005) and *Nymphenburg Sketches – Animal Bowls* (2004) (figs. 61–62), in which she broadened the scope of her intervention into industrial production processes by creatively re-ordering assembly-line operations, re-mixing the application of decorative

⁴⁰ Since the 1980s, the generative practice in design has mainly focussed on the use of software tools. Bernard Cache, whose research was influenced by Gilles Deleuze, was a pioneer of software based generative practices in furniture. The thesis for this doctoral research (later presented in his book *Earth Moves: The Furnishing of Territories* (1995)), was subsequently referenced in Deleuze's *The Fold* (1993). Greg Lynn, another Deleuzian practice-based researcher, has also contributed to the field of software-based generative design (Keulemans, 2012: 73; Lynn, 2004). While there are such links between Deleuze and software-based generative experimental design in the discourse, Cache and Lynn are not discussed further in this thesis though because firstly they do not relate their work to affect, and secondly because this thesis is more concerned with non-software based generative techniques, such as those of Jongerius and the repair techniques I explain in Chapter Three. John Frazer, the generative architect and theorist comments, "It is the conceptual model of generative tools, not the hardware or software that is important" (Frazer 1995: 24). Jurgen Bey's *Minutes Service* (2003) and Marcel Wanders' *Snotty Vases* (2001) and *Sponge Vase* (2002) are other Dutch conceptual designs which employ non-software based generative techniques. More broadly, works by Dutch conceptual designers which may utilise post-consumer waste, such as Remy's *Chest of Drawers* or *Rag Chair* (1991), can also be understood to employ generative systems. My prior work *SMASH REPAIR* (2009-2010) (with Martijn Dijkhuizen) deploys a generative system of destruction and repair. For further discussion on generative design in general, distinctions between software and non-software based practice, and Deleuzian strategies for generative design, see my paper "The Trajectories of Yachts and Snot: Strategies for Generative Designers" in *Deleuze Studies Journal* (2012).

elements from the production catalogue into unorthodox arrangements, and directing factory workers to autonomously remove or modify glazing processes. The results of these generative techniques transmit a sense of variability that counters the sameness or repetition typically experienced from mass-produced objects.

Rawsthorn argues that Jongerius's generative practices arise from socio-environmental concerns for production and consumption conditions, noting that by the time Jongerius was studying at the Design Academy Eindhoven in the 1990s, the "environmental and human price" of industrial mass production was well known (Rawsthorn, 2010: 75). Jongerius comments that the significance of these projects to her is the way they expose consumers to the typically hidden industrial processes from which the products were made (Jongerius, 2011: 36). This comment indicates some correspondence to a concern for opening up the affective relations between producers and consumers. Rawsthorn makes the point that while the resulting artefacts are still industrially produced, they appeal as if they are not, which prompts Rawsthorn to label them aesthetic "tricks" in that their variability has the pretence of craft or artisanal production, though they are actually mass-produced (Rawsthorn, 2010: 75).⁴¹ This identification resonates with Branzi's comments that industry introduces aesthetics into society by "stealth" (Branzi, 1984: 47–48), which, in the case of Jongerius, might suggest that her industrial design innovations do not do anything in particular to unburden the environment from the negative effects of industry. However, Rawsthorn argues that Jongerius's aesthetic strategies are not solely concerned with consumption, but work within the conditions of production and have positive effects on industry. She notes that the implementation of Jongerius' techniques inform industry how to "embrace playfulness, sensuality and pleasure" in a production context conventionally modulated by business constraints (such as economies of scale, which tend to enforce standardisation) (Rawsthorn, 2010: 75–76). This conclusion

⁴¹ Rawsthorn argues that Jongerius is nonetheless successful with her strategies. She speculates on the positive effects they may have on consumers, both practical and aesthetic; for example, consumers may form the same kind of positive emotional attachments to Jongerius' products as they would feel towards handcrafted, well-aged or heirloom objects, yet benefit from the practical qualities of industrial manufacture, such as the strength and durability which come from standardised production (Rawsthorn, 2010: 75).

complements one of my proposals within this thesis, which is that affect operates across normative divisions within production and consumption systems, and indicates that design can modulate the practices of industry through the affects of products. Like Jongerius' techniques, the repair techniques I employ in my own practice are non-software-based generative practices with affective potentials. However, as I will argue in Chapter Three, my practice gives priority to potentialisation in domestic consumption, rather than production, and furthermore is more focussed on mobilising shifts in perception specific to issues of environmental concern.

Critical design

'Critical design' is a term used to describe a particular type of speculative, reflective and socially driven product design practice that began in the late 1990s (Malpass, 2009: 289; Dunne and Raby, 2014a). Much of the writing and thinking on critical design comes from the work of Anthony Dunne and Fiona Raby and their students in the Royal College of Art's (RCA) Design Interactions program. Dunne defined the term critical design in his book *Hertzian Tales* in 1999, based on his doctoral research from the 1990s, and then expanded upon its definition in his and Raby's book *Design Noir: The Secret Life of Electronic Objects* (2001). The content of these books is focussed on electronic and consumer products – which Dunne and Raby consider to be designed (and subsequently used and experienced) by overly tight, "conservative" commercial constraints that should be critically challenged (Rickenberg, 2009; Dunne and Raby, 2014a).⁴² The call to break open such constraints and develop new ways of critical thinking has been taken up in design in a number of ways. Some of the works Dunne and Raby cite as demonstrating criticality are by designers such as Noam Toran, Marti Guixé, Natalie Jeremijenko and Jurgen Bey (Dunne and Raby, 2014a). To this list, I would add works by Thomas Thwaites, whom I discuss later in this chapter, and Formafantasma, whom I discuss in Chapter Two. Researcher Matthew Malpass proposes a taxonomy of critical design and notes that

⁴² They note that, while consumer products are produced to tight constraints, they are often marketed with utopian promises to make a consumer's life less constrained, but in reality this rarely happens. However, it can drive a desire to want more from products, which, for a few technophilic consumers, inspires the modification of products in unexpected ways (Dunne and Raby, 2001: 7-8).

its various conceptual and theoretical analyses have significant concern for the complex relationships between humans, products, technologies and the environment (Malpass, 2009: 289–293). Some critical design proposals, like Thwaites's *Toaster Project*, are of importance to this thesis due to the way they address the worldly relations of materials and in doing so open up an understanding of such relationships between production, consumption and the environment.

Aspects of critical design are pre-figured in the work of earlier theorists and practitioners, such as those practicing within Italian radical design and Victor Papanek (Dunne and Raby, 2013: 6). Dunne and Raby note that conceptual design of the 1990s also facilitated the emergence of critical design (Dunne and Raby, 2014a). Papanek's book *Design for the Real World* (1973) has been described as a “cult object” in critical design for the way it proposed a type of design focussed on social need (Fineder, 2010: 99; DiSalvo, 2011: 186). This concern for a social form of design is also of interest to other theorists, such as Ezio Manzini and Victor Margolin, who theorise that design can influence social concerns by proposing socially attractive or unattractive scenarios (DiSalvo, 2011: 186).⁴³ However, the critical design approach espoused by Dunne and Raby does not attempt to polarise affective responses into simply good or bad. Instead, they frame critical design as having speculative (or fictional) characteristics, which can be humorous, provocative or shocking (Dunne and Raby, 2001: 45–46). They note that the experience of products is messy, complex, full of “complicated pleasures”, or pleasurable fears, which do not correspond with the normative goals or methodologies of industrial design (Dunne and Raby, in Moggridge, 2007: 595; Dunne and Raby, 2001: 7–8; Raby, in Moline, 2011: 89).⁴⁴ Instead of understanding design as either attractive or unattractive, Dunne and Raby

⁴³ Dunne and Raby draw from Ezio Manzini for their development of design scenarios. In his essay *Prometheus of the Everyday* (1992), Manzini stated that a designer does not solve problems, but rather is, or should be, “a cultural figure in the process of creatively linking the possible with the hoped-for in visible form” (Manzini, 1992: 19). Therefore, the designer visually develops scenarios that can disrupt the normative interests of science or industry. Manzini claimed such interests are prefigured paths and liable to passive consumer acceptance; design should disrupt, resulting in challenges and changes to producer and consumer behaviour (Manzini, 1992: 19).

⁴⁴ That Dunne and Raby can elicit fear from their audience has been noted; one journalist has called their work an evocation of a “grotesquely twisted future” (Hiroknui, 2011: 95).

propose an alternative dichotomy for product design in which it is either affirmative or critical. As is well known in postmodern art discourse, affirmative design promotes the dominant ideology or normative practices of industry and reinforces commercial/industrial paradigms corresponding to “cultural, social, technical and economic expectation” (Dunne and Raby, 2001, 58). Alternatively, design can be critical, in that it rejects dominant ideologies or normative practice as the only possibility, and instead questions their nature and premise.⁴⁵

While their alternative dichotomy of affirmative or critical design is in relation to affects that operate in a wider range of registers, neither Dunne nor Raby specifically refer to affect in their research. The theorist Jonas Fritsch, however, has recognised that their practice of addressing the messy, ambiguous and sensory world of products is affectively focused (Fritsch, 2011: 180). An implication of their proposal is that confirming or rejecting social norms concerning interaction design is guided by an affective component embedded in the aesthetics of a product, though this does not result in a dichotomous response. Rather, the pleasures and fears to which they refer are ambiguous and affective in the sense that they intricately grow or strengthen, or sever or weaken, connections within the subjective assemblage that modulate the potential to act. Furthermore, in their attempt to address the sensory world of products Dunne and Raby position critical design in parallel with other creative practices, such as art and film, suggesting an implicit concern for the affective counter to the normative concerns of function and style in product design (Dunne and Raby, 2001: 59–60).

This affective dimension can be illustrated through examples of their work, such as the *Blood/Meat Energy Future* (figs. 63–65) component from their 2004 exhibition *Is This Your Future?*, which concerned the use of alternate energy sourced in the form of animal

⁴⁵ Dunne and Raby insist that because the context and constraints of the market is viewed as the only reality by some industrial designers, critical design must at least partially conflict with marketable concerns to expand the scope of design beyond the commercial. They insist that critical design is not inherently pre-disposed towards or against business and industry, but acknowledge that this open and intentional challenge to commercial and industrial practice places limitations on critical design with regard to its dissemination. For example, they note that it may be best suited to academic practice due to its freedom from commercial restrictions (Dunne and Raby, 2001: 60).

blood. In this speculative scenario, children in the future are inculcated in the use of animals as sources of biofuel by breeding and processing animals. A mock book is titled *Animals for Energy: Avoiding Emotional Attachment to Animals Purchased for Use as Energy*, and blood bags in the child-friendly shape of teddy bears are supplied for the collection of mouse blood (Dunne and Raby, 2014b). The problem of limited energy supplies, such as fossil fuels and the issue of peak oil, is the background for the design, which proposes the potential of biotechnologies as an alternative source of energy. The concept is that biotechnologies become so ubiquitous that animals can be converted to energy. This draws the viewer to consider the ethical relationships of animality in light of the energy crisis. Aesthetically, the design and staging of the work is full of rich, connective, ambiguous or contradictory inferences. The finished, mass-produced appearance of the bag suggests real-world proximity, as if the scenario is already occurring. The bag design is cute, but, juxtaposed with the blood it contains, becomes startling. The children in the photographs appear innocent at first glance, until one realises that one of them appears to be dropping a hamster into something that might be a processing unit – though the other child does not seem to be thrilled by this. Also noting that the children are wearing uniforms in the corporate colours of McDonald's, a heavy industrial user of animals for food products, hints at the social context in which the work can be understood.

The scenario presented in *Blood/Meat Energy Future* is an example of design that Manzini proposes can affect or disrupt enough to prompt a “re-organisation” of ecological thinking by either a “force of fear” or the “attraction of new possibilities” (Manzini, 1992: 19). Carl DiSalvo gives an example of an attractive component when he describes the sophisticated, but cute, design of the teddy-bear bag as “alluring” (DiSalvo, 2009: 55). The blood that fills it creates the fear. This affective push and pull is modulated by the design of the work, which DiSalvo discusses as a tactic of “projection”, leveraging aesthetic moves in the present to prompt the consideration of a complex “interwoven spread” of future consequences (DiSalvo, 2009: 53). The relationship of energy use and animal rights is just such an interwoven spread, which, Gavin Sade proposes, motivates a deep reflection on how we value others, including animals, and the formation of a non-

anthropocentric worldview. He speculates that vegetarianism can then act as a pivot tilting towards the consideration of an “ethics of consumption” (Sade, 2011: 85–86). The contemplation is if killing animals for energy is not acceptable, is killing animals for food acceptable? DiSalvo continues this line of thinking by asking, “what other kinds of alternative energies are acceptable?” (DiSalvo, 2009: 54).

These analyses of *Blood/Meat Energy Future* are relevant to concepts of affect in two respects. The first is the use of product design to pull the viewer into an assemblage with potentialised future consequences. This recalls Deleuze's claim that the individual is constructed in time; the process of remembering the past or imagining the future is tied to the experience of the present. In other words, the present contains other temporalities (Deleuze, 2005: 99, 109). The affective strategies of critical design thus pivot the assemblage to connect the subjective present to an open-ended future. The second aspect concerns the non-anthropocentric worldview identified by Sade. As affect pulls the viewer into an assemblage at one end, the other end of the assemblage is open and hungry for connections and crosses the human/non-human divide – a sensorial presentation of the non-rational desires of the inorganic world. This possibility is a key point in the contemporary formulation of Spinozist-Deleuzian concepts of affect developed by theorist Jane Bennett that belong to the theoretical formulations known as new materialism (Bennett, 2010: 21–24). I will elaborate this further in the next chapter, but refer to it here to note that DiSalvo sees the mandate of critical design as complementary to the Deleuzian-influenced concerns of new materialism, and recognises their significance for illuminating the political effects of objects and systems and the expanding role for politics in design (DiSalvo, 2012: 24). From the perspective of this thesis, the formation of non-anthropocentric worldviews important to critical design has resonance with the materialist capacities of affect as conceived by Deleuze and Guattari, but what is missing here is a theoretical explanation of how affects *potentialise* such a formation. Likewise, it can be asked, how does critical design's use of affects prompt the consideration of future consequences relevant to environmental concerns? In the following chapter, I will deploy Deleuze and Guattari's concepts of affect and time with Bennett's new materialist concepts to further explain the relationships between

human and non-human worlds, perceptions of the past, present and future, and how experimental design can potentialise shifts in the perception of production, consumption and the environment. The remainder of this chapter will serve as a preface to this discussion by providing one more example of critical design – Thwaites's *Toaster Project* – that indicates how these relationships are actualised by experimental use and design of material.

Thwaites' project involved recreating a cheap, industrially manufactured toaster that he purchased from a department store for just a few British pounds. More than recreating the toaster, the project extended to performance in that much of what is known about *The Toaster Project* comes from Thwaites's public appearances and book (Colbert and Thwaites, 2011; Thwaites, 2011 and 2010). For this reason, the following section refers frequently to Thwaites's comments on the work. Thwaites claims he was intrigued by the design and component complexity of the ubiquitous toaster, noting the hundreds of different materials it uses (fig. 34). His reinterpretation and recreation of it sought to use only the most basic tools and materials attainable, without relying on the complex industrial systems deployed in the production of toasters – systems he observed to be self-supportive and imbricated with large-scale environmental disaster (Thwaites, 2011: 16, 174–177). Such problems are made explicit by various tasks required for building his homemade toaster. For example, he required copper to transmit electricity to the element. No active copper mines currently exist in the UK, so he instead collected many litres of copper-polluted waste water from an abandoned mine and used electrolysis to extract it (fig. 35) (Thwaites, 2011: 142). Such activity led Thwaites to consider the very real problem of toxic-waste copper leaching into river systems and water tables and damaging ecologies (Thwaites, 2011: 152–55). Likewise, the expressions of heat and energy resulting from his process of smelting iron ore at home (using a leaf blower and several destroyed microwaves, which he conceded was cheating) (fig. 36) indicates the massive amounts of energy required to smelt iron at the industrial level (Thwaites, 2011: 62–77). These tasks are mobilised in his book on the project to create a discourse on the environmental problems of mining and metal production.

Thwaites' solutions circumvented industrial manufacturing, but he also challenged the normative aesthetic practices of industrial design through the provocative and unsettling form of his toaster. Rough, hammered metal, clumsy DIY wiring, melted plastic and shards of raw mica (a heat-resistant organic mineral) dominate the visual appearance of the toaster. It is at odds with the industrially produced toaster that served as its model, the form of which – as is typical for domestic electronic products – is dominated by the smooth and shiny white appearance of its plastic shroud. This particular feature of the industrially made toaster is a typical contemporary example of the industrial technique of shroud-design pioneered by twentieth century industrial designer Raymond Loewy, in which the inner workings of electronic or mechanical products are covered by a protective shell, shroud or sheath, often made from plastic (Loewy, 1979: 13; Herman, 1975: 10). Thwaites was unable to duplicate a shroud very precisely – industrial synthesis of petrochemical plastic is highly technological – and anyway he was unable to obtain crude petroleum, the base ingredient. Faced with a looming deadline, he was forced to scour the local rubbish dump for discarded plastics, which he heated and poured into a mould formed by chiselling out a hollow in a section of wood from a tree trunk. In principle, this corresponds to industrial practice, because industrially manufactured plastic shrouds can be said to be poured too. Injection moulding, for example, is liquid forced through a nozzle at a high temperature and pressure, an engineered form of pouring. What is different, however, is the material expression. Sophisticated production techniques tend to reduce materiality to surface – matte, satin or gloss – hiding the trace of its manufacturing process. By this, I mean that the concept of injection moulding is not especially evident in the form of an industrially produced toaster, at least to someone unfamiliar with mass manufacturing technologies. Thwaites's toaster, however, has a rich and expressive materiality imbued with an almost drunken flow, conferred by the swing and sway of his quickly poured plastic and tremor of the hand (fig. 37). His shroud is not attractive in any conventional sense.⁴⁶

In that regard, Thwaites' project realises Dunne and Raby's proposal for the potential of critical design to challenge and subvert the paradigms of industrial practice. Yet, within

⁴⁶ However, one commentator described it as “beautiful” (Kabat, 2010).

the terms of affect described by Deleuze and Guattari, *The Toaster Project* expresses the complicated relationships between production, consumption and the environment in its materiality. The performance of the project, in which Thwaites poses himself as an average consumer (albeit a design student) attempting to replicate systems of industry, also challenges the distinctions of convention between production and consumption.

Just as with other examples of critical design, *The Toaster Project* has important affective processes that construct an imagination of the past, present and future. It constructs an imagined past through its use of historical metallurgical techniques and, even more so, from its rough, hammered iron structure that recalls archaeological artefacts from the Iron Age. I would also argue that the interconnectedness of industrial systems that Thwaites's design and commentary exposes works to create an imagination of the technological age in the present. Its construction of an imagined future, however, is perhaps its most affectively intense and bleak quality. Thwaites searched for discarded plastics in a rubbish dump, hunted for mica in the wilderness of Scotland, and scavenged other materials from abandoned mines. These are actions from a resource-poor, environmentally stricken, post-industrial or even post-apocalyptic future. This said, it is far from clear how exactly the affective capacities of the work draw us towards such perceptions.

Thwaites's project is ambitious in scope, and relevant for this thesis, due to its novel arrangement of affects that leverage the very rich and expressive capacities of materials to link the industrial manufacture of materials, the normative pressures of industrial design practice, and consumer expectation together with their effects on the environment. The perceptions of such things as iron smelting, copper pollution and plastic production evident in the form of Thwaites's toaster are examples of how materials can be manipulated to indicate their origins in techniques of production and are a counter-example to the perceptions of typical industrial products in which design is used to hide or obscure the origins of materials, their techniques of production or method of operation. The toaster concretises, in a physical object, the proposition that industry is responsible for environmental degradation, and that alternatives must be proposed.

However, the project also corresponds with other examples of critical design that tend to prioritise negative affects for the potentialisation of shifts in perception. This is what Manzini calls the force of fear (Manzini, 1992: 19). The expression of negative affects that may close down capacities for action can be contrasted with the alternative – a search for more open or affirmative potential directions for shifts in perception. In the next chapter, I will deploy Deleuze and Guattari's concepts of affect to investigate how some material expressions, which may be absent from normative domestic products, can be accentuated in the experimental design of domestic products to raise issues of environment importance and potentialise shifts in their perception. Further, in Chapter Two and then Chapter Three, I will use these theoretical tools to understand how alternate affects can connect the present with imaginations of the past and future that work in more positive or life-affirming directions, rather than the bleak or negative propositions raised by some examples of critical design.

This chapter has aimed to demonstrate that, despite differences in style, theory and practice, a thread of common concern exists in Italian radical design, Dutch conceptual design and critical design in relation to the role of aesthetics and affect (though the latter term is rarely used) in addressing concerns of production, consumption and the environment. My broad intent was to show how design has addressed, in different ways, such issues via the sensory world of materials.

Italian radicalism was shown to be born from concern regarding the changing modes of consumption in society in the 1960s and 1970s, and the concern for how those changes may impact the environment. Designers such as Sottsass became interested in the relationships between design and processes of sensory transmission, and others such as Branzi identified that these processes were used by industry to introduce aesthetics to consumers for the purpose of increasing consumption.

For Dutch conceptual design associated with Droog, the repetition of found or recycled products and DIY produced objects and furniture were perceived to be connected to the impact of production and consumption on the environment. Sensory engagement with

these issues was of interest to some Droog designers, such as Tejo Remy but, more generally, Droog was concerned with the communication of concepts, of which sensation was considered one concept among many. Deleuze and Guattari's discourse on conceptual art indicates that concepts themselves are nonetheless experienced through sensation, and that such kinds of creative practice can be described as *sensation of concept*. Working from an affective analysis of Hella Jongerius's practice, I attempted to show that her generative practices may have untapped potential for modulating sensory perception across divisions within and between production, consumption and environmental spheres.

Finally, critical design attempts an unorthodox, but rigorous critique of production and consumption paradigms by challenging the normative practices of industry via the use of speculative scenarios. From the perspective of this thesis, these strategies have correspondence to role of affect on the construction of the imagination of the past, present and future (as proposed by Deleuze), and the new materialist theories developed by Jane Bennett (following Spinoza, Deleuze and Guattari). This indicates that a more rigorous theoretical interrogation of affects and their capacity to disrupt normative systems of production and consumption has potential to expand the scope of experimental design and address issues of environmental significance, which is the subject of the next chapter.

Chapter Two

A 2012 article for the *New York Times* by design critic Alice Rawsthorn brought the relationship between affect and product design into non-academic discourse (Rawsthorn, 2012). Her article discussed contemporary architects and designers' interest in affect and gave a short summary of how it can be used for design analysis. Initially noting the way typefaces are quickly perceived in a manner particular to their form – for example, the lean, non-decorative font Helvetica is perceived as indicating speed and efficiency – she went on to explore the affective agency of furniture, using Michael Thonet's *No. 14* chair (1859) (fig. 27) as a case study. Rawsthorn identifies this historically significant chair as expressing various qualities, including robustness, strength, a sense of reliability borne from its assembly-line precision (suggestive of the machine age contemporary to its development), and a humanism expressed through its gentle, undecorated curvature (Rawsthorn, 2012). Rawsthorn describes these expressions as affects. While noting that such expressions may spark or activate emotions in those who experience them, she nonetheless invokes the early distinction made by the philosophers Rene Descartes (1596–1650) and Spinoza between affect and emotion, in which affect is distinguished by its “transformative” agency (Rawsthorn, 2012). Their theories will be expanded on shortly, but first it is worth exploring this idea of transformative agency.

In Rawsthorn's article, a number of factors sensible in the chair are described; for example, the machine-assisted curvature of its wood, the discrete number of components (its screws, nuts and bent wood components) and its light weight. As the scope of a newspaper article is limited, later in this chapter I will provide a fuller affect-based inquiry of this chair, which will extract a greater amount of detail about such factors, their relations and the sensations they transmit. Such sensations are experienced in relation to one another, but also connect and ‘open up’ upon a larger affective field pregnant with sensation (Deleuze and Guattari, 1994: 167–168, 172–176). This is the

transformative experience possible with objects: an experience of moving into relation with material and its broad socio-ecological conditions of production. Within the field of design, affect gives us a way to explore the human and non-human together as entangled relations, rather than conducting limited inquiries into such things as ‘the product’ and how it functions or who produced it. Shortly, I will expand upon this idea, using the example of soil pollution.

In line with the concerns of this thesis, the affective opportunity is to grasp the connection and passage between production, consumption and ecological concerns simultaneously, rather than as discrete areas of investigation. In this chapter, I will use the Thonet chair as a case study to explore the extent to which concepts of affect can open up these relations, from design development, manufacturing, and use through to the impact of product design on society and the environment. To this end, this chapter also investigates a contemporary example of experimental design through the lens of affect, using the Formafantasma's *Botanica* (2011) (figs. 28–31) as a case study.

As established in the last chapter, affect lends itself to such inquiry because of its principles of openness and connectivity. Affect connects material through sensation to human and non-human experience and back again to matter (Deleuze and Guattari, 1994: 172–179). Brian Massumi notes that affect works like a “world-glue”, transforming a multitude of contiguous experiences into a seamless affective field of “self-continuity” that facilitates sensory transitions from one thing to the next (Massumi, 2002: 217). As will be soon discussed in depth, affect is pre-individual and embedded in matter. Massumi describes it as ‘prepersonal’, by which he means that it refers to the passage between the experiences of one body, to that of another (Massumi, in Deleuze and Guattari, 1987: xvi). Affect enables movement from one thing to another – passages that span affective fields in which assemblages form from sensory intensification.

Assemblages are beyond the conception of affect as merely a set of experiences. Ian Buchanan explains that the pivotal idea is that the subject becomes part of the assemblage in a way that intersects “expressions”, in the form of affects or ideas, with

“content”, in the form of an action or thing (Buchanan, 2015: 390). In the context of this thesis, an assemblage activates a passage – a set of relations across the non-human world – between the *experience* of materiality by users, producers and consumers, to actual *practices* of use, production and consumption. This is not to say that assemblages necessarily require material objects, but that material objects have the agency to form or transform assemblages (Buchanan, 2015: 385). In this chapter, I will explain how such assemblages are triggered by the compounding of affective intensities within material. As forces that draw out form, colour and other sensory qualities, these intensities work on the senses, and, in doing so, place humans into a transformative relation with the world (Smith, 1996: 40–41).

I intend to demonstrate the way in which such affects operate at the micro-level of the body, yet have the capacity to open out into larger macro-scale socio-environmental transformations. This chapter will explain the importance of creative production in potentialising and opening up capacities and will argue that, particularly for experimental design, this is mediated by the quality of *anomaly* – an operator that creates new passages within affective networks and binds subjective experience into new assemblages. The aim of exploring the role of anomaly and affect in the design of domestic products is to illustrate the capacity of products to catalyse transformations in our ecological relationships to production, consumption and the environment.

The design movements analysed in Chapter One allude to the role of affect through reference to aesthetics, sensation and perception, changed states or emotions, among other sensory aspects, however, without the rigour found in theoretical discussions of affect. Since this thesis aims to address the gap in scholarly analysis regarding how affect operates in the experimental design of domestic products, this chapter will develop a rich interpretive framework for understanding the relations of production and consumption to society and the environment. The remaining lack of knowledge, being the mobilisation of concepts of affect in product design practice, then becomes the work of Chapter Three.

In this chapter, after further explicating Deleuze and Guattari's concepts of affect, and describing how such concepts have been applied by other theorists to understand the production and consumption of design, I go on to illustrate the interrogative capacity of concepts of affect using two case studies. The first is the *Thonet No. 14* chair, a well-known and mainstream industrial design, and the second is the contemporary work of Formafantasma, the experimental designers Simone Farresin and Andrea Trimarchi based in Eindhoven, The Netherlands. For this latter study, I develop my argument using additional, complementary concepts of affect, such as affective depth (based on the technical 'depth of field' borrowed from photography), which Deleuze employs in his second book on cinema (Deleuze, 2005b: 98–100, 106–109), and *machinic phylum*, a concept from Deleuze and Guattari's *A Thousand Plateaus: Capitalism and Schizophrenia* (Deleuze and Guattari: 1987: 335, 395–98, 407–411). As a concept for uncovering the continuous modulation of expressive forces moving through material, machinic phylum is contrasted with the logics of *hylomorphism*, the imposition of form onto matter.

Originating in the philosophy of Aristotle, hylomorphism has become “embedded” into the discourse of Western thought, finding expression in the perception of material as inert and subjected to the will of the mind in the practice of design (Ingold, 2010: 92). As an applied logic of production, hylomorphism is dominant in production and consumption systems by way of facilitating mass reproduction. It is therefore imbricated with the environmental problems of excess production, such as pollution and waste (De Landa, 1997 & 2004: 21–22; Deleuze and Guattari, 1987: 369; Protevi, 2001: 8). It also expresses in particular contemporary paradigms of industrial design and production, including black-boxing, in which the functional structure, construction methods or internal components are hidden from consumer view or access. The term black-boxing applies to both physical and digital products; in physical products, black-boxing guides attention to surfaces. In regard to this, I also detail Nigel Thrift's identification of techniques of surface presentation and concealment used by design and industry that he refers to as *sprezzatura*, an effortless-looking, seductive glamour, which pulls the consumer interest away from production concerns (Thrift, 2010: 299).

That designers want to hide the sensorial complexities of their products can be conscious; Jonathan Ive notes that this is a characteristic of a “considered solution” – a product that hides the “terrible struggles” that designers and engineers undergo in the course of their practice (Ive, in Hustwit et al., 2009). The problem of products presenting a world *without* troubles is a justification for this thesis, because, while it may be comfortable for consumers to be untroubled by products, and financially beneficial for producers if this increases consumption, the world of products clearly *is* troubled.

These theoretical concepts will be discussed with the intention of helping designers understand the means by which such issues arise in sensation from affective intensities, and how these intensities can be modulated differently by new practices of product design. Concepts of affect are useful tools with which to describe this sensory encounter. I will show how the sensations that comprise the encounter can be uncovered and identified, leading to the creation of new affective connections with the potential to increase cognisance of environmentally harmful practices, such as those of deforestation, petrochemical culture and industrial manufacturing.

Affect

Deleuze and Guattari’s concepts for affect developed from the works of Spinoza, with whom much of the modern study of affect begins. Deleuze understands Spinoza’s work as a non-dualist philosophy of mind and body, in which thinking and acting are in a continuum (Deleuze, 1988: 18). Determining the value of an affective relationship is a matter of evaluating the capacities and activities produced by an encounter. If an encounter with something, such as an object or designed product, increases one’s ability to act then the encounter is a good one. If it decreases the ability to act, the encounter is weak. ‘Good’ or ‘bad’ are not to be understood in absolute terms, but only relative to the capacities of strengthening or weakening the sensory being. Deleuze reiterates this aspect of affectivity in his book *Spinoza: A Practical Philosophy* (1988), in which he describes affect as a basic relationship; an affective encounter that strengthens the capacity to be affected is good, and that which weakens the capacity to be affected is undesirable

(Deleuze, 1988: 71). The point is openness – a body should strive to become open to the “greatest number of things”, rather than closed to new affective relations and their possibilities (Deleuze, 1988: 71).

Affects are human/non-human hybrids, “non-human becomings of man” (Deleuze and Guattari, 1994: 169), which Deleuze and Guattari term “a clinch” – a complementary relationship of forces, which produces the affective world of human experience (Deleuze and Guattari, 1994: 182). This is a ‘becoming’, an affective clinch that changes us and our relations with things. In light of Spinoza's conception of affect, such a change is a ‘transformation’, opening us up to new affective connections and thereby strengthening affective powers.

However, affects are also pre-individual and exist in all types of matter prior to a subjective relation. By way of a transitional process, they fold qualities of matter into us, qualities that change as they come into relation with us, as do we ourselves. So, an affective encounter can be considered not just within human relationships, but also within non-human relationships or combinations thereof. As an example, consider the relationship of humans to the problem of landfill. If heavy metals or other toxic components of products end up in landfills and then leech into groundwater, the capacities of the ground are weakened because the potential of the soil has been closed down for purposes such as farming. There may be nothing that can be done with polluted soil besides attempting to clean it up. In turn, this weakens the capacities of humans who are in relation with the soil – they must spend time and energy depolluting the soil, rather than engaging with the soil to strengthen their options regarding life on it, off it, or through the many types of farming possible. This is not the end of the process; other non-humans are also weakened, including all the animals, insects and microbes that depend upon soil for food and habitation. However, if consumers choose not to purchase or discard products into landfill (or producers choose not to produce such products), then the soil may remain unpolluted – or, at any rate, less polluted – and consequently open to a larger number of affective capacities. Among other uses, it can be farmed for food, landscaped for recreation or building, planted with trees for wood, or restored to

wilderness, all of which have effects at the human and community level. The notion of 'clean soil' can therefore potentialise a vast array of movements, happenings or events at the social level.⁴⁷

Through their collaborative works, such as *A Thousand Plateaus: Capitalism and Schizophrenia* (1987) and *What Is Philosophy?* (1994), Deleuze and Guattari develop an ontogenetic account of how art, philosophy and science compose the world. As an experimental designer, my concern is for the component of art, which develops and extracts sensations from material (Deleuze and Guattari, 1994: 167). However, art is not to be understood as merely a disciplinary practice. In *A Thousand Plateaus*, Deleuze and Guattari establish that art is not restricted to disciplinary convention (painting or sculpting, for example) but is in production all around us, at all times. Art is evident in the world of animals, the character development of literary figures, and every other thing (Deleuze and Guattari, 1987: 320, 1994: 169).

Following this line of reasoning, discussion about sensation and affect is, by necessity, a discussion about art not as a discipline, but as a creative force. And although Deleuze and Guattari make extensive use of the *disciplinary* practices of art, such as a painting and film, to illustrate the power of affect, they consistently reiterate the idea that the practice of art is a generalised force of creation present in the world.⁴⁸ Affect, therefore, courses through various types of designed products, objects, human and non-human systems and experimental practices. In *What Is Philosophy?*, affects are described as coalescing into *blocs* or *compounds* of sensation, which are extant in matter and preserved by the

⁴⁷ This intertwining of affective relations is also reflected in Guattari's theory of 'three ecologies', in which social, subjective and environmental relations are interconnected (Guattari, 2000: 19). That our neighbourly relations are dismal is entwined with our mental condition and our relationship with nature. These three ecologies are not separate domains, but "interchangeable lenses or points of view" (Guattari, 2000: 19). Guattari's three ecologies are affective ecologies, distinguishable yet overlapping and relational. What occurs at the level of one domain has the capacity to propagate or compound, invest or divest, affects into another, making them ecologies of relations rather than separate areas.

⁴⁸ It is for this reason that *What Is Philosophy?*, as is made explicit in its last chapter, has been described as concerning the "modern brain in its direct confrontation with chaos" (Buchanan and Lambert, 2005: 6).

ontogenetic force of creativity. Deleuze and Guattari use the example of painting to show that it is difficult to know when sensation begins and matter ends. The content of the canvas is material and sensation, but so is the “preparation of the canvas” and the “brush’s hair” (Deleuze and Guattari, 1994: 166). Sensation is “realised in the material”, but also passes from and through the material (Deleuze and Guattari, 1994: 193). Sensations are therefore the expressions of affects concatenated or threaded together into compounds, subject to increases and decreases in intensity, density, duration and strength.

Sensations exist as compounds because affect has an innate connectivity that pulls sensation together. These compounds can be simple or complex and infinitely variable; the nature of sensation is as infinite as the matter or materials into which they can invest. Yet, Deleuze and Guattari make some effort in categorising various compounds of sensation. They note varieties of sensation such as the “vibration”, the “embrace or clinch”, and the “withdrawal, division, distension” (Deleuze and Guattari, 1994: 168). Using the example of painting, Deleuze and Guattari find these categories in Francis Bacon's work, and in the work of other famous painters such as Paul Klee, Piet Mondrian, Vincent van Gogh and Paul Gauguin (Deleuze and Guattari, 1994: 181-5). Regarding Gauguin and van Gogh, they find tensions between the areas of flat and plain colours, or between areas of recovery (technically, often backgrounds or representations of walls or floors) and details of flesh or flowers with “broken” tones and more complex colour work (Deleuze and Guattari, 1994: 181).

Of particular relevance to my own practice (as will be shown in Chapter Three) is Deleuze and Guattari's discussion of abstract paintings; they refer to Mondrian. Mondrian is known for his canvases divided by bold black lines and coloured rectangles, but what is interesting about those compositions is the tiny slits in the paint at the edges of plain areas adjacent to the black lines. These slits can be observed to be broken and cracked, not because this is the way they were painted (although it is the way they were painted), but because they are what Deleuze and Guattari consider “the bearer of glimpsed forces” (Deleuze and Guattari, 1994: 181). The plain areas are charged with an energy from which the dividing black lines break free and construct their architecture on the canvas.

Deleuze and Guattari recognise there are physical forces within paint. For Mondrian I propose this may be the different material properties of base paint, top coats and adjoining colours that induce cracking as they dry at different speeds. Such analysis goes beyond the intentionality of the artist and reveals force embodied as blocs of sensation, compounded through materials.

The same kind of energy and force invested in the painting of Mondrian's black lines can be observed in the material of numerous designed objects, including concrete, ceramics, paper and plastics. Art can capture intensive forces in material that create form, colour and other sensory qualities (Smith, 1996: 40–41). The energy of the relationships between such forces is more important to Deleuze and Guattari than the representation of the object or thing itself, be it artwork, product or architecture. They believe that “no art and no sensation is ever representational” (Deleuze and Guattari, 1994: 193).⁴⁹ Deleuze makes this explicit when he discusses a painting by Jean-François Millet that depicts peasants carrying a religious offering, an *offertory*, “like a sack of potatoes” (Deleuze, 2004: 57). Criticised for this, because the carriage of a sacred offertory should not be considered a burden, Millet responded that the distinction between carrying an offertory or a sack of potatoes was unimportant; rather, what is important is their shared yet invisible force of *weight* (Deleuze, 2004: 57).

In Deleuze and Guattari's ontogenesis, this shared quality of weight particular to potatoes and offertories is not an affect precisely – though it has an affective strength or intensity – but a type of sensation extracted from art, known as a *percept*. Percepts are “packets of sensation” that move through the things of the world (Deleuze, 1995: 137). They are not perceptions because they come before and after *perceivers*; they are “independent of a state of those who experience them” (Deleuze and Guattari, 1994: 164). This distinguishes them from the hybrid becomings of affects and their transitory sensations (Deleuze and Guattari, 1994: 169).⁵⁰ Nevertheless, Deleuze and Guattari claim that through both affects and percepts art has the ability to ‘think’ (Deleuze and Guattari, 1994: 66). The purpose of

⁴⁹ Therefore, they see abstract art in particular as having value due to its intention to focus on these forces and attempt to avoid representation.

the percept is to make perceptible the “imperceptible forces” of sensation, and it is the expression of such a force – weight – that Millet paints (Deleuze and Guattari, 1994: 182). Many other kinds of forces persist as percepts in human or non-human activity. The forces of smashing, lifting or splitting affect us, for example, but also retains an autonomy independent of when, how, by whom or by what they are experienced. Percepts survive their affective lives and survive those who experience them. This is the aim of all great artists, Deleuze claims, because it is the creation of a sensation that endures beyond the affective experience of any one particular artwork (Boutang, Deleuze and Parnet, 2011). Percepts maintain a consistency altogether different from the continuous modulation of affects.

New materialism

One of the ways in which Spinozist and Deleuze and Guattarian concepts of affect have been explored in regard to the human/environment relationship is in the area of 'new materialism'. Jane Bennett extends Deleuze and Guattari's concept of assemblage from *A Thousand Plateaus* to consider a vitalistic agency across all forms of matter and material – whether human, animal, plant, mineral or other – for the discovery of ecological and political interactions (Bennett, 2010: x). This project, which destabilises anthropocentrism and author-intentionality, uncovers the affective forces which influence and react, shape and modulate our world, including its people, social systems and matter itself (Bennett, 2010: vii–xx, 21). Matter and material do not have an inertia that impedes human agency but, rather have their own force, a vibrancy, with unique “trajectories, propensities and tendencies” that form assemblages working at scales both small and large (Bennett, 2010: viii, 23). Bennett believes that the traditional view of matter as inert may encourage the “earth destroying” practices of contemporary production and consumption and that, a converse view of matter as alive and active can foster improved ecological awareness (Bennett, 2010: ix).

⁵⁰ Perception necessarily comes after affect, in that it is an affective projection “gathered by a receptive organ” of the body (Deleuze, 2006: 109).

This view reiterates the importance of the Spinozist conception of affect and its ontological difference from the Cartesian conception of matter as inert.⁵¹ For Descartes, thought was dependant on a subject–object duality in which only the subject could be known through thinking, while the object is subjected to the force of conscious action. In this conception, matter and material as objects have no agency and merely respond to the rationality of the subject in a predictable manner (Roberts, 2012: 2514). This has some value in that it allows theories for the use and manipulation of matter to be modelled (Coole and Frost 2010: 8). However, new materialist thinkers, following Spinoza, assert that the binary style of Cartesian thinking impacts the environment by enabling a “domination of nature” (Coole and Frost, 2010: 7–8). Cartesianism is perceived as resulting in an entrenched “anthropocentrism”, which drives production and consumption systems and ignores the full, non-human implications of those systems on ecologies and environments (Roberts, 2012: 2514).⁵²

For example, Tom Roberts applies a new materialist analysis to explore how the design of retail spaces modulates consumer behaviour. He first notes the way that commercial public spaces, such as airports and shopping malls, are designed so that affective capacities encourage “economically desirable choreographies.” (Roberts, 2012: 2518). It should be noted, then, that affect is itself neither politically desirable nor deplorable, but can be captured to enhance consumerism. In his case study of Ikea (perhaps the most airport-like of retail stores), he observes how designed features, such as the music system and coffee distribution, compel the body to shift from passive observation into active consumption (Roberts, 2012: 2520–21). He argues that Ikea can be perceived as a huge assemblage or people and things across production and consumption with ecological considerations extant throughout, “from petrochemicals to pine” (Roberts, 2012: 2526).

⁵¹ New materialism, like Deleuze and Guattari's concepts of affect, therefore recognises the importance of Spinoza's concept of 'monism', the ontological principle that everything is part of one thing, as an important counter concept to Cartesian dualism. This principle drives Deleuze and Guattari's concept of 'immanence'.

⁵² However, it is also claimed that it is not desirable for new materialism to counter Cartesianism as an oppositional theory, but rather use Cartesian thinking is as a non-exclusive tool for uncovering vitality.

It should be considered that binding into such an assemblage is not clear to consumers while in-store. In a way, Ikea does not need to do much to influence customers to consume within their retail space. Customers have come there with the intention to shop, so they do as expected. Nonetheless, Roberts identifies coffee, music, floor layout and other affect-modulating aspects that Ikea implement in certain ways to increase consumerism. For example, coffee is served free near the store entrance, so that caffeine can “work on the bloodstream” to stimulate “the cells of the human nervous system”, while the music is of a type and volume to energise, but not distract (Roberts, 2012: 2520). Such stimulations are not wholly excessive. Rather, they work with durations and relationships between movement and rest to ease the customer into a bodily state that is, at the most, unexpected only in its occasional intensity. Ikea attempts to capitalise on these unexpected moments of intensity by channelling them into opportunities for consumption, hoping that customers will purchase more products than intended as a result. On arriving home, customers may ask themselves: *why did I buy that?*

Just as their binding into a consumption-assemblage may be unknown to Ikea customers, it can be speculated that the material capacities of Ikea products may be likewise unknown to them. Some materials overtly express their production conditions (furniture applications of unpainted pine clearly originate from within a tree), but there is also a lot of trickery and surface play at work. Chipboard furniture is coated in melamine polymer plastics in a range of palettes and finishes – the interior material is only glimpsed at the seams later when the pieces are being assembled or disassembled in the home. Likewise, the mild steel interior structure of many white, polymer-coated bathroom and kitchen products is only perceived later when the surface coating cracks and rust emerges between the fissures. However, if customers are not concerned by these material eventualities at the time of purchase, it is unlikely that Ikea will design their products in any way that addresses such eventualities. Consequentially, the destructive environmental scenarios that arise from the production systems typical to companies such as Ikea are likely reinforced by consumer behaviour.

For experimental design that seeks to influence the environmental scenarios of production and consumption systems in different ways, a relevant concern is how to modulate such behaviour. This should be examined with regard to the passing of affect from matter and material to users, consumers and producers, constructing assemblages with the potential for different effects within larger social systems. In the next section of this chapter, I will explore, in relation to these assemblages, the role of anomalous objects as potential outcomes of creative practice and experimental design. I contend that *anomalous* objects, compared to more regular objects, have different affects when introduced into assemblages and that, consequently, they may modulate assemblages and the relations between expression and action. This has consequences for shaking and shifting the normative routines of consumption and production. The next section of this chapter looks at how such behaviour is mediated by anomaly.

Anomaly

In *What Is Philosophy?* and *A Thousand Plateaus*, Deleuze and Guattari evoke the character of Captain Ahab from Herman Melville's *Moby Dick* to illustrate the forces of percept and affect and their role in the process of becoming. As Ahab chases the whale and increasingly obsesses about it, he is transformed by the affects of their relationship. His behaviour deviates from normality, his conventional habits as a captain of a whaling vessel break down and the pattern of his life changes (Lorraine, 2005: 168). The whale chase consumes him to the extent that he *becomes* part-whale, taking on aspects of Moby Dick's monstrosity and rage. This is not an imitation of the whale, but a "coupling" with the whale (Deleuze and Guattari, 1994: 91, 93).⁵³ It is a "becoming-whale" using the "monstrous" unique qualities of Moby Dick as an actant, or operator, which adjusts the whole of the whale/whaling/ocean assemblage (Deleuze and Guattari, 1987: 243, 325).⁵⁴

In this explanation of the *Moby Dick* narrative, Deleuze and Guattari contend that Ahab's

⁵³ This becoming-whale opens Ahab up to the experience of a *percept*, which he had previously resisted: the vast blue ocean. Not the ocean perceived by sailors or cartographers, but the ocean as sensed by Moby Dick and whales. This percept is distinct and autonomous. It needs no one to exist and existed prior to its sensation by Ahab, when it destroys and survives him (Deleuze and Guattari, 1994: 169).

coupling with the whale is a result of the whale's monstrosity – an anomalous condition that defines it as an extraordinary whale, expressing the “phenomena of bordering” (Deleuze and Guattari, 1987: 245). Located within yet at the extreme edges of their groups, anomalous objects engage with external groups, facilitating affective becomings, new encounters, relations and passages *between*. Anomaly is of particular consequence to the study of experimental design. As shown in Chapter One, experimental product designers tend to be located at the edges of the product design field. These extremities are the places where aesthetics are often novel, and characteristics typical of design, such as utility and commodity, tend to blur or become subsumed by conceptual and aesthetic concerns. Some (if not many) of these experimentally designed products exist on the fringes of the conventional definitions of their product types; these objects can be described as anomalous.⁵⁵

This quality creates the potential for experimental design to open up new relations, as will be illustrated using the *No. 14* chair and the context of its original design and production. This chair, which has been popular for more than a century, *seems* ordinary now. Yet it was highly anomalous during the early years of its invention and popularity, and, as I'll show, it continues to be anomalous in various ways. As I will explain, its initial anomalous qualities played an important role in the chair's commercial success and its transformation of social relations. The following discussion of the *No. 14* chair will also serve to introduce other, complementary concepts of affect that are useful in understanding experimental product design.

⁵⁴ Bennett takes note of Deleuze and Guattari's use of the term 'operator' and attributes importance to it as an actant within an assemblage with the particular power to influence the assemblage as a whole. It makes a difference by the “fortuity of being in the right place at the right time.” (Bennett, 2010: 9, 42). While Bennett also draws from the work of Bruno Latour and Actor Network Theory for her explication, the concept resonates with Deleuze and Guattari's concept of anomaly. Likewise, the concept is akin to what Buchanan calls an “assemblage convertor”, an agent that interrupts the relationships between the assemblage's “expression and content” (Buchanan, 2015: 391).

⁵⁵ While this is my observation arising from use of an affect based theoretical framework, the anomalous character of experimental design has been noted in the design discourse by theorist Guy Julier, in his book *The Culture of Design* (2000). Julier states that anomalous characteristics belong to objects straddling boundaries conventional to product design, such as crossing between functionality and status concerns (Julier, 2000: 75–76).

Affective relations of the *No. 14* chair

One of the most successful consumer products of the nineteenth century, the No.14 chair is also possibly the most successful chair in history (Doick, 2009). It was not just the first industrially produced bent-wood chair, but the world's first mass-produced chair, having sold and seated millions since its invention during the Industrial Revolution (Rawsthorn, 2008). It was also the first chair manufactured for transport and designed for local assembly (Doick, 2009). Each chair comprises only six pieces of wood and ten screws (fig. 66), which can be packed and dissembled in a small shipping crate with enough parts to assemble 36 chairs (fig. 67). This particular innovation is considered the first instance of 'flat-packed' furniture (Miller, 2005: 285). The chair is now recognised the world over, most commonly associated with use in cafes and restaurants, and was influential to certain changes in society and industry during the late-nineteenth and early-twentieth centuries.

It is also, relative to the typical furniture of its day and even by contemporary standards, exceptionally light and durable, not to mention visually innovative and referential to its own material. It will be shown that such qualities account for the chair's anomaly, which activates novel becomings in the chair's affective relationships with humans. It will be argued that the chair's commercial success is correlated to its potential for affective becomings, and that the chair draws human attention via its intensities and forces. Such force works on the personal or bodily level, but also transmits through the systems of market and commerce. This transmission will be interrogated to show that it compounds intensities and draws the human experience into an assemblage of production and consumption systems and their environmental effects. In other words, it will be shown that between the chair's material properties and its position within human/environmental ecologies, there is a traceable thread of affects.

A significant aspect of the *No. 14* chair is its use of emerging industrial processes, including steam bending (fig. 68), but additionally system-level changes to the

production process. Thonet did not invent steam bending, nor was he the only designer aiming to create a mass-produced chair. Both were goals of Thonet's contemporaries, yet he was the first to achieve them together (Rawsthorn, 2008). For much of his life, Thonet worked as a traditional, albeit experimental, carpenter on furniture that was complex enough to allow only small production runs. Thonet, recognising the limitations this placed on his business, began exploring techniques and processes for mass production. These included the use of standardised components (the same legs, backs and seat were used over multiple models, for example), vertical integration (controlling production from raw materials to retail distribution) and specialised component-making machines (this last factor later saw an entire factory built just for making screws).⁵⁶ Such processes are the first implementation of the "American system of production" to furniture – a system previously applied to firearms and sewing machines, and later applied to automobiles, bicycles and a great many things, and that came to define twentieth-century production (Kyriazidou and Pesendorfer, 1999: 147–151). The chairs that Thonet developed numbered 1 to 13 incrementally applied the techniques of this system, but it was not until the production of the *No. 14* chair, with its new use of jigs (fig. 71) and steam for bending solid pieces of wood instead of laminates, that Thonet was able to greatly expand production. In turn, this resulted in lower production costs and soaring popularity. This was a trend occurring in other industries, associated with the massive changes to production systems underway in the nineteenth century. The *No. 14* embodies the transition of furniture production from a guild-based artisanal craft to an assembly line-driven automated industry (Gleiniger, 1998: 28).⁵⁷

In terms of affect, the novel industrial qualities of the *No. 14* chair have certain expressions. An obvious perception is that the steam-bending manufacture of the *No. 14*

⁵⁶ The role of standardised components can be observed in an image from an early twentieth century Thonet factory (fig. 69), which show leg, back and seat components grouped in sets on the floor and hanging from ceiling hooks. Martino Gamper's *Conran Collection* (2008) (fig. 70) plays with this feature of Thonet's production technique by re-arranging these components into unorthodox configurations (note the similarity to Jongerius' project for Nymphenburg discussed in Chapter One).

⁵⁷ In addition to implementing production techniques, which relinquished the need for guild-trained carpenters, Thonet was also active in various legal manoeuvres to reduce the power of the guilds in furniture production (Vegesack, 1997: 31).

expresses an ability to control nature.⁵⁸ Straight sections of beech tree are manipulated via a machine-driven 'elemental' power – the heating of water to produce steam. This was a defining technology of the Industrial Revolution and, from around 1855, Thonet used a custom-built steam engine in his factory to expedite production. A similar expression of captured, natural force is embodied in other steam-based inventions of the time, most notably the steam engine, and, especially for the general public, the technology of the steam train and the steam ship. However, unlike steam trains and steam ships, the No.14 chair was small, light and modest in price. Rawsthorn claims that the chair, being comfortable and friendly in contrast to the new noisy, smoky machines, helped make the Industrial Revolution palatable to society (Rawsthorn, 2008).

That the chair is perceived to be gentler and more soothing than an experience of power and energy from steam-driven travel does not, however, discount the chair's affective force, which is considerable. This force can be uncovered by an inquiry that deploys the concepts I have introduced above and that has the potential to go beyond Rawsthorn's brief article, in that it exposes the connections and directions of the force moving in and out of the chair – always through material. Thonet chairs are literally solid, single pieces of wood, bent under heat and pressure into extreme curves not previously possible without ply-construction techniques. This positions the chair as anomalous and at the extremities of at least two groups. It belongs to the group of *chair*, however positioned at the edges of this group at the time of its invention by virtue of its lightness, innovative construction and novel aesthetic. Yet, its material qualities also account for its relationship to *beech trees*, at the extreme edges of that group. Not because it is recognisable as being made out of wood, because that is common to nearly all wooden

⁵⁸ Andrea Gleiniger remarks that this aspect of the chair is characteristic for its time, in that the tension between nature and technology was a strong theme in aesthetic theory of the nineteenth century (for example in the works of John Ruskin and Gottfried Semper) (Gleiniger, 1998: 40). Given this expression of human control over nature in this chair when it was first produced, it's interesting to consider its recent incarnation, the *214k* chair (figs. 72–73). The addition of a knot, tortuously bent, in the front leg breaks the familiarity the chair has developed over time and, by indicating the extreme capabilities of the steam bending process, alludes to the novelty of the original design. Other experimental versions of the chair also work to renew the original expression of plasticity characteristic of the chair, including works by M/M Paris (*Thoumieux Chair*, 2011) (fig. 74) and Pablo Reinoso (*TH 24*, 2006) (fig. 75).

furniture, but because, in its pretzeled form mediated by the technology of steam bending, the chair recalls the branches of a tree and a curvature found more readily in nature than in the artifice of other contemporary carpentry practices, such as straight sawed edges or the mathematical ideals inherent in machine-turned construction. A hybrid of chair and branch, the *No. 14*'s anomalous character at the edges of two groups activates a non-human becoming and introduces a particular sensation, a percept of the forest, into consumer relations.

The transmission of this forest-percept is achieved by the way the chair becomes-forest within its form. This can be clarified by examining the difference between a *No. 14* chair and a more regular wooden chair. Typically, in making a more conventional wooden chair, a piece of timber is cut out of a tree and processed by straight saws, lathes, hand-carving or other subtractive production techniques. These techniques isolate the timber from its origin within a tree. The timber that we touch on such a chair is perceivably the *internal* material of the tree – not something that traces the sensory experience of a whole tree. Conversely, the pliability of the Thonet chair draws to mind the thinness and flexibility of a young branch or sapling because the components recall whole branches shorn of surface bark and bent into shape, though this is not how they are actually made.⁵⁹ This false perception is produced through resemblance to common human experience; a familiarity with bending young tree branches through the experience of strolling in a forest or climbing trees as children, perhaps, or, at least, a familiarity with such things in picture books or film. The compounds of sensation that Deleuze and Guattari discuss in *What Is Philosophy?* are relevant here because the bending of young branches, including the array of sensory stimulation (visual, tactile and kinaesthetic) that accompanies such an action, coalesce into a compound that is the percept of a tree. The Thonet chair re-exerts this percept (it returns unchanged to the viewer at the moment of seeing the chair), but it also modulates the compound by sustaining the duration of the bend. The curves are held indefinitely. This is not an act of representation, but an expression of the capacity of affect to vary and change sensory compounds. The

⁵⁹ The chairs are made from large logs cut lengthwise into square cross-sectioned lumber. These are steamed under pressure and bent when removed from the ovens. It is then, prior to assembly, that the bent components are sanded back to form the round cross-sections of the chair's parts.

difference consequently serves to make a new force sensible; a force of permanency, or permanent curvature, embedded in the chair. This sensation is a new percept – the power of industry – yet a percept of the forest remains.

One can sense both the forest and the factory within the chair, in that the chair is a product of the forest processed by machines and used by humans. Thus, it affectively binds together the forest, the machine and the human. The expressions of this factory-forest-human becoming propagate into broader ecological levels, such as the culpability of the chair in environmental degradation. Rawsthorn views the chair through the prism of contemporary sustainability concerns, noting that the wood from early chairs was sourced from local forests and that factory tools were likewise locally produced (Rawsthorn, 2008). Yet, the local forests were vulnerable. Design historian Alexander von Vegesack's research reveals an evident pattern of Thonet factories depleting local resources and the company subsequently opening new factories elsewhere. The first factory in Vienna relocated because of the cost of transporting wood to Vienna down the Danube. The replacement factory in Koritschan was chosen because of its proximity to "virtually untouched" forests of beech in Moravia (Vegesack, 1996: 32). Less than three years later, the Thonet factory was producing 200 chairs a day and a local shortage of wood prompted the opening of another factory 50 kilometres away, closer to new beech supplies. Six years later, yet another factory opened in Hungary, its location near "huge beech forests" determined by the "need for raw materials" – by which point, the two older factories had depleted their local resources and were sourcing wood from further afield (Vegesack, 1996: 32–36).⁶⁰ A conclusion reached via affective analysis is not that the factories should be praised for using local resources, as if that decision was anything other than economic, but rather that the factories moved, like beech-eating machines, to locations that could feed their demand.⁶¹

⁶⁰ While the steam-bending technique used in the design of the *No. 14* produces a chair from minimal material relative to other chairs of the same period (Vegesack, 1996: 116), Thonet chairs designed later in the nineteenth century better reflect the environmental situation that eventuated. The *No. 56* chair from 1885, for example, uses shorter lengths of timber in subdivided components in order to economise on the use of wood (Alvera, 1987: 50).

It is relevant to question how this complicity in deforestation becomes sensory within the form of chair. There is force active within the chair and just as its wood is subjected to the force of steam and human agency, so is the forest. Just as this power moves in one direction to affect forest ecologies, it moves in another direction towards the consumer. This expression of the factory is sensible in the use of the screws, which lock the wooden curvature in place at the legs and seat. While the wood is forced into shape by industry, it is not fully subjugated. A force of the forest, morphogenetically expressed via tree cells – made rigid and capable of withstanding internal osmotic pressures several times that of the atmosphere due to cellulose and lignin in the cell walls – preserves in the tendency of the wood to return straight and pull away over time, applying outwards force to the screws. This is considered normal and expected by Thonet, and paper labels are typically glued to the underside of the seat rim, advising the consumer to intermittently re-tighten the screws (fig. 76). The screw is machine-made from metal, and expresses a quality of the factory in that way, but this is not its most affective aspect. What is more consequential is the return of force and action the screws capacitate: they work to maintain the shape of the chair in consumption, just as the factory works to produce the chair in production. The screws maintain a presence of the factory-machine within the chair by the intensities of this work. Their capacities are incomplete, however, without human labour and they bind the consumer to these intensities with their requirement for intermittent re-tightening. The chair's human-forest-machine hybridity preserves from production into consumption.

Within the consumer landscape, this preservation of machine power then works to open up the chair's set of relations in unexpected ways. The power is palpable not so much in the ways the chair is like wood by sight or touch, but in the ways it is *not* like wood in the haptic and kinaesthetic senses. When lifted and moved, the chair is *unnaturally* light, stiff and rigid, so much so, that it has been put to unexpected uses. One novel application was its use by circus performers, who channelled the power within the chair into actions

⁶¹ It should be noted that the nineteenth-century attitude to forestry and sustainability was different to contemporary perspective. Architect and sustainability theorist William McDonough notes that during the first Industrial Revolution, natural resources were seen as being “immune to human activities” (McDonough, 2000).

opposing animal force. The chair was considered light and resilient enough to be used in lion taming.

From photographic evidence, the similar *Thonet No. 18* (1876) chair (or a North American copy of it) appears to have been a favourite of lion tamers Clyde Beatty (figs. 77, 80) and Pat English (figs. 78–80).⁶² The lion tamers hold the chair, with one hand, in front of their bodies as a defensive shield, its four wooden legs working to confuse the senses of the lion (Beatty, in Witney, 1995: 39–40).⁶³ The chair becomes a prosthetic, an extension of the lion tamer's body, that serves to increase their size and power in the senses of the animal. The chair must withstand the incursions of the animal, such as a paw swipe or bite. In one picture of the lion tamers together (fig. 80), claw marks are visible on the legs of the chair, indicating its robustness. Note, too, the lightness of the chair indicated by Beatty and English being able to also grip a gun in the same hand that gripped the chair (fig. 79). This historical information suggests the potential of anomalous objects to enter into chains of becoming with other groups, such as performing animals, for which they were never intended.

The use of the chair in lion taming was, however, rare, and its exceptional lightness and durability had far more impact in regular human affairs – particularly in cafe culture. Historians have noted that the chair was as important as electricity to the spread of the cafe culture across Europe in the late-nineteenth and early-twentieth centuries (Fitch 2006: 21). The chair is referenced in descriptions of famous European cafes (Grafe and Bollerey, 2007: 134, 181), and has been praised for its ubiquity as a “classless” object of cafe culture, found in equal use in upmarket and downmarket establishments (Grafe, 2007:

⁶² Barry M. Harwood notes that good imitations of the Thonet chairs became widely established in North America by the late-nineteenth century, and that the *No. 18* was a model copied early (Harwood, 1994).

⁶³ The *No. 18* chair is very similar to the *No. 14*, except that the back interior support is vertically aligned in an ergonomic improvement avoiding contact with the spine. This structural difference appears to have informed Beatty and English's preference for the *No. 18*. In the photos of Beatty and English taming lions, they grip this section to keep the chair legs horizontally upright and facing towards the lion. It's probable the *No. 14* chair would not have offered the same grip and neither the same performance posture.

39–40). The association with cafe culture began with its predecessors, the *No. 4 Daum* chair (1849), so named after the Viennese coffee house owner, Anna Daum, who first purchased the chair in bulk (Vegesack, 1996: 23). Realising this chair's suitability for hospitality environments because of its strength, Thonet strove to improve these features, first in the *No. 8* (1855) and then the *No. 14* (Gleiniger, 1998: 22–28). From the point of view of the manufacturer, the relationship between the *No. 14* and cafe culture is intentional and causal; in the late nineteenth century the company developed sophisticated marketing strategies targeting specific industries such as including cafes, restaurants and theatres (Vegesack 1996: 41).

An affective analysis reveals that more is happening sensorially within the chair than the designer or producer may have intended. The transformative power of affect can be imagined in regard to cafe management and employees, especially in the case of outdoor cafes. For example, moving chairs up onto tables for floor cleaning, or in and out of cafes at opening and closing times, is made easier with light and strong furniture. Furthermore, the lightness of the chair makes it easy for customers to move chairs around, to join other tables and revel in de-stratified seating arrangements. These affordances transmit affectively from the chair's material properties into the action of muscles moving and lifting. The bodily sensation at the first point of contact between person and chair – the interactivity of forces (such as the weight of the chair meeting the kinaesthetic receptors within human muscle) – immediately potentialise a set of possible behaviours. This is the play of affective forces as micropolitics, the field of interactions at the level of the human body. Micropolitics take the form of “micro-shocks”; small cuts into consciousness or shifts in perception that change thinking and that can furthermore potentialise larger social changes at the macro-level (Massumi and McKim, 2009: 4–6). Thus, lightness, a materiality perceptually captured by the encounter of wood with steam, the factory and the human hand, activates a whole series of affective possibilities that run up and down the chairs' chains of relations, from the micro-sensibilities of a lion tamer or cafe worker, to the macro-social changes of class mobility in European cafe culture.

Macro-social relations arising from encounters with design objects can also be understood by examining the relationship between affect and consumption in capitalist economies. Betti Marenko notes that to do so involves the examination of material objects in the real world, not as just objects of production and consumption, but as commodified markers of affective forces (Marenko, 2010: 139).⁶⁴ She makes the distinction that consumer goods are not *loaded* with affect for marketing purposes; rather, commodities are transformed into triggers that propagate their affective fields. Consumption is defined by the interaction of these fields. Marenko, developing her argument from the work of French nineteenth-century sociologist Gabriel Tarde, says products use affects to bind consumers into consumption patterns that work in a biological manner akin to the spread of viral epidemics (Marenko, 2010: 141 and 145). Thrift also examines Tarde and his focus on “passionate interests”, noting that such passions bring humans and materials and products together in unique combinations, which trigger “imitative” behaviours (Thrift, 2010: 290–291, 295).⁶⁵

In the case of the Thonet chair, certain qualities of beech trees give capacity for the chairs to be light and durable.⁶⁶ The qualities are modulated by design to become affective

⁶⁴ This idea is shared by Massumi; he writes, “The ability of affect to produce an economic effect more swiftly and surely than economics itself means that affect is a real condition”, and notes that the ability of affect to circulate, re-group, transverse contexts and create effects in vastly different settings gives affect a “metafactorial ubiquity” (Massumi, 2002: 45). By this, I take Massumi to mean that affect can mobilise anywhere, grouping and hybridising entities together in a manner that goes beyond those entities’ extant permutations. For the Thonet chair, such an extant permutation would be its role as a cafe chair, due to this role being intentional and normative from its early development and production. Its role in lion taming is an example of the chair moving beyond such a permutation and affecting in a transverse context.

⁶⁵ Such behaviour is not perfect imitation, however, but relies on the human imagination to be ceaselessly restless so that it can engage with “every surface” or quality of an object (Thrift, 2010: 296).

⁶⁶ Potentially, this becoming enhances the fecundity of the tree; it no longer grows only under its own evolutionary factors, but develops a hybridised power to be planted, grown and exploited by chair makers. From the sources I have used, this didn’t appear to explicitly occur with the production of the *No. 14* chair, at least not during the nineteenth century. Or in other words, Thonet didn’t make efforts to plant and harvest beech trees, but rather found and exploited existing forests in Europe. However, the potential for a human-plant hybridised fecundity remains, and the success of many plants, from food crops to drug crops, depend on such a becoming.

triggers, which extend the chair's field of affect into the supply-and-demand market mechanisms of capitalism. These qualities compelled Anna Daum to purchase Thonet chairs for her cafe. Daum's order was swiftly followed by a much larger order from another client for his hotel, and in the following decades, the chair proliferated across the cafes and homes of Europe (Vegesack, 1996: 23). The popularity of the chair motivated other producers to imitate the chair, especially after Thonet's primary patent expired in 1869, and, by the early 1890s, more than 50 companies were producing similar furniture throughout Europe and North America (Harwood, 1994: 92). This explosion in popularity among producers and consumers is an example of the epidemic-like spread of passionate interests within market systems described by Marenko (Marenko, 2010: 140–143).

As mentioned, the demand for beech trees compelled the Thonet company to open successive factories in close proximity to increasingly larger beech forests (fig. 81–82). There were social effects resulting from the fast expansion of the company. The Thonet workforce became large – documented in 1913 as more than 7,000 workers (Kyriazidou and Pesendorfer, 1999: 145). Even prior to the turn of the century, the workforce was sufficiently large to support the provision of schools, housing estates and shops for employees and their families, all directly provided by the company. The monopolistic condition of this service, exacerbated by the issue of a Thonet currency for wages, the use of which was mandatory for the purchase of company-supplied goods and services, made employees dependant on the company. This situation is described by Vegesack as the actions of an “autarkic empire” (Vegesack 1996: 37). It can be understood as an example of what Deleuze, recalling Michel Foucault’s term, calls the “disciplinary society” in which individuals are organised by various forms of confinement (Deleuze, 1995: 177). Employees were not economically free enough to leave the company and find employment elsewhere. This can be understood as an intensification of the Thonet affective field to the extent that employees became bound to the product of their labour.

Marenko notes that this binding also works on consumers, and in the contemporary world, various mechanisms have been developed to take advantage of it, including the practices of emotional design, narrative-based marketing, experience economies and

forms of “psychotechnologies” (Marenko, 2010: 146). Another contemporary example would be the design of proprietary 'digital ecosystems', which tend to lock users into exclusive use of a company's particular computer operating system and devices. Unlike the direct application of economic force used against Thonet employees, these are not practices of a disciplinary society, but a “control society”, in which power is exercised in continuous modulations (Deleuze, 1995: 179). Such modulations apply not just to consumers in the examples Marenko cites, but to producers too (or, at least, employees of producers) in the form of varying and complex motivational forces, such as bonuses, performance targets and occupational training expectations (Deleuze, 1995: 179). Marenko concludes that specific knowledge of such modulations in product design and their effect on affective fields is still needed, but suggests that the more active forms of consumption ('prosumer' activity, hacking and modding, for example) are the most likely forms of consumption to catalyse a power shift away from centralised production.

Scenarios such as these can be understood as eventuating (or *triggered*, as Tarde would have it) from the unique affective configurations of materials. The particular example of Thonet's autarkic empire demonstrates the historical relationship material expressions and their modulation of large-scale socio-industrial production conditions – a set of relations through which a thread can be traced, however unpredictable its modulations may have been at the time. This is also a relationship illustrated in the practical works of Formafantasma. In the remainder of this chapter, I discuss how their work *Botanica* re-configures the material expressions of their chosen material, plastic, for a speculative re-configuration or modulation of likewise large-scale socio-industrial production scenarios.

Formafantasma

The primary importance of Formafantasma's practice to this thesis is their creation of work with material qualities that constitute a temporally expanded assemblage with environmental and industrial relations. Their methodical approach to research and experimentation generates a critique of industrial production and consumption paradigms approximate to my own interests. While their practice includes wider social

commentary, they do not neglect environmental critique, which, in *Botanica* (figs. 28–31), is interwoven with their call for the use of alternative materials and production systems. The designers Simone Farresin and Andrea Trimarchi who compose Formafantasma are self-aware of the significance of their material experimentation, commenting that they are “interested in the power of materials to communicate both emotions and ideas to the user” (Farresin, in Baas, Farresin and Trimarchi, 2014: 40). The forthcoming analysis is not formed from a close reading of their own critical writing on their practice, though their own essays and commentary are clear in their own regard, but rather based on the visual, tactile and haptic sensory qualities that arise from the material qualities of the *Botanica* and *Craftica* objects. Both collections have material qualities in relation to history and the future; Lidewij Edelkoort notes their use of materials that are “embedded in memory” (Edelkoort, 2014: 70), and Marco Petroni their loading of future “potential” into objects (Petroni, 2014: 14). I explore this aspect of their practice, which I propose aligns with Deleuze’s concepts for the time-based, temporal qualities of affects, and which collapses perceptions of past and future into present sensation. The material and moulding techniques of *Botanica* also has relevance to the concerns of this thesis for illustrating, in practice, hylomorphism and Deleuze and Guattari’s concept of the machinic phylum. I use discussion of *Botanica* to develop these concepts and foreshadow their role in the analysis of my own practice in the next chapter.

Formafantasma’s *Botanica* presents a series of vessels and rough table surfaces made from non-petroleum-based polymer materials – so-called natural plastics comprising substances such as sawdust, blood, tree sap and various shellacs (the last colourfully described as “insect excrement”) (Fairs, Farresin and Trimarchi, 2012). These concoctions were derived from researching the historical period prior to the invention of bakelite, one of the first synthetic polymer plastics. The presentation of this work alludes to this historical period and suggests a counter-factual historical narrative, as if proposing an alternate present in which synthetic plastics were never invented. This is a result of their focus on the history of materials in their practice, rather than the technical properties of material, which they claim distinguishes their practice from conventional forms of product design (Fairs, Farresin and Trimarchi, 2012).

Formafantasma's focus on historically and research-driven design is also seen in their subsequent collection *Craftica* (2012) for the fashion house Fendi (figs. 83–87). While not explicitly stated as counter-factual, this collection likewise produces a similar feeling of looking into an alternative world. The sensitive interrelationship of materials such as fish skin, cow bladders, brass, bone, glass and marble is suggestive of pre-industrial craft. Yet, though the work is raw and visceral, it is also unweathered and precisely crafted. The mixing of materials in some works in the collection is historically incongruous; a glass vessel is blown through a bone, a metal hook is stitched in leather. Past and present are violently juxtaposed.

These material qualities are suggestive of an alternate present, a step both backwards and sideways in time. As objects present as sensoria, affects are strung together and overlaid with memories from, or nostalgia for, different historical dispositions. In this way, products can extend into the past (and future) in a way expressive of their origin (and fate). This is significant for an environmentally concerned experimental design practice because it is the origins and fates that define their environmental consequences; origins concern their manner of production, and their fates concern their manner of use, re-use, or non-use.⁶⁷ Formafantasma's efforts to re-imagine a historical period and bring it forth into a hypothetical present trigger the consideration of these origins and future conditions of the objects and, in turn, potentialise, within the object, an awareness of production and consumption conditions and their environmental relationships.

Deleuze's cinema books are helpful here in understanding how an object can express past and future through a manifestation in the present. Deleuze cites Fellini: "We are

⁶⁷ An example of this is the connection between form and origin in the fish skin stools (fig. 83) – for example, the legs are elongated like fish bodies and the sizes of the stools vary based on the size of fish skin leather available (Rossi, 2013a). The latter aspect is not inconsistency, but a variance of form, which flows from natural variety; i.e., some fish grow bigger, ergo some stools are made bigger. This is also the case with their water containers made from cow bladders (figs. 87–88). This illustrates that material expressions of fish and cows flow into the sensory experience of the stools and potentialise the consideration of their production conditions, such as how the fish and cows were caught, killed, skinned and cleaned.

constructed in memory; we are simultaneously childhood, adolescence, old age and maturity” (Deleuze, 2005: 99). The processes of remembering the past or imagining the future are always initiated from the present, and remain connected to the present because these processes are made active to mind. The present always contains other temporalities. Deleuze describes two interlinked forces at work; an extension of the past or future, described as “sheets”, and a “contraction of the actual present”, which is our conscious awareness of *now* (Deleuze, 2005: 109). As the past or future expand, these sheets grow larger and the awareness of the present inversely contracts. While Deleuze developed these concepts specifically from a study of the mechanism of movement and action in cinema, this study was not just of physical movement onscreen, but of “movement in general”, which also characterises thought. The techniques and “artificiality” of cinema is likewise relevant to perception and the processes of memory and imagination (Marrati-Guénoun, 2008: 9).⁶⁸ The remit of the experimental designer wishing to develop counter-factual historical narratives in the manner of Formafantasma is to discover how the present, with all its temporalities, instantaneous perceptions of past and future and forces on memory and imagination, can be captured in the sensations of an object.

Deleuze develops this discussion of the sheets of the past in terms of how depth of field is used as a cinematic device in the movies of Orson Welles, and in historical forms of painting (Deleuze, 2005b: 98-100, 106-109). Depth of field is a term from photography that

⁶⁸ Paola Marrati-Guénoun claims that the development of Deleuze's concepts in his cinema books was facilitated by the particular expression of movement found in cinema, that she claims is lacking in static objects (Marrati-Guénoun, 2008: 7). Her examples of static objects include masks, paintings and sculptures, but domestic products could also be included according to her criteria. However, it is not the case that resulting concepts of movement that Deleuze extracts from cinema cannot relate to static objects because they lack such movement. The perception of movement in domestic products is not limited to the physical movement of which such objects are capable when manipulated, nor it is only contingent to, as I propose in this chapter, the movement of subjective memory and imagination. Rather, the perception of objects is infused with potentialities of movement within the object's material and form. This is the implicit movement to which Massumi refers when he discusses the perception of volume; we don't need to walk around a solid object to know it is voluminous, a volume *is* an “abstract experience of volume” (Massumi, 2011: 42). This is an exploratory perceptive movement along the object's edges and surfaces, which, even if they are not directly visible, are sensed.

describes the spacing of clear objects in a frame in relation to unclear objects. In an analogical sense, objects too have a depth of field. Their affective qualities can be either sharp or dull, and their arrangement foregrounded or backgrounded. Foregrounded or focused qualities are those that are seen or sensed first: colour, tactility, shape, and, in many cases, also affordances of use. Backgrounded qualities are those that are sensed secondarily or not at all, but that may be no less important. I propose that in product design, background qualities are often construction techniques and material durabilities that are inadvertently or intentionally obscured by designers and producers.

Extending this line of thinking, the contemporary problem of design obscuring the production conditions of products can be interrogated by analogy to the developmental history of painting technique. Deleuze notes that prior to the development of perspective during the Renaissance, sixteenth-century paintings were composed of scenarios or plans, each with their own characters and props, and, when assembled together on the canvas, there was a distinction between each plan resulting from a lack of technical relationship. This is also true of other, non-European, styles, such as Chinese landscape painting. In Europe, this changed when perspective developed. Then the characters or entities within a painting could be presented within the same plan or tableau through the correct use of a technical and methodological organising scheme. Characters and props might now be massively reduced or enlarged to suit the scheme, sometimes in a “violent perspective which does even more unite the near and the faraway” (Deleuze, 2005: 107). The question this theoretical conception poses for design is the appraisal of products where the affective relationship to their production is constrained or distanced. The question becomes: is there an organising schema available to help product designers capture the conditions of making, manufacture and production within an object, as sensation, as opposed to keeping these conditions suppressed? It would seem like such a schema should develop from immersion in material practices, just as the concepts needed for the development of perspective arose from the use of tightly pulled string to lay out walls and foundations by builders (Ingold, 2010: 100).

In Chapter One, I discussed how Hella Jongerius's *Soft Urn* was noted for having a highly noticeable part-line – a material artefact resulting from her experimental and anomalous substitution of rubber for clay. The part-line, captured by the material capacities of rubber, works to express manufacturing conditions. Typically though, part-lines are removed or visually minimised. In ceramic production the practice is to wipe away the mould's part-line from the clay cast. In many mass produced objects with a Loewy-derived plastic or metal shroud design, the part-line is a feature of a mechanical design (such as male-female style socket) which joins two or more parts of the shroud together. It is the *visual indication* that those parts have been joined, and thus also an expression of the potential for those parts to be separated.

Returning to the example with which I opened this thesis, it has been observed that Apple iPhones, and other Apple products, have part-lines that are difficult to discern. This aspect, combined with the use of screws either hidden or incompatible with conventional screwdrivers, has led to criticism that such products are black-boxed – visually and technically impenetrable for consumers, and difficult to repair or modify (VanHemert, 2011; Foresman, 2011). Criticism from industry oscillates between the view that Apple products are too sophisticated for user repair or modification and claims that Apple intentionally discourages such activity to encourage upgrading and purchase of whole-product replacements. Scott Mitchell sees such practices as making consumers dependent on manufacturers in a kind of “tethering”, constructed by information control, which hackers and modders subsequently try to break to assert their autonomy (Mitchell, 2011: 110, 126).

Mitchell considers these design techniques used by Apple and other manufacturers as serving dual purposes (Mitchell, 2011: 116). Within a methodology of built-in obsolescence, it can be considered that hiding the part-line reduces the potential for the components to be separated for repair, reuse or modification. Yet, it can also be considered that part-lines may be hidden, obscured or minimised for reasons of an aesthetic ideal, perhaps because it expresses the product as 'one thing', rather than as a collection of components.

These two considerations are, however, the same thing, because it is the perception of the product as one thing, unable to be separated into components *in the mind*, that limits the possibility for repair. This issue can be explored in regard to Deleuze's conception of the relationship between affect and time, in which past and future are contracted into sensation in the present, and the concept of affective depth of field. The decision to obscure part lines serves to reduce the affective depth of field of the product and focus attention away from conditions of manufacture and assembly. This is a reduction in the capacity to sense production conditions, a perception of the past, but also a reduction in the capacity to imagine a possibility of reuse or repair, impacting the perception of an alternate future. When both are excluded from expression in present sensation, the possibility for multiple, open temporalities is lost, along with the affective possibilities those temporalities may offer.

Thrift addresses this problem by looking at the presentation of effort in design and production. In his study on glamorous materials, he contends there is an art of *sprezzatura* at work in contemporary product design – a construction of glamour as something effortless, an art that is perceived to be practiced without strain or struggle, even though it actually requires much effort (Thrift, 2010: 299).⁶⁹ *Sprezzatura* has dual action; it works by effort, but also works to conceal effort. *Sprezzatura* can be seen in the trend of smooth and glossy mouldings, the removal or obfuscation of part lines and in the marketing of box-fresh, scratch free surfaces. The work required for such artifice is immense, in the form of material experimentation and testing, the study and writing of technical white papers, in addition to design, prototyping, product testing and the work of the advertising and media industries. Likewise, the qualities of the factory, whether grimy, noisy and hot, like a metal foundry, or the meticulously designed, controlled and cleaned confines of a chip-manufacturing plant, have an effort to them in contrast to the appealing, apparently effortless, sensible simplicity of many new products, shiny and autonomous, pulled from their box for the first time. Glossy and shiny features have a particular effect worth noting; it is understood by product designers that the movement of reflected light draws the eye along and conveys a sense of motion *to the surface* – the

⁶⁹ The term originates from Baldassare Castiglione's *Book of the Courtier* (1528)

design of this is termed “reflection management” (Seymour, 2011). The eye is drawn past and over any details that may therefore indicate production conditions, such as assembly and disassembly technique. For Thrift, the affective appeal of such *sprezzatura* in objects is the capacity to become bound “without troubles” – an internalised becoming in which an identity forms distantly from the problems or complexities of the world (Thrift, 2010: 298). I take this to mean that the absence of complex production conditions in the sensibility of the object is a proxy for the absence of the many social, industrial and environmental complexities of production itself. Therefore, the product can be used and consumed without trouble, guilt or forethought.

Hylomorphism is aligned with the practice of *sprezzatura* in contemporary design and production. Deleuze and Guattari, working from the theories of Gilbert Simondon, frame it as a model that distinguishes matter (*hylo*) from form (*morphic*) (Deleuze and Guattari, 1987: 409). In hylomorphic practice, form is imparted *over* or imposed *onto* matter. A simple example of hylomorphism in practice is that of pottery casting, in which the vital qualities of a material like clay, such as grain, texture, elasticity or porosity, are smoothed away by perfect formation into moulds. Deleuze and Guattari use this example of casting in particular to explain the hylomorphic model because of its construction of thresholds, which prevent material properties from carrying forward within the object. The manifestation of this threshold in casting works to erase or remove the presence of structural complexity and subject surface materialities to designer intention. They note that this conception of the hylomorphic model and its thresholds has particular sympathy for certain materials and techniques, which can comply with a procedural logic, such as clay and the mould. In this example, the clay material is prepared and flows into the mould, meeting a threshold in which the clay is subject to the form of the mould (Deleuze and Guattari: 1987: 410–411). More precisely, clay can recede or exceed any number of thresholds, and the mould confers or obstructs this potential. This example of casting illustrates the connivance between hylomorphism and mass-production and reproduction. Once form is conceived abstractly, it can be applied by design to a mould. The mould then imposes form repetitively into material inside it, until the mould obsolesces.

As an ontological concept, however, hylomorphism has limitations that can be understood beyond the example of casting, through its framing of the relationship between an abstracted form and matter. This can be illustrated using the example of architecture and building. Tim Ingold claims that a major development in hylomorphic practice occurred during the Renaissance, when construction developed from a builder's craft to the field of architectural design. Renaissance architect Leon Battista Alberti perceived architecture as composed of perfectly abstract forms, lines and shape, albeit originally informed by the use of string in building to lay out walls and foundations, but then conceptually constructed in the mind. Such lines and shapes are perceived to be a design that is created prior to, and in control of, the construction process. This can be understood as an ontology in which form precedes and imposes itself on matter, but Ingold notes that while architects may perceive the process of design and construction this way, builders may not (Ingold, 2010: 93–94). Builders are aware that construction is actually a series of practical, procedural and contextual operations, such as digging holes, cutting timber, pouring concrete, stacking bricks, etc. These operations are continuously modulated by conditions that present as challenges to the unfolding of the design, which *could* be, respectively, rocks in soil, knots in wood, air bubbles in cement, cracking bricks, etc. These examples do not convey the full idea of contextual operations either, though, because such things are only *local* conditions. They are given agency as *objects* that “act back”, but only insofar as they present obstacles to the builder's intention to control material in specific ways (Ingold, 2010: 93–4). Rather, the process of building is modulated by a real, vast, messy and interrelated array of local and *global* conditions, which include but are not limited to climatological, geological and ecological forces, into which builders immerse themselves to discover a path of construction.

When hylomorphism occurs in practical situations – that is, when it can be observed in material practices that comply with a procedural logic like those just described – it has expressions akin to *sprezzatura*. It exerts a dual effort: it wants to produce with material, but at the same time control, diminish or conceal the material. In doing so, hylomorphic practice precludes a hidden middle, an area of “continuous modulation”, through which

the material and form interact (Deleuze, Parnet and Pinhas 1979; Smith, 1996: 43). This preclusion was embedded in scientific paradigms in place by the Industrial Revolution, that Deleuze and Guattari characterise by the distinction between 'Royal' (major, or State) and 'Nomadic' (minor) sciences (Deleuze and Guattari, 1987: 361–63). On the one hand, Royal science was concerned with overarching theories and rules that modelled phenomena, but, because of the limitations of mathematics, there was a tendency to select only simple materials and behaviours for study, such as elemental gasses or solids (De Landa, 2004: 20–22, Deleuze and Guattari, 1987: 363–65). The hylomorphic model fits this mode of thinking well, in that Royal science studied simple and often predictable linear behaviours complementary to the assumption that matter was inert (De Landa, 2004: 20). Their concern was the “conditions that restore the primacy of the fixed model of form” (Deleuze and Guattari, 1987: 365). Nomadic science, on the other hand, was applied science. It continued a millennia-old study of complex materials begun by metallurgists, potters and alchemists, and was concerned with functional and practical outcomes. However, Royal science had its own practical outcomes too. Its successes in studying *simple* materials led to the significant development of *consistent* materials whose modes of function and failure could be understood and predicted. Steel is an important example due to its ubiquity during the Industrial era. Materials of consistent quality could be fed to industrial machines of mass production, machines that were otherwise unable to manage the diversity and variability of complex materials in the way that a craftsperson, like a swordsmith or knife maker, could (De Landa, 2004: 22). Deleuze and Guattari explain this relationship between material and machine, in which one is made consistent so that the other makes consistently, as emblematic of the hylomorphic model, “implying both a form that organises matter and a matter prepared for the form” (Deleuze and Guattari, 1987: 369).

Hylomorphism is discussed by Simondon in his theoretical writing on *individuation*, the ontogenetic processes through which individuals both crystallise and yet also continue to change. Simondon claims hylomorphism is a kind of thinking which tends to perceive formation as isolated – to the extent it can only grasp an “impoverished reality” (Simondon, 1992: 315). Deleuze and Guattari's concern is to uncover material information

by shifting the focus from material-*form* relationships to material-*force* relationships (Deleuze and Guattari, 1987: 335, 395, 407–11) (Smith, 1996: 42–43). This is to address *matter*. Matter is the composition of immanent forces, or degrees of intensities, of “resistance, conductivity, heating, stretching, speed or delay, induction, transduction...” (Deleuze and Guattari, 1987: 511). Materials capture these forces as individuations of matter defined by specific operations (Deleuze and Guattari, 1987: 342 & 345). For example, metal may be annealed and then rolled into sheet, an engagement with its crystalline structure affected by intensities of heat and pressure in speeds and durations. These task of the metallurgist (or designer, or engineer) is to uncover these “forces of the earth” and bring them into sensation, not directly as forces, but as materials that comprise “relations between matter and form” (Deleuze and Guattari, 1987: 347). However, these relations *flow*. They are unstable; materials are immanently in the process of becoming something else. Iron rusts, wood decays, liquids evaporate. Materiality thus concerns the processes of “matter-flow” (Deleuze and Guattari, 1987: 409).

For Ingold, the concept of matter-flow becomes a manifesto – follow the materials – in a Deleuzian-Guattarian framework for making (Ingold, 2010: 94). Ingold illustrates the manifesto by returning to the role of string in building. As much as the architectural lines of Alberti are abstractions that assert a hylomorphic logic in the mind, they are also abstractions of a material practice dating back to ancient times and of string itself as an ecological assemblage of plant-human operations, such as farming, harvesting and weaving.⁷⁰

Within the field of product design, the hiding of part-lines, the design of glossy mouldings, and other industrial techniques of *material* obscuration are evidence of hylomorphic practice. These features, or lack of features, emphasise formation, a sense of the complete product as one thing, but lack information; how does the product come apart? What does it contain? How is it made? Of what is it made? How it assembled and how can it be repaired? Such issues apply to black-boxing, when users are unable to

⁷⁰ Renaissance illustrations explaining the techniques of perspective had their perspective lines drawn as strings, with ends flowing loose on reaching their apex at the origin of the viewer's line of sight (Mitchell, 2006: 348).

access or understand how to repair or modify the internal components of a hardware or software product. Such production conditions, materiality, internal functioning, system operations and more – the sweat and stink of the factory or mind of the engineer – are contained in the hidden middles concealed by *sprezzatura* technique and hylomorphic practice.⁷¹

Deleuze and Guattari, however, develop a concept for developing and uncovering such modulations from the middle; a concept for uncovering the vitality of matter, which they term *machinic phylum* (Deleuze & Guattari, 1987: 368, 407-11). This concept shifts the focus from material-*form* relationships to material-*force* relationships, and Daniel Smith notes that this is expressed in the practice of modern artists to take a material, such as paint, clay or plastic, and capture its intensities and traits (Smith, 1996: 42–43). In this sense, machinic phylum is a concept resonant for affective analyses because it uncovers material capacities and tendencies – the relationships of matter, force and the “mechanisms” between objects (rather than interpreting such connections at the post-matter or representational level) (Deleuze and Guattari, 1987: 73). In the case of thermoplastics, for example, the heat, which transforms a solid polymer to a liquid, has a duration of effect, a memory of heat which modulates the flow and form of the material.⁷² In turn, these modulations are affects, which can be sensed by an artisan or craftsperson – by the sight or feel of liquid polymer moving in a bowl, perhaps; a sense of speed and viscosity that indicates the plastic is ready to be poured into a mould. In ways like this, the machinic phylum and affects operate together via force relationships for the purposes of morphogenesis.

⁷¹ It is this same problem, the hidden material relations of products, that Mike Anusas and Tim Ingold have alternatively termed *infrastitial* relations – a “logic of form” paradigmatic to industrial practice, which extends to include architecture and urban design (Anusas and Ingold, 2013: 58–59)

⁷² Philip Goodchild points out it might sound strange to talk about objects and materials as having memory, but it makes sense because of the way forces carry through and transmit from one phase of becoming to another; “everything has a duration” dependent on a perception of duration from another thing. Thus, even in non-human objects, there is a duration that can be expressed as a form of memory (Goodchild, 1996: 26).

The visual and haptic peculiarities of Formafantasma's *Botanica* illustrate the play of the machinic phylum. Their vessels pull out rich qualities and material intensities, which embody the conditions of manufacture. Generally, the vessels are composed of two sections, a base or shell and a smoother upper section. Some surfaces roughly resemble organic materials such as fish scales or overlapping leaves, others are irregularly translucent. Many of the bio-resins they use do not have perfectly smooth emulsion during casting and so have small negative spaces near the surface, in the form of pits, crevices and veins, where the irregularly viscous material does not fully compress against the mould. Like the example of black lines in Mondrian's paintings, in which small cracks offer a glimpse of their forces, the crevices and pits of *Botanica* bring the force of their production into sensation. The force carries into the haptic realm when touched. The crevices can be felt under the fingertips as well as seen, but also through the weight of the vessels, which are unexpectedly light, suggesting the presence of voids.

In contrast to petrochemical plastics, which often have a high molecular density and thus relative heaviness – and certainly for types of plastic commonly used in homewares and furniture, such as the heavier forms of polyethylene (UHMWPE) or polyoxymethylene (POM) – the bio-resins used in *Botanica* are light and, while hard, also feel spongelike. This perception is conveyed through the material not just exhibiting irregular viscosity during casting at the surface, but throughout the whole form, resulting in a spongelike structure of dense and less dense material. The sensation of lightness carries across the senses so that the vessel's backgrounded qualities, the synthesis of the resin and its behaviour during production, become foregrounded, or redrawn to the present, in the sight and touch of the object. The manufacturing techniques that Formafantasma deploy allow the material intensities of the biopolymer to express within the mould, rather than be subsumed by the mould. This is a tacit, artisanal practice of following a matter-flow that expresses in the aleatory form of components, such as in the leaf-like layers that cradle the lower half of some vessels (Fig. 30).

Such material practices, in their deviation from hylomorphism, facilitate the expression of production conditions and open out to imaginings of the past and future that are

accentuated by presentation and dressing. For example, the vessels are photographed among plants and greenery in a space that is fairly, but not completely, neutral. The wall behind the vessels opens to a set of tall, multi-panel steel-framed windows of a sort typical to early-twentieth-century factory design (Park, 1984). The vessels are tagged with information regarding their materials, in a manner redolent of scientific investigation or the display of artefacts in science museums. Together with the indoor plants, instruments and construction tools as props and the industrial qualities of the space, these features are evocative of the period in which scientists were called naturalists. Some of the vessels rest upon tree rings. The lower or rougher half of the vessels approximate features like overlapping leaves or fish scales and the colour palette of browns and yellows are naturalistic – evoking dirt, clay and the earth. These visual features transmit a sensation of the past but, because they are also expressive of the idea that the vessels are biodegradable, an imagining of the future.

However, it cannot be concluded that the future of the objects *is* biodegradation. The vessels are dressed, photographed and staged formally, in the manner of art or exhibition and science museum, an appealing design that suggests a future life safe-guarded within a museum collection – a life less humble than burial and decomposition in dirt. The reality is that much of Formafantasma's work in the last few years has been purchased by museums and cultural centres (Farresin and Trimarchi, 2012). The photographic staging makes their work appear attractive and ready for preservation. The museological authority of their scenography produces a sense of timelessness at odds with a conception of the work as functionally or biologically disposable.

These complexities and conflicts within the *Botanica* vessels are indicative of the speed and durations in which humans bind with objects and materials. Deleuze and Guattari note that assemblages have points of recuperation and rest, in which the speed of change within a subject slows (Deleuze and Guattari, 1994: 166-168). The presentation techniques of Formafantasma provide such recuperation points: moments of glamour or glimpses of *sprezzatura* with less fervent intensities – a sense of a world without troubles. Such techniques are seductive, but accentuate the immersion into an assemblage in which

more significant considerations arise – such as the potential of counter-industrial production methods, the possibilities of biopolymers and the prospect of an alternate present in which synthetic plastics are no longer ascendant.

In this chapter, I have attempted to give an account of how the concept of affect opens up the understanding of designed products and their relations. I began by introducing affect as conceived by Spinoza and developed by Deleuze and Guattari concerning the capacity to affect and be affected. For products, this is an account of the intensities and forces that are sensorially and materially encountered in an object. Such sensations take the form of affects, such as the forces that crack paint or bend wood, which move through materials, objects, and people to potentialise change. The movement of affect creates passages across fields, forming assemblages with micropolitical relations, but also opens out to much larger social and environmental relations. In the case of the Thonet chair, it is how intensities of beech wood, the lightness and strength of its fibres, modulated by forces of steam and screws, affect producers and consumers in ways that have implications for forestry, cafe culture and circus performance.

It was identified that such relations are facilitated by the quality of anomaly. Anomalous objects, by virtue of their position on the edges of object groups, enable assemblages to form or transform, bringing humans into new relations (such as with industry, forestry, cafes and lions, etc.). Using the case studies of the Thonet *No. 14* chair and Formafantasma's *Botanica*, I demonstrated that the qualities of anomaly are especially relevant to experimental design because they disrupt the expected sensory encounter with objects. They shake up habitual behavioural patterns, in a manner correspondent to the micro-shocks described by Massumi, and facilitate passage into new relations, binding users and consumers into unexpected assemblages. While this is not an event that predicts consumer responses to products, the process of binding into such assemblages anticipates new responses, including the experiences, perceptions or action that may comprise them.

Furthermore, concepts of affect have been mobilised by theorists such as Thrift, Marenko, Bennett and Roberts to show that the role of affect in design is both nuanced and powerful. Roberts explains how the consumer experience of shopping at Ikea is affectively modulated within their showrooms, and Thrift and Marenko discuss these types of modulation in regard to the broader consumer society. They show that products work as triggers, propagating affects up, down, across consumption and production systems. An important aspect of this propagation, according to Bennett, is that it moves through material in both human and non-human relations. This focus serves to shift critical attention away from the intentions or goals of producers and consumers and towards the materiality of objects and their production, consumption and environmental relations. An implication is that if production, consumption and the environment are considered together as having shared, co-relational affective forces, environmental impacts can be problematised wholistically as part of an affective field in which consumers and producers are aware of their own ecological relations.

In my analysis of Formafantasma, I intended to show how concepts developed by Deleuze and Guattari uncover the depth and intensity of product relations and work to expose the conventions of industry. Deleuze's understanding of differentiating temporalities, put to work in his use of depth of field in painting to bring out affective richness, shows how perceptions of the past and future can be embedded in the present sensation of an object. Such practice tends to run counter to existing consumer products subjected to industry standards of, for example, built-in obsolescence and shroud design, which can be understood as expressions of *sprezzatura* and hylomorphism. Deleuze and Guattari's concept of machinic phylum, however, can be used to uncover alternative design practices that accentuate the morphogenetic expressions of material tendencies and production conditions. The results have a capacity to strengthen the environmental significance of Formafantasma's proposition; a counter-history of industrial plastics. The affects from such an alternative practice can likewise propagate into consumption and production systems.

In the next chapter, I will mobilise the concepts of affect explicated in this chapter to unfold my own work, its material tendencies and its production and consumption conditions. In doing so, I will propose how such concepts can inform a design practice concerned with mobilising affects, which propagate into larger social and environmental systems, and bring producers and consumers into closer relation with environmental concerns of pressing importance.

Chapter Three

In this chapter, I use the concepts of affect from Deleuze, Guattari, Thrift, Massumi and others, explicated in Chapter Two, to reflect on my own practice. This analysis uncovers the expressivity of various design techniques I use that move in and across affective fields connected to the issues of production, consumption and the environment. For the first work, the *Marble and Steel Room Divider* (2013) (figs. 9–16), these concerns include contemporary global marble production, industrial repair and the human relationship to industry and geology.⁷³ For the work *Archaeologic* (2011–2014) (figs. 17–22, 95–96), and for the Japanese ceramic repair craft of *kintsugi*,⁷⁴ which is its primary influence, these concerns relate to affects of urgency and amelioration, risk and hope, and are transmitted by the expression of cracks and their repair in the materiality of the works made. Specifically, I show how these affects expressed through the process of *kintsugi* operate in relation with Japanese socio-cultural traditions and sensibilities. The affective field uncovered by this analysis indicates how a similar and emergent affective field for *Archaeologic* can create the conditions for environmental awareness in a contemporary, globalised society. In the last work discussed in this chapter, *Copper Ice Cream Scoops* (2012) (figs. 23–26), the similar affects of damage and repair are re-examined within the context of metal and its properties, production and history, with a particular concern for the relations of metal production to consumption, and their associated environmental

⁷³ My long interest in repair became more pronounced during my involvement in the Dutch design organisation Platform 21's *Repair Manifesto* in 2009. For this program, I exhibited several works, including *SMASH REPAIR* and the *1=2 Chairs* (2008), which developed my concept of transformative repair; i.e., repair that transforms aesthetics at the same time as it restores the functionality of an object. As will become clear in my discussion on *kintsugi*, this, as applied, is not new in Japan, and subsequently became a focus of my practice.

⁷⁴ *Kintsugi* (金継ぎ), the practice of repairing ceramics with shellac glue and gold or silver leaf. Literally, gold (*kin* 金) -connecting (*tsugi* 継ぎ). The corollary term *gintsugi* (銀継ぎ), or silver-connecting, is also used, though the term *kintsugi* covers the technique in general.

contingencies. In each case, I argue that by opening up a space for an affective encounter between damage and repair in the design of domestic products, it becomes possible to shift understanding of and relation to production and consumption and the effects of these industrial processes on our environment.

Cracks, voids, material damages and other irregularities, along with their repair, are identified as features central to my practice. Such features have significance for their relationships to both qualities of anomaly and for their affective speeds and durations. The presence of damaged material is one aspect of these works' anomaly, at the very least because such damage diverges from the hylomorphic standard and the concern for perfection and glamour that characterises much contemporary design. I argue that cracks and imperfections can accentuate the materiality of objects, opening connections across affective fields that pull subjects into assemblages. Cracks, and their repair, have capacities to affect through different speeds and durations. These capacities modulate the sensory encounter, particularly the perception of the object in relation to time. I suggest that the crack in the *Marble and Steel Room Divider* is the morphogenetic product of incredibly long periods of geological action, whereas the cracks in *Archaeologic* diagram the instant, physical and concussive forces that shatter ceramic. Such speeds and durations affect the perception of the past and future. A crack in marble or ceramic is not just the expression of the materialities of either in the present, but also of the past in which these were formed and of their future, too, since cracks have a tendency to grow and, likewise, come apart. These expressions draw the imagination towards a percept – the likely need for repair. A crack that has already been repaired modulates the perception of capacities and urgencies differently again, and this has an impact upon our relations to production and consumption practices. I will propose that such percepts might help us to imagine different kinds of environmentally beneficial domestic and industrial practices.

Each work also has its own particular anomalous characteristics that pull the viewer into novel assemblages in relation to specific concerns of production, consumption and their environmental contingencies. I will argue, for example, that the anomalous, luminescent

qualities of *Archaeologic* uncover a relationship of affect between technology and imminent environmental catastrophe. In *Copper Ice Cream Scoops*, the scoops' anomalous features (composed of differences from the Zeroll-style ice cream scoops upon which they were based) initiate a discussion of hylomorphic practice in industrial design and production. I propose that *Copper Ice Cream Scoops* disrupt this paradigmatic practice by capturing the vibrancy of metal in its play across the machinic phylum through the expression of voids and irregularities. This vibrancy, in turn, opens up the affective field for experiences beyond those afforded by expressions limited to the styles of gloss, glamour, shroud design and *sprezzatura*, or 'world without troubles' that align with hylomorphic practice. The cracks and irregularities of the metal at the surface of the copper scoops capture into sensations the intensities of heat and flame from the smelting and casting processes. These are affects forged in the processes and relations of and between metal foundries and mining, which re-combine within a domestic context to generate and capture new percepts. An awareness of metal and its environmental relations is expanded by the capture of such percepts, with a potential to pull designers, producers and consumers into a relation with environmental conditions.

Marble and Steel Room Divider

The *Marble and Steel Room Divider* (2013) (fig. 9–16, 89–90) is a slab of marble suspended in a frame made from square cross-sectioned steel tube.⁷⁵ The marble slab has a long, natural crack running its diagonal length, which was re-joined with glue and reinforced using a fibreglass and polymer textile backing by the quarry's stone masons. This backing is observable on the reverse side of the divider, where it has been partially ground off to expose the non-cracked areas of marble (fig. 11). The backing in the proximity of the crack was left in place to preserve its purpose of holding the marble together in one piece. The slab is drilled in with two holes near the left and right top corners, strung with a thin 2mm diameter length of sailing cord, hung via the use of pulleys (fig. 12) and tied off with cleats (fig. 13) positioned near the bottom of the frame. While the frame is solid and appears adequately sized in relation to the marble slab, the cord is thin and visually light.

⁷⁵ Development drawings of the Marble and Steel Room Divider are shown in figures 91–93.

The crack in this work is a natural feature commonly found in quarried marble, and its origins correspond with the morphogenetic formation of the marble itself. Over millions of years, limestone, an accumulation of sea shell and coral particles, is compressed and softened by geological forces that recrystallise it into marble (Freeman, 2004: 96–98). The marble retains the same chemical composition as in its previous form as limestone carbonate, but intensive forces of heat and pressure over time reconfigure and interlock those chemicals so as to make its material harder. The crack is an expression of chemical intervention in this process. It snakes through the marble as a line of impurities – a dusting of iron oxide, carbon and sediments – that infiltrated the limestone carbonate during its original aggregation from sea animal bodies. As the heat and compression of the earth transformed the limestone into marble, these impurities were compacted and trapped within the marble. The crack diagrams an internal edge of the marble's chemical structure, contained by the compressive force of bulk marble around it. So while the slab itself may have split during extraction, the genesis of the crack is geological, not human, a product of the regular tectonic grinding and compression of the earth. Just as with the cracking black lines of Mondrian's paintings, discussed in Chapter Two, the crack here is a bearer of glimpsed forces; by intervening in the metamorphic change from limestone to marble, it exposes a process that may be otherwise invisible.⁷⁶

Still, the crack is disruptive to the marble's structural strength, as evidenced by the need for its repair.

Industry and consumer attitudes regarding repair can be discerned from the features of this repaired crack. The glue used to repair the slab is translucent, a clear type of synthetic glue, which minimises the visibility of the repair and is intended to maintain a natural appearance. Such practice attempts to modulate the perception of the crack as a

⁷⁶ Such processes – the tectonic forces that shape our continents and form the environments in which we mine stone and metal, and the ground on which we live, farm and take shelter – belong to what has been called “deep time”, as named by the eighteenth-century geologist James Hutton for the philosophical concept of geologic time (Palmer and Zen, 2000). In the vast majority of human experiences, such processes are unknowable and benign.

natural, perhaps desirable, imperfection and not the result of industrial accident. Indeed, the stone mason from whom I received this slab told me that it was inspected and rejected by customers, and subsequently deemed unsellable. To me, this reaction suggests that affects activated by the geological forces and industrial accident present within the cracked marble are under-appreciated. My response was to design a structural and conceptual frame, which revitalised and enhanced the affective transmission of force, weight and energy from the cracked marble.

Primarily, this design response involved using the suspension system to hang the marble, in order to produce visual tension. The marble's weight is held by a rope thin enough to suggest that it could break, or come loose, and drop the marble to the floor.⁷⁷ A viewer, drawing their eye along the rope, through the holes pierced in the marble and through the pulleys, then finally down towards the ground, will notice that the rope is tied off with sailing cleats.⁷⁸ The task of tying off a sailing cleat produces a sensation of slowly decreasing tension as the line is wrapped around the cleat. This is felt as an incrementally diminishing force sensed kinaesthetically by the hand and body, an experience that contrasts with the sensation of tying off a proper knot, which stops the force of tension in a concentrated point. The difference is that a knot counteracts the tensile force with an equally strong force; it converts or folds the force of tension in the line back into itself as a compressive force. The cleat converts tensile force into compressive force too, but at incremental points – every time the line is wrapped around one of the two cleat posts. In a cleat, unlike a knot, there is a haptic sensation of a *reversible* lock-off event. The cleat expresses the delicate, contingent qualities of the cracked marble and the possibility that the tension-to-compression conversion holding the marble can be quickly and easily undone. The cleat's lack of a lock-off point has an implication for its sensory speed and duration; the slow incremental graduation of *diminishing* force in the line can reverse if unwrapped without proper care, resulting in a rapidly *increasing* force of release. The

⁷⁷ Though, in actuality the rope is over-specified and has no risk of breaking.

⁷⁸ *Marble and Steel Room Divider* was exhibited at *Interpretations III: Stone* (2013), at which I was able to observe audience engagement with the work (Simpson, 2013). Subsequently I installed the work in a stone mason's yard and made a videographic work, described in detail shortly, in which I attempted to emulate the experience of this engagement.

excess line that dangles loosely from the cleat does not present a finality, but rather an entry point inviting the reversal of the wrap – an unleashing of the tensile force, breaking its resistance to gravity and sending the marble slab crashing to the floor. Accentuating this possibility is the placement of the slab uppermost within the frame, producing a void underneath the marble that indicates the space within which movement would occur should the slab fall.

This description of potential events serves to unpack an immediate and tacit understanding of the hand and body in relation to tension, rope and cleats. These sensations, mediated through the observation and experience of the eyes and hand, compound a tension or concern for *potential* sensation – what may arise, in the future, should the marble fall, a kind of threat profile. Together, the experience and its concurrent projections correspond to qualities of implicit form. This is a concept, described by Massumi, in which objects transmit sensation to the body, from one sense to another, and in feedback across all the senses. Implicit form becomes the sum total of such sensory interaction, minus the object itself (Massumi, 2002: 35). Implicit form is sensed immediately, without contemplation. For example, we don't need to walk around a solid object to know it is voluminous, a volume is an “abstract experience of volume” (Massumi, 2011: 42). Voluminous is not a quality to be seen directly, yet its sensibility is activated by the act of looking, through the process of exploratory, perceptive movement along the object's visible edges and surfaces. The movement of such a process indicates that movement in objects is not limited to the physical movement of which such objects are capable; rather, the perception of objects is infused with potentialities of movement within the object's materiality and form. Just as Massumi describes the way that the voluminousness of a volume can become immediately sensible, the potential of imminent collapse is sensible within the form of this hung marble. The concept of implicit form indicates that the room divider is much larger than it visually appears, because our senses flow into the object through touch-points, such as the cleats and the rope, an extended nervous system feeling out the forces contained within objects.

Some of the sensory compounds formed by this process of 'feeling out' implicit form can be described as percepts, which, Deleuze notes, are persistent, consistent, captured by sensory apparatus and capable of preserving themselves through changes in materials and expression (Deleuze, 1995: 138). The preservation of certain percepts that exist beyond the form of the divider is uncovered by sensory investigation. For example, the tension of the rope and its suspended weight has a relationship to surrounding architectural material. Suspension is also a property of roofs and ceilings. My task with this work was to compose the material expression of the slab to open up the affective field to the surrounding environment and to a broader context of production. The slab's expression of weight and potential collapse in *sensation* might therefore potentialise a likewise loaded consideration of marble's extended relations in *perception*.

Such extended relations include the many significant environmental effects of marble production and transport. The manufacturing systems of this industry are reported to negatively impact river ecologies (Mulk et al., 2015), cause localised air pollution and soil toxicity (Hanieh, AbdElall and Hasan, 2014), and produce large amounts of waste, especially those associated with traditional explosive quarrying techniques (Liguori et al., 2008: 198–9). As much as 70 percent of quarried stone can be wasted during extraction, cutting, and finishing. The waste in the form of slurry presents a great risk of pollution and resource depletion to local water ecosystems (Nemerow 2009: 42). Additionally, marble manufacturing and transportation are typically fossil fuelled and emit greenhouse gases (Liguori et al., 2008: 204). Transportation is a key concern, making up the bulk of manufacturing and marketing channel costs combined. Despite the expense and environmental effects of marble transportation owing to its bulk and weight, marble is still shipped around the world to places that have their own marble of comparable quality, and even exchanged between marble-producing countries (CEPI, 2004).

In Chapter One, I introduced Andrea Branzi's observation that such practices are 'logics of production' – logical outcomes of complex, interconnected systems of production contingent on globalised relations and market-based economic conditions – that perpetuate despite their negative environmental effects. For marble production and

many other types of production, these logics include, but are not limited to, differences in labour costs, regulatory systems, subsidies, tariffs, and exchange rate fluctuations (Stock, 2011: 46–8). Branzi notes that such logics open temporary avenues of profitability – for example, the shipping of marble to places that have their own marble – despite the costs and pollution associated with shipping such a material (Branzi, 1984: 47–8, 54–5). Branzi's claims are reflected in Thrift's proposition that, within the norms of industrial product design, techniques of surface design and glamour are used to appeal directly at the sensory level of the body, an affective level, that distracts the consumer from contemplating an object's production conditions or troubled relations (Thrift, 2010: 299). In this work, I attempt to counter such practices identified by Branzi and Thrift and expose logics of production, by loading and strengthening the perception of the work's extended relations via sensible features.

This proposition can be illustrated by an analysis of photographs of the room divider *in situ* at the industrial workshop where I obtained the marble. In these images, the divider stands among loose slabs, stone cutting equipment, waste and refuse. These elements construct a relational field that gives context to the room divider's threat profile and its relationship to production. The threat profile is modulated because workplaces such as these produce affects of danger and risk, accentuated by the experience of wearing safety equipment (hardhats, gas masks, safety glasses, etc.) and the presence of warning signs. Other less-immediate experiences also contribute to this perception, including news reports and fictional or factual descriptions of industrial accidents. Such perceptions of risk and safety are affective, but the elements themselves can be categorised as percepts because they retain a consistency through different expressions, places and experiences. Consider the perception of a cracked human head or broken toe, falling weight, or the perceptions of dust particles and smoke. The background equipment, sounds of industry, and products of industrial manufacture pull these threats into the affective field of marble production. Features of the room divider itself have relationships to background objects: the hung slab associates with spare slabs resting against vertical shelves (fig. 14); the ropes suspending the work associates with various cables and electrical cords; the steel frame associates with the similarly proportioned steel framed wheeled tables (fig.

10); and the suspended, framed slab associates with a skip haphazardly filled with waste stone slabs (fig. 15). These images position the marble room divider within a scenario of production and the bloc of sensations that comprise it: lifting, cutting, moving, cleaning and finishing. Attention is drawn to the processes of marble production in the broader world – a labour- and energy-intensive, wasteful industry.

To open up different perceptions of the project and explore these relationships to the processes of industry in a different medium, I subsequently produced *Marble and Steel Room Divider, Video* (2013) (fig. 16). It is a single-channel video of the divider being installed in the stone mason's yard, intercut with found footage of container ships, quarry machines and marble cutting. I manipulated the material of the video, its time-based imagery and sound, by applying video and audio effects that attempt to express the haptic dimension of marble and its material tendencies – particularly its weight, granularity, solidity and the way it can break and fall apart into rock and dust. The digital effects shake and vibrate the sound and image to emulate such material events. I conceptualise these distortions as disrupting or breaking through the surface of the video track in the same manner as a crack may propagate through marble. There is the potential to jolt the viewer affectively, correspondent to the micro-shocks I described in the last chapter, which may modulate the relational field of marble and marble production. My intention is draw the viewer into an assemblage in which the otherwise-conventional imagery of marble production binds human and geological processes together in an expression of force, energy and movement of the natural mass and inertia of stone and earth.

To experiment with the affective capacities of the video, I also deploy the device of anomaly. At two minutes and 19 seconds into the video, an animated infographic of the earth flashes onto the screen. The animation shows the earth cut away to reveal the layers of the earth, titled 'crust', 'mantle' and 'outer core'. Though it provides further context to the geological formation of marble, compared to the rest of the footage in the video, this animation is stylistically discordant, an intentional aesthetic strategy to disrupt the

viewing experiences and activate broader considerations of geological time and processes, and their human relations.

I consider the video, however, like the photos, as mainly documentation, albeit experimental documentation, and I give priority to the room divider itself as an object that compresses industrial affects into a domestic object for the generation of new percepts. The room divider is designed for a domestic environment and my intention was to atypically fill such a domestic environment with qualities of industrial production. This is both similar and dissimilar to Sottsass's *Ambiente Sperimentale* discussed in Chapter One. The grey plastic units of *Ambiente Sperimentale* produce tension by disrupting the expectation of domestic comfort. *Marble and Steel Room Divider*, likewise, produces tension – from the relationship of the narrow rope to the heavy slab – but of a different kind, and its otherwise industrial features are domesticated, in the sense that they are designed to suit the home. For example, the ropes and pulleys are smaller and shinier than their industrial counterparts, and the open ends of the steel tubes at the tops and feet are sealed with a pale, peach-coloured silicon rubber to prevent the trapping of dust. The steel used is stainless in order to avoid the patina or rust that develops on mild steel in industrial use and to preserve a clean and shiny appearance appropriate for the home. This modulated exchange of parts serves to bind the worlds of industry and the domestic together. In doing so, the room divider may be perceived as anomalous – a bridge between worlds – that generates new percepts that totalise the interrelation of industry with the domestic. While the divider has yet to be permanently installed in a home, to indicate how these perceptions may be activated, I photographed the room divider with a simulated domestic installation in which the divider's legs are sunk into floorboards (fig. 89). Functionally, this installation also serves to remove the trip hazard posed by the object's long feet.

Prior to domestic use, however, my conceptual works tend to spend time in public exhibition, the presentation of which also requires design. Preparing for the work's exhibition in a public space, I painted the divider's feet in striped yellow-and-black hazard zone colours (fig. 90). I did this to indicate the trip hazard posed by the object's

feet, as a practical matter for an exhibited work, but also to intensify its affective relations to an industrial context. Viewers may only have a few minutes to reflect on the work in an exhibition context and so the purpose of the hazard zone colours was to bring immediate attention to context and other fields of relation. Conversely, when permanently installed in a domestic space, a viewer/owner may have much longer – many years, perhaps – to reflect on such relationships, obviating the need for the intense affectivities of the hazard zone striping.

It is not necessarily my intention to embed a polemic attacking the environmental problems of marble production, but rather strengthen an awareness of how industrial practice flows through to the rest of the world external to industry. Like other examples of my practice discussed in this chapter, this work is intended for a long life of use in the home, which may allow time for contemplation of the work's subtleties and may potentialise the capture of percepts.

On reflection, one of the shortfalls of the *Marble and Steel Room Divider* as a creative work is that I did not repair the slab myself. The preparation and care of such naturally found cracks in marble are performed within the pre-consumer industrial zone of quarries and stone masons. In some sense, this repair work can be said to be part of a conventional pre-consumer production cycle. However, there are forms of post-consumer repair that occur after initial production, as response to post-consumption accident or mishap. Some kinds of post-consumer repair are additionally transformative in that they modify the object and its affects beyond original qualities. The Japanese art of *kintsugi* is notable in this regard and is the primary influence on my work *Archaeologic*, which presents broken ceramic vessels repaired with photoluminescent glue. In order to explore the sensory relations of this work, it is necessary to first discuss the Japanese art of *kintsugi* within the theoretical framework of affect.

Kintsugi

Kintsugi is a traditional Japanese craft in which ceramics, either accidentally or purposefully broken, are repaired with lacquer and gold leaf (fig. 94–95). Japanese ceramics as a general craft developed from the import and influence of Chinese and Korean ceramics; for this reason, many Japanese ceramic techniques can be traced back to non-local origins (Gopnik, 2009). However, the craft of *kintsugi* is prized as a “specifically Japanese phenomenon” (Kopplin, 2008: 6). For Japanese ceramic collectors, the distinctive features of *kintsugi* are considered identifiers, serving to mark and re-possess foreign made or foreign influenced ceramics as local (Gopnik, 2009). For example, some ceramics readily identifiable as having Korean-influenced styles, such as *karatsu*, have been re-worked with Japanese patterns using *kintsugi* techniques (fig. 90).

This Japanese identification with *kintsugi* is pivotal to understanding its significance within Japanese culture. At first glance, it may not be surprising that a ceramic repair technique is popular in a country whose residents routinely experience earthquakes, since ceramics are commonly broken during tremors (fig. 96). However, *kintsugi* elevates the degree of care with which broken ceramics are repaired to a level commensurate with the care put into their creation.⁷⁹ These relationships give rise to the cultural conditions that mark *kintsugi* as a highly valued technique that is tied to cultural practices that are expressive within objects. A richer analysis of this relationship between object, damage and repair can be developed when the operations of affect are considered.

To reiterate, Deleuze and Guattari conceive of affects forces transmitting, and realised in material, as compounds of sensation, that furthermore penetrate and move beyond material (Deleuze and Guattari, 1994: 166 and 193). Massumi sees affect as glue that connects material qualities to human experience, and back again into matter (Massumi, 2000: 187). This is a process of morphogenesis, the influence of dynamical forces on the creation of form (De Landa, 2002: 4). Insofar as morphogenetic processes influence form,

⁷⁹ *Kintsugi* is a broad craft incorporating a number of different techniques, but most are time-consuming and require skilled and multiple applications of *urushi* lacquer over the course of weeks, if not months (Iten, 2008: 20).

but also the sensation of form, the affective depth of field for the object is enlarged by understanding such conditions of production. These conditions include the chemical compositions of the material structure (the preparation and shaping of clay and glaze), and, during firing, the force and duration of heat. But importantly and uniquely with *kintsugi*, these forces include those that later shatter the ceramic, a force that is ultimately expressed via repaired cracks. These cracks resonate with, and have a relation to, the cracks that result from earthquakes – cracks in buildings, walls, and the cracking of the ground (figs. 97–99). This is more than just visual similarity; it is the result of sharing the shattering forces that move through material. *Kintsugi* researcher Christy Bartlett notes that in *kintsugi*, these cracks “diagram the point of impact” (Bartlett, 2008: 10). A crack is a diagram of the flow of applied force moving through ceramic at the time of impact, just as cracks in the ground caused by earthquakes diagram the force of tectonic energy moving through the earth. This force manifests through material as sensation – accentuated by the *kintsugi* master's application of gold or silver over the seams of the repaired crack.

The care that the *kintsugi* master takes in repairing and accentuating the cracked ceramic is significant in regard to how it modulates the affective encounter of the object. The crack, while visually dominant in the ceramic, is a *compound* of sensations (like the 'vibration', the 'clinch' and others discussed by Deleuze and Guattari in *What Is Philosophy?*). Compounds are composed of relational affects and percepts that work in different sensory registers (forces and rhythms), with different intensities and speeds of duration. While compounds maintain their shape enough to be sensed as such, they also, and continually, connect, disconnect and reconnect their composition to the external world. In the case of *kintsugi*, I contend that the crack is a compound of sensations maintained within the repaired ceramic, but softened, slowed even, by connectivity to another compound of sensation materialised by the use of glue and gold leaf to decorate the repair: the 'clinch'. The speed of the crack – by which I mean the capacity for the crack to express the speed of the concussive force from which it was generated, and also the expressive tendency for cracks to grow until they culminate in the instantaneous breaking apart of material – is mediated by the application of gold, a heavy and dense metal known for its qualities of permanence, longevity and resistance to rust and

corrosion. Because of their cracks, *kintsugi*-ware can already be thought of as anomalous homewares, but the use of gold to soften and slow the expression of shattering and breaking force produces another anomaly-producing modulation. The cracks in *kintsugi*-ware are not the literal effects of earthquakes (though they may be), but a composition of forces, affects and percepts that are shared with earthquakes. These forces manifest in the form of a vessel and are modulated by changes in scale (physical reduction in size), materiality (the use of precious metal and glue to seal the crack) and affordance (placement within the context of domestic ritual, display and utility).⁸⁰

These modulations are significant when considering how repaired ceramic objects transmit their affects in socio-cultural registers. In Japan, the highly ritualised tea ceremony includes an event in which ceramics are passed from the tea master to the participant for contemplation by eyes and hand (Holland, 2008: 14). Such ritual modulates the force in the *kintsugi* object, in which the world-shaking vibration of an earthquake may be perceived in the expression of a hairline crack in a bowl held intimately in the hand. The intimacy of this act may have a calming effect, yet potentiality is maintained to the extent that *kintsugi*-ware express a warning that calamity is ever possible. *Kintsugi* materialises that calamity can be overcome. The smoothed, golden seams that bind the ceramics together suggest a life of quality beyond calamity and are an expression of a binding force that ameliorates the oppositional forces that pull apart. The strength of this binding is also evident in the second use of the word *tsugi* (継ぎ - connecting) in Japanese language to describe family bonds in regard to inheritance, succession and the continuation of family traditions or craft. The sense of this binding, a percept, is a *becoming* for the Japanese – a way to move beyond the affects of alarm and danger inherent in the sensation of the crack and towards the sense of community and togetherness embodied by 'the clinch'.⁸¹

As explained in the previous chapter, the clinch is a compound of sensation that arises from the transmission of force through material, but that also has its own unique affective

⁸⁰ These modulations have some correspondence to the design strategies I deploy in *Marble and Steel Room Divider*, in which the pulleys, cleats and clean polished surfaces are features scaled down and altered from an industrial context for the domestic context.

becomings. Deleuze and Guattari use the term to describe the play of “complementary forces” that bind percepts to affective becomings (Deleuze and Guattari, 1994: 168). When a clinch in material is perceived, it is not a passive sensory experience of materials bonded together, but an active becoming in which the viewer is drawn, and bound, to the sensation itself. Therefore, the clinch is capable of articulating twice; it binds material, but also binds to the sensation of *becoming bound*. Conversely, the cracks of *kintsugi* (and cracks in general) also articulate twice – they split material, but simultaneously transmit an affective force of splitting or pushing away, so much so that cracks can be repellent and alarming. They jolt, and can be felt in the body as a warning for the potential of the crack to further grow and split material.

The capacity of cracks to jolt is of relevance to micropolitics. For Massumi, such a jolt is a micro-shock to the body. The diagram of force within ceramics and the earth moves outwards to engage with our bodily senses. This is a micropolitical event in which materially based affects modulate perception and suggest action at the level of the body, but, as indicated in Chapter One and Two, have a capacity to extend outwards to potentialise macropolitical action (Massumi and McKim, 2009: 4–6). This analysis is reflected in specialist English-language literature on *kintsugi*. For example, Bartlett sees *kintsugi*-ware as defined by a sense of “rupture” of “surface and structure” that corresponds to the struggles and tragedies of life in pre-modern Japan. She notes:

The vicissitudes of existence over time, to which all humans are susceptible, could not be clearer than in the breaks, the knocks, and the shattering to which [*kintsugi*] ceramic ware too is subject. (Bartlett, 2008: 11)

Bartlett makes reference to the particular social and environmental context in which *kintsugi*-ware is traditionally appreciated. The viewing of *kintsugi* ceramics in tea ceremonies is typically limited to the waning days of autumn, the last two weeks of

⁸¹ Bartlett says, in other words: “...mended ceramics convey simultaneously a sense of rupture and of continuity. That one moment in which the incident occurred is forever captured in the lines and fields of lacquer mending. It becomes an eternally present moment yet a moment that oddly enough segues into another where perishability is circumvented by repair” (Bartlett, 2008: 12).

October known as the *nagori*.⁸² Historically this was a delicate time of year for the Japanese, when they would work hard to prepare for winter, engaging in communal tasks requiring close cooperation, such as re-thatching roofs. Bartlett identifies such events during *nagori* as having certain expressions – inclinations to perceive, value and share community resources in a time of scarcity and threat – that are shared by *kintsugi* ceramics (Bartlett, 2008: 12–13). More precisely, within the perspective of this thesis, the clinch of *kintsugi* manifests and potentialises percepts of community via affects of becoming bound, and the cracks of *kintsugi* manifest and potentialise sensitivity to the calamitous potential of life. Indeed, such sensitivity is an ingrained aspect of Japanese culture, as seen in the “aesthetic of existence” known as *mono no aware* – the melancholic expression of life's impermanence (Bartlett, 2008: 10; Parkes, 2011). To summarise, and regardless of whether a ceramic is actually broken by the action of an earthquake or not, *kintsugi*-ware has an affective field shared by earthquakes and tremors containing a force of affects and percepts, which flow through material, from ground to glaze and beyond, imbricated with the geological and cultural conditions of traditional life in Japan.

Archaeologic

Archaeologic is a series of ceramics works that have been broken and repaired with photoluminescent glue. The use of photoluminescent glue was inspired by various uses of UV technologies in archaeological research and restoration, in which archaeologists either use UV light to detect the chemical composition of ancient glues, or embed UV markers in glue they use themselves for repairing ceramics (White and Odegaard, 2007).⁸³ By contrast, the photoluminescent glue used in *Archaeologic* stores energy in the form of photons under exposure to conventional light (natural or artificial) and then releases

⁸² The limitation is understood by Bartlett to prompt a perception of rarity. Bartlett notes this is an established Japanese aesthetic technique and comparable to historical Japanese poetry which developed rules regarding the frequency of using certain emotionally charged words in order to “preserve their affective impact” (Bartlett, 2008: 12).

⁸³ One such technique is to use glues that are invisible to the naked eye, but visible under ultraviolet light. The purpose is to preserve the appearance of the archaeological object as undamaged, yet have the repair identifiable under specific conditions when needed (Reed, n.d.).

those photons in the process of glowing for several hours in the dark. In some of the *Archaeologic* objects, such as *Archaeologic 1, small bowl* (figs. 17–18), the repaired cracks are white and only slightly visible under day light, while in others, such as *Archaeologic 1, vase* (figs. 19–20), the cracks are coloured and quite visible in light, but change colour in the dark. In the domestic context, the vessels are intended to be housed in a typical room lit during use, but dark during the night. The glowing cracks are therefore reserved for rare glances – in the few moments after turning off the lights and retiring to bed, or during nightly somnambulist, or insomniac, perambulations.⁸⁴

The proposition embedded within *Archaeologic* is that the affective relations of *kintsugi*-ware can be mobilised for a wider, non-Japanese audience. While *kintsugi*-ware aesthetics have some specificity to traditional Japanese aesthetics, seasonal events and rituals, the bloc of sensations that flow from the crack and the clinch are more broadly relatable. *Archaeologic* proposes that their respective expressions of warning and binding have contemporary relation to human affairs and environmental concerns.

Industrial ceramic production, like other forms of mass production, has its own specific environmental effects of waste, pollution and climate change that can be summarised as emissions to air and water, process and packaging waste, and energy consumption (European Commission, 2007: ii and 4). Emissions are a concern because they impact workers, through effects such as lung diseases, and the environment, through river and soil toxicity. However, there have been many practical technological solutions developed to control such problems, and comply with best current practice, as outlined in reports, such as the European Commission's *Reference Document on Best Available Techniques in the Ceramic Manufacturing Industry* (2007). This means that historically consequential environmental and health effects, such as lead poisoning and the lung disease silicosis,

⁸⁴ The first iteration of *Archaeologic* has not been publicly exhibited, but all iterations have been in use in my home and studio for the purpose of informal experience testing by myself and others. The repaired domestic crockery of *Archaeologic 2* (2011) were also exhibited during *Sydney Design Week* (2011) within in a large box equipped with a peephole and a reversed timed light switch; viewers look through the hole and see the vessels lit brightly, then, at the press of a button, the lights turn off and the vessels glow for a minute in the darkness (fig. 100–101) (Keulemans & Wilson, 2011).

are less likely to reoccur. The energy consumption required by ceramic production is, however, significant, due to the high temperatures required for kiln firing, and a majority of industrial kilns are fired with fossil fuels from sources that produce high levels of greenhouse gasses, such as coal and petroleum coke (European Commission, 2007: 4–5).

However, unlike the previously discussed work, *Marble and Steel Room Divider*, for which I attempt to raise issues of industrial production specific to marble, the design of *Archaeologic* does not address issues specific to industrial ceramic production. Rather, my motivation is to more generally address the affect-modulated responses humans have to broken or damaged objects, and to disastrous events such as earthquakes and effects of climate change. I propose the affectivity of repair has particular potential to modulate action that responds to the problems of production and consumption, at the micropolitical scale. As with *kintsugi*-ware, I propose that *Archaeologic* potentialises intra- and inter-personal action from a sense of ameliorated damage: an urgency to prepare, resist or repair.

The urgency of this warning is enhanced by its photoluminescence. Light is captured in the material of the repaired crack. It emerges in the dark, exaggerating the visual contrast of the crack and de-emphasising the vessel silhouette, which partly merges into the background. When the vessels are lit, the opposite is seen; the vessel silhouette has higher contrast. In the small saucer, for which I used white photoluminescent glue (fig. 17–18), the crack is only just traceable upon its surface. The object therefore has at least two modes of encounter. In one, the viewer has an increased engagement with the crack when the room lights are off; in the other, the viewer has a decreased engagement with the crack when the room lights are on. These affective modes, which can be summarised as 'threat on, threat off', may reflect the dichotomous and contradictory positions our senses are capable of holding.

The duration of the glow of the photoluminescent cracks in the *Archaeologic* ceramics is known as “persistent” luminescence, a form of luminescence, unique to phosphorescent and fluorescent materials, commonly mediated by technologies (Valeur and Berberan-

Santos, 2011: 731–737).⁸⁵ Artificial forms of photoluminescence are used in scientific and forensic imaging, as well as in military, transport and consumer applications.⁸⁶ For example, phosphorescent materials were sufficiently developed by the mid-twentieth century to be used in a range of 'glow-in-the-dark' paints and pigments for aviation and aerospace readouts, and technical and consumer watches (fig. 102). Some of these early applications even used radioactive materials, such as radium, an off-shoot of nuclear science research (fig. 105).⁸⁷ In the later-twentieth century, fluorescent dyes used to image the internal structures of animal and plants bodies were refined and popularised (fig. 103), as was the use of chemicals (known as reagents) to uncover fingerprints and blood at crime scenes (fig. 104). Improvements in consumer luminescent paints are also reflected in their popularity within late-twentieth-century arts and music culture, especially electronic dance music culture. Correspondingly, the dissemination of images related to technological discoveries or practice in these fields plays a pivotal role in public awareness of luminescence. The perception of luminescence is modulated by its relationship to twentieth-century technologies and, to a lesser degree, through the experience of luminescence from natural phenomena.⁸⁸

⁸⁵ Persistent luminescence is also found in nature, such as in the fluorescence of minerals. However, fluorescence is only visible when the material is subjected to special forms of light such as x-ray or ultraviolet light. As such, its luminescence is also mediated by technology, just as with other forms of persistent luminescence.

⁸⁶ The history of the technological manipulation of luminescent chemicals dates back to the early-nineteenth century, with some important early observations coming from the pre-modern era (Valeur and Berberan-Santos, 2011: 732–733).

⁸⁷ And with perilous consequences. In the case of radium, in which the luminescent pigment is charged by radioactive energies instead of natural light, it had the unfortunate effect of lethally poisoning production workers and placing consumers and post-consumers at risk. For more information on the female factory workers poisoned by radium in the 1920s and 1930s, see Claudia Clark's *Radium Girls, Women and Industrial Health Reform: 1910–1935* (1997).

⁸⁸ Luminescence occurs naturally in the form of bioluminescence, which can be observed in the glow of the firefly or in dinoflagellates and phytoplankton that sparkle in surf. However, these are different to the persistent luminescence of *Archaeologic* in that the luminescence is brief and dynamic, subject to short durations and continual movement; for example, the surf sparkles at the splash of the wave or hand and then quickly fades.

The experience of photoluminescence in *Archaeologic* pulls the percepts of the crack and clinch together with technological machines. Some of these accentuate the sense of warning that the crack transmits; for example, nuclear research, medical and forensic imaging are associated with disasters, accidents and mortalities. It may be also relevant that the experience of luminescence is correlated with twentieth-century technologies because it was in the twentieth century that many environmentally disastrous technologies became widespread and globalised. Nevertheless, it cannot be discounted that more positive affects and associations – for example, in the dance culture context – may also occur from the experience of luminescence, though these are also technologically mediated. However, the affects are not limited to human experience. Jane Bennett's new materialist approach indicates that the relations between humans and chemicals, for example, extend deep into the materiality of the world and flow in all directions. In the case of photo-luminescence, humans have manipulated the chemical conditions found in nature for purposes as varied as nuclear research to underwater lighting, but, in so doing, are themselves transformed by the operations of chemicals in action and expression within products, the environment and our bodies – the human-chemical assemblage. *Archaeologic* attempts to coalesce these processes into the form of a repaired crack that glows with the energy of human-chemical relations. The human-chemical relation is both ground on which industry is able to produce plastics (and metals and other substances), but also damage and pollute the environment. The glowing cracks of *Archaeologic* use photo-luminescence to accentuate the acuity of these relations and intertwine them with their existential threat.

Assemblages facilitate the flow of micro- to macropolitical affects. As indicated in my discussion of *kintsugi* ceramics, for example, golden repaired seams diagram the burst of cracking forces augmented by a re-binding to metallurgical percepts (of gold from the ground) that has consequences for the craft's sociocultural reception. In *Archaeologic*, this bursting force is bound to technological relations of chemical synthesis and, more generally, the capacities of technological innovation, but, at the same time, preserves the semblance of a domestic object. That bursting force is felt as a micropolitical technological affect, but technological affects have macropolitical relations. The work is

posed to bridge the micropolitical and macropolitical by passaging micropolitical technological affects into the domestic space, thus potentialising the perception of technological macropolitical relations. Deleuze and Guattari note that such micro- to macropolitical passages have great potential to “thwart and break” global organisation (Deleuze and Guattari, 1987: 216). For example, they note the inability of politicians and unions to understand the May 1968 protests in France because they did not evaluate micropolitical affects aggregating into massed behaviours. They write that even the smallest of affective operations, “micropercepts, unconscious affect” or “fine segmentations” of experience, have such capacity to aggregate together at the scale of animal, sexual or political classes. Such masses or classes are, however, also leaking affects because they are not constrained masses, but dynamically fluid, temporally and operationally defined, and liable to deform or disperse should their binding intensities abate (Deleuze and Guattari, 1987: 213–14).

However, there may be limitations to the affective potential of such repair practices that are contingent to an extinct status – that of ‘unbroken’. *Archaeologic* and *kintsugi*-ware open up an affective encounter with ceramics so that conditions of post-industrial production (repair) become perceptible. The repair and decoration of damaged ceramics expose the forces that broke the ceramic and accentuate the ceramic’s materiality. This union of form and material, an expression of the continuous middle between the two, is distinct from the hylomorphic practice discussed in Chapter Two. However, *before* a ceramic is broken, there is no particular expression of the possibility for repair because the hylomorphic process pulls material expression to the surface or limits of the ceramic. In other words, it can be questioned as to whether there is a material indication that a ceramic can be repaired before it is broken. Is there an imagination of this possibility embedded in the ceramic itself? It’s possible, and conceivable for ceramics that appear

less-industrial than others.⁸⁹ Fully glazed ceramics, in which the glaze wraps around the fired clay as a hard, impenetrable barrier, have a particular effect when broken. The newly opened, broken edge-surfaces are porous by comparison, as if hungry for glue and pregnant with the potential for re-bonding.

However, the perception of an object's potential to be repaired also comes from relations external to the object-form itself. In Japan, the craft of *kintsugi* is culturally engrained to the extent that the possibility is intrinsic to any ceramic. While *kintsugi* in Japan is firstly considered a specialist craft reserved for important ceramics (and so broken ceramics in Japan are still routinely discarded), the technique is also used for consumer ceramics, and home *kintsugi* repair kits are sold in Japanese homeware and hardware stores (fig. 106). This is not necessarily so in Western cultural contexts, where readily available glues that are capable of mending ceramics are advertised as 'ultra-clear' and designed to minimise the visibility of repair. Repair is thus reduced to something to conceal, and make invisible, rather than something to be explored and experienced for its transformative potential. Meanwhile, many consumer products, even those that can be easily repaired, are routinely discarded in developed economies. Product designers developing strategies to embed possibilities for transformative repair within objects, as micropolitical possibilities that can be sensed and embodied prior to breakage or obsolescence, may spark an uptake in repair practice at the broader macropolitical level of consumer culture.

⁸⁹ As indicated in Chapter Two, some ceramic processes, such as casting, are especially suited to hylomorphic industrial practice. However, it should be noted that the types of Japanese ceramic-ware typically repaired with *kintsugi* techniques do not necessarily fall into such a category, being hand-crafted and based on aesthetic styles, such as *wabi-sabi*, which activate the continuous middle between form and material. Irregularity is important in this regard; for example, using kiln firing techniques to produce irregular glazes and using clays with uneven distributions of impurities, such as iron particles, to generate irregular pattern effects. Such techniques expose the material of form and the conditions in which it form is produced. However, such techniques still do not necessarily indicate the possibility of future repair, should the ceramic be broken.

Copper Ice Cream Scoops

Prior to and during this thesis, I experimented with repairing domestic products by using novel processes. However, through my research, I discovered an ongoing problem: regardless of social or cultural mobilisations of post-consumer repair, many objects seem to lack an intrinsic and affective expression of their potential to be repaired.⁹⁰ The question arises: how can a nascent, emergent propensity towards repair become invested in a designed product? Limiting the expressions of repair to the post-consumer sphere diminishes possibilities for such expressions to become embedded in an object before consumption. The current paradigm is described by Thrift's analysis of industrial production and the *sprezzatura*, or effortless glamour, for which it strives. Here, consumers are enticed by products whose form and materiality are "without troubles", an enticement modulated by perceptions of newness or perfection: box-fresh, scratch-free, virgin, seamless, unused, etc. (Thrift, 2010: 298–99). Yet, as discussed in my analysis of *Botanica* in Chapter Two, rough and irregular materiality can be enticing too, as is evident in the broad appeal of DIY, maker culture and artisanal production, and Formafantasma prepare the staging of their vessels with a museological authority to accentuate that appeal. I will describe tactics of 'reflection management' at play in my next example of material research that likewise accentuates the appeal of repair. I will suggest that there is scope within the *pre-consumer* phase of industrial production to disrupt the style of 'perfection-appeal' dominating mainstream consumer products by embedding formal and material characteristics that activate the repair of products prior to consumer encounter. This is the area of experimentation for my work *Copper Ice Cream Scoops*.

Copper Ice Cream Scoops (2012) is a collection of Zeroll-type ice cream scoops reproduced in copper. The scoops are based on the classic 1935 aluminium design patented by Sherman L. Kelly (fig. 107), which has been produced by Zeroll since that time (fig. 108), but also widely copied by other manufacturers (fig. 109). Kelly specified aluminium for its

⁹⁰ These social or cultural mobilisations include examples such as *kintsugi* in Japan, traditional repair industries elsewhere in the world, as well as slum living culture and the emerging DIY and hacking global culture. These are important, but often marginalised at the subcultural level and relegated, for socio-economic reasons, to poorer rather than richer countries or sectors of society.

reasonable thermoconductivity. The scoop is designed to capture and conduct heat from the hand to the scoop blade via a heat transfer fluid (propylene glycol) contained in the handle. Aluminium has other qualities which make it suitable for reasons pertaining to manufacturing, ergonomics and price; it casts well, is light and easily obtainable. But it is not necessarily technically optimal for Kelly's design because some other metals have better thermoconductivity. In *Copper Ice Cream Scoops*, I swapped aluminium for copper in order to gain such an advantage. Copper, in its pure form as an element, is the second most thermoconductive metal after pure silver. However, pure copper behaves unpredictably during casting; pure molten copper flows thickly, is unstable and difficult to control. It oxidises in air and off-gases at high temperatures, so it must be melted under a layer of flux – a chemical that floats over the top of the metal – to prevent it forming oxides as it melts. Typically, and historically, pure copper is alloyed with other metals, most commonly tin and zinc for the formation of bronze and brass alloys. However, since these alloys do not have the same thermoconductive properties as pure copper, I decided to manufacture a scoop using pure copper, a decision that led to some practical difficulties.

The first of these was the challenge of finding a manufacturer willing to pour pure copper using the lost wax method.⁹¹ While I was surprised by this, my previous experiences working with experimental production processes and the satisfaction of their unpredictable outcomes encouraged me to continue regardless. The hesitancy of manufacturers to do something I had thought trivial motivated me to research the complexities of the process from their perspective. After many phone calls and discussions, a Sydney foundry specialising in architectural products agreed to experimentally cast the scoops. The result of this experiment was that the metal did not flow freely into the mould and the ice cream scoops came out collapsed and imperfect (fig. 26 & 110). The foundry regarded this outcome as a non-chargeable failure. I then repaired the failed casts at my studio. This first involved filling the voids and cracks with

⁹¹ It was pointed out to me more than once by manufacturers that if I wanted to make the project easier I should just use a copper alloy, such as brass or bronze, with better casting behaviours (that are, in fact, developed for these behaviours). However, as just described, their material properties would have defeated the advantage of their substitution for aluminium.

molten tin or epoxy resin polymer (fig. 111). The scoops were then drilled, sanded and polished, filled with food-safe thermoconductive fluid (propylene glycol), as per the commercial versions, and then sealed with a fitted end cap to become complete (figs. 23–25). The primary condition of this process is that the scoops were restored to the highest quality and functionality as possible, in order to complement the prior decision to improve the scoop with a material substitution.⁹² This does not forego attempts at glamour, even *sprezzatura*. The scoops are highly polished. They are photographed on black velvet, in the manner of jewellery photography. The black of the velvet is reflected in the scoops, in contrast to the white intensities of reflected light. This creates gloss, and broadens the colour spectrum of reflections on the object, enriching the perception of voluminousness. Given the environmentally concerned capacities of this work – soon to be described in detail, but which are not dissimilar to those previously described for my other works – the use of a glamour-producing practice of industry can be interpreted as an attempt to package the work to attract attention or desire in a way that is not entirely burdensome. It is commensurate with the industrial design practice I discussed in Chapter Two by the name of 'reflection management', a tactic of *sprezzatura* that typically draws the eye past details such as like part-lines that indicate production or assembly/disassembly methods. I propose, however, that the reflections in these scoops must draw the eye *towards* areas of repair, given such areas disrupt the flow of reflections along and around the scoop's curves. So while it could be interpreted as a hypocritical strategy commensurate with Branzi and Thrift's analyses of industry using glamour to promulgate aesthetics favourable to consumption, from the perspective of this thesis, it should be understood as a more tactical articulation. Just as *kintsugi* uses gold or silver to entice and bind attention to the object, the *Copper Ice Cream Scoops* have glamorous qualities that may bind in a similar sensory clinch. From this initial binding, the affective analysis can begin in depth.

⁹² In the end, the *Copper Ice Cream Scoops* work well, as well or better than aluminium scoops, but do not improve on the solution to the original problem Kelly observed. The Zeroll design originally arose from Kelly's awareness of the ergonomic problems encountered by ice cream parlour workers using mechanical scoops repetitively over many hours. So while the improvement to thermoconductivity works as intended in the *Copper Ice Cream Scoops*, making them suitable for domestic or occasional use, the scoops are probably too heavy for prolonged commercial use.

The scoops are anomalous in that they lie on the border of their conventional product group and of a genre of objects. Firstly, the material substitution, and the repair it necessitates, differentiates them from other ice cream scoops of similar design. Visually, this is evident by colour and form; the complexity of their pink/orange copper hue, mottled by additions of grey-silver tin and white polymer, contrasts with the smooth, grey, homogenous colour and form typical of the original aluminium design. The difference is not just visual. The scoops also behave differently in the hand.⁹³ Copper is much heavier than aluminium and the difference in weight compared to a Zeroll scoop is noticeable. Furthermore, the high thermoconductivity of the scoops creates dynamic thermoception. When the scoop is picked up from a bench or drawer, it is at room temperature, but quickly warms to the hand.⁹⁴ For these reasons, the copper scoops have characteristics that are anomalous to the group of product behaviours seen as typical Zeroll-style ice cream scoops.

The anomalous aspects of the material substitution, however, are not limited to the scoops' aesthetic qualities, but extend to their relation to normative practice of industry. Just as Hella Jongerius's *Soft Urn*, discussed in Chapter One, uses a material substitution to disrupt a normative practice (the removal of part-lines by wet wiping), the material substitution in *Copper Ice Cream Scoops* disrupts the industrial casting process. The casts collapse and cannot be cleaned and polished until they are first repaired.

Their relationship to the genre of objects conventionally regarded as 'repaired products' is worth considering. Typically, such products are repaired in the consumer or post-consumer phase. These scoops, however, require a substantial act of repair within the

⁹³ *Copper Ice Cream Scoops* have been exhibited several times, including the three iterations of *Domestic Renewal* at CraftACT (2012), Craft Victoria (2013) and JamFactory (2013), Temple & Webster Design Award (2014) and Object Future (2014) (Nicol, 2012a, 2012b and 2013; Temple & Webster, 2014; Hardiman and Henty, 2014). I was present at two of those exhibitions and able to propose and observe audience interaction with the works. I also conducted my own informal use-testing with ice cream.

⁹⁴ While this last effect is shared with aluminium Zeroll style scoops, it is barely felt with cutlery made from less conductive metals, such as steel.

pre-consumer phase of production. The scoops are damaged as a result of a flawed casting process to an extent not normally tolerated by industry. Indeed, if this project were subject to a conventional industrial design methodology, a decision would be made to resolve the problem, either with the use of an alloy or by improving the casting process itself, rather than by repairing the flawed casts. My decision to accept the scoops 'as is' and to repair them departs from normative industrial practice, and from typical scenarios of repair. In this sense, it is an act of repair that is anomalous to the genre of repaired objects because it is repaired in the pre-consumer phase of production.

This anomaly works in a variety of ways to establish an affective depth of field with a capacity to connect to issues of production, consumption and the environment. Firstly, the use of repair connects affects from the past and future together within a user's experience in the present. This can be illustrated by examining the typical way that designed products unfold temporal affects. Affects unfold backwards in time via memories and prior experiences of the product, but also forward in time via an imagination of future use or life of the product. Significantly, in terms of environmental concerns, these future imaginings tend to occur at the moment when a product's *uselessness* is foreshadowed. For example, it is when the milk is nearly finished that its tetra-pack container is perceived as soon-to-be-trash; or, it is when the granite kitchen bench top cracks that the difficulties of its repair or disposal become apparent. The durabilities and disposabilities of products that are usually and conveniently backgrounded in human lives come to the fore at such times. This is the formation of an assemblage as a "living arrangement" between expressions and action (Buchanan, 2015: 384). Such arrangements recall the Spinozist concepts for affect, in which affective relations open or close down options for living, constituting a perception of the future as a time and space for potential action. It can be said that broken products facilitate a perception of the future that is troubled or even crisis. The action potentialised may be disposal of the product, actualising an urge to push away its troubling emanations.

Yet, the idea of repair can ameliorate that emanation and, in turn, by relation to action, ameliorate the waste and pollution associated with broken products. That the copper ice

cream scoops incorporate repair prior to consumption is significant because it embeds the notion of a product-crisis *and* the ameliorative affects of its potential repair within a consumer-ready materiality. Held within the hand, and within a domesticity, the capacities and possibilities of its future repair are embodied by the experience of its extant pre-consumer repair. At every use, the consumer is presented with an opportunity to be affected by this production event.

The characteristics of the assemblage potentialised by the damage and repair of domestic objects can be framed in regard to how materiality conduits micropolitical affects. When a domestic object in someone's possession breaks, that person is pulled into an assemblage. The assemblage is initiated by content; the breaking of an object is a consequence of force or effort. A vase slips through the fingers suddenly, or material fatigue propagates a crack from years of use. The expression of uselessness guides the assemblage towards action. If that action is disposal, there is an environmental cost, but also a micropolitical cost. The damaged object is no longer present and able to affect those that may otherwise experience it. Likewise, if the action taken is a kind of conventional repair that restores function, but hides the expression of its own repair – for example, by using transparent glues or replacing broken components – then the assemblage dissipates. There is no longer a micropolitical affect of damage or repair if there no longer a perceivable expression of that damage or repair in the object.

However, the agency of transformative repair is that the affective powers of destruction bound to the event of the broken object are preserved in expression. The assemblage persists, but differently arranged. Function restored, anxiety disperses, but the sensibility of repair persists, and may be enjoyed. Possibilities for styles and types of repair may form as ideas. This is to say that transformative repair pre-loads an assemblage with expressions of damage, but untroubled by the practical consequences of the content of damage. The viewer or user is pulled into an open assemblage hungry for connection to a future form of effort. That effort, if actualised as repair, further capacitates the pre-loading of assemblages in others - a micropolitical operation. This is a “feedback loop” between expression and effort (Buchanan, 2015: 391). As indicated by *kintsugi* craft and its

relations to the Japanese world, such feedback may propagate into macropolitical registers.⁹⁵

In relation to my work *Copper Ice Cream Scoops*, there are some macropolitical aspects to its use of pre-consumer repair and how pre-consumer repair affects the distinction between production and consumption. Pre-consumer repair blurs and disrupts the conventional boundaries that define contemporary production and consumption, in which the producer is deemed an active agent and the consumer is considered passive recipient. User self-repair does this in practice; the consumer becomes active in a type of production emergent from the act of repair. However, in the case of the scoops, this is not required to occur in actuality, and the boundaries between producer and consumer in perception become blurred due to the pre-consumer repair visible in the form of the scoop. This *pre*-permeates the boundary between production and consumption so that an affective exchange between the two catalyses an imagination of repair as a future possibility.

Given that the design of the scoops open up the imagination of future as a time and space for action, the combination of historically significant metals in the scoops (copper and tin, which, when alloyed, become bronze) should also be considered in regard to how the scoops open up a perception of time more broadly. These metals have a powerful relational field formed from their significant historical presence. Manuel De Landa indicates this importance when he notes how historians have named “crucial” stages of human civilisation after their metal technologies, such as the Bronze Age and the Iron Age (De Landa, 1995). The perception that the scoops may have archaeological origins (and a timeless value) is enhanced by the staging of the scoops in exhibition, in which the repaired scoops are displayed, alongside a rough pre-repaired cast, upon stands similar to those used for presenting archaeological artefacts in museums (figs. 112–115). Yet, the

⁹⁵ The macropolitical development is contingent to what Buchanan calls “symbolic accolade” or reward, based on whether the acts of repair deliver a sufficiently satisfying form of expression meeting the effort expended (Buchanan, 2015: 391). However, the symbolic accolade guides the assemblage competitively, given there also seems to be prestige in the capacity to discard broken products and purchase new replacements.

scoops are not actually archaeological; there are no ice-cream scoops of this typology from ancient history. Its contour and silhouette is mostly identical to the Zeroll scoop designed by Sherman L. Kelly in the 1930s. This form developed in response to technological advances in aluminium extraction and then refrigeration, the latter allowing commercial quantities of ice cream to be stored in warm climates.⁹⁶ The design required a technical understanding of the thermoconductivity of aluminium and the ways that this quality could be exploited, in shape and form, for functional, aesthetic, ergonomic, production and market-related purposes.⁹⁷ The *Copper Ice Cream Scoops* appropriate this shape and, for this reason alone, can only be a product developed later than the early-twentieth century. The scoop affectively associates with archaeological artefacts, but this modern, industrial shape and function works to pull the scoop in other directions within the relational field; in doing so, the scoops become anomalous to both archaeology and industry, situated on the borders of their respective relational fields. However, archaeological and industrial affects are not polar forces. While they may seem

⁹⁶ Aluminium was first developed in 1825, but, due to the difficulty of extraction from ore, was more expensive than gold until 1880. It did not become widespread as a material until the twentieth century after extraction technologies improved (Davis, 1993: 3). An explanation of developments in refrigeration in regard to this point is more complex, because ice harvesting was an existing, viable and simpler competitive technology. Regardless, and while gas-based refrigeration systems date back to the eighteenth century and ice harvesting to antiquity, neither was suitable for storing commercial quantities of ice cream until the early-twentieth century.

⁹⁷ As a result, its material expression is tightly regulated by industrial processes; for example, by the constraints of mass-produced casting and the technical and legal implications of patent documents. It should be noted that limiting the material expression is normative for industry due to energy and manufacturing efficiencies, and so, for example, shapes are designed to release predictably from moulds or to be finished by automated processes. These efficiencies have relevance to issues of production and consumption because they allow more to be produced with less energy and material. Such efficiencies are beyond the scope of this thesis however, though it can be speculated that such material and economic efficiencies may also facilitate, if not encourage, excessive consumption. A secondary aspect to consider is that just as mass-production yields efficiencies for producers, consistency is also considered valuable to users and consumers. A consumer can expect that a Zeroll scoop purchased tomorrow will work the same as the Zeroll scoop used the day before. Producers can enhance this expectation by product branding and marketing, constructing a perception of reliability and autonomy for the Zeroll brand. Brand identity relies on the limitation of relational affects in order to focus the sensory experience of the product, though such limiting may inhibit awareness of production conditions and the experience of the object's ecological footprint.

oppositional, the relationship between these affects is complex and dynamically constituted by properties of metal that emerge from the capturing of forces in material.

As introduced in Chapter Two, the capturing of forces can be understood through Deleuze and Guattari's concept of machinic phylum. Conductivity is a property of copper whose force is captured in the materiality of the *Copper Ice Cream Scoops* through the casting process. Pure copper is a highly effective conductor for heat and electricity. This is also true in casting, to the extent that when temperatures are high enough to complete the phase transition of copper from solid to molten metal (the point known as the *liquidus*), the heat is present in the metal in an extremely reactive way (Davis, 2001: 171). In the terms of affect, the copper becomes 'alive'. It wants to dangerously react with oxygen in air and it wants to move and spit; these are tendencies that the caster must control with a flux cover, careful handling and temperature control (Davis, 2001: 174). As it is poured into the cast, the molten copper will cool below its liquidus point and begin its phase transition back to solidity (the point of *solidus*).⁹⁸ This transition is contingent on the technique of the caster and may not be fully controllable. Tendencies within the liquid metal emerge and the mould may not fill as expected because the copper is too active to behave predictably. This is not just an interpretation within the framework of affect; these tendencies are also noted within the technical metallurgical literature (Davis, 2001: 171–72). Manufacturers are explicitly advised against the casting of pure copper and are informed that its casting results in coarseness of granular structure, rough surfaces and the formation of irregular shrinking cavities, all of which increase the difficulties of producing a cast of typically desirable quality (Davis, 2001: 171–80). This is why carefully portioned additives of tin and zinc (as well as lead and cadmium, among other additives) are almost always added to copper to create alloys that 'behave' better. These additives 'tame' the copper. This highlights the contrast between the alive and

⁹⁸ This is an expression of the capacity for metal to have a memory, in the sense that forces transmit from one phase of becoming to another via affect (Goodchild, 1996: 26). In the case of metal, the heat which transforms the metal from solid to liquid has a duration, a memory of heat, which modulates the flow and form of the metal's materiality. Even after cooling, the effect of this transformation persists as a memory evident in the metal's interior crystalline structure.

emergent properties of pure copper and the way copper is manipulated by industry for domestic applications.

My practice attempts to work with the machinic and material elements of pure copper and introduce its raw, elemental and alive affects into the domestic sphere. It is not that homewares made of copper alloys, such as brass or bronze, or even other metals like silver or steel, provide less of an encounter, but rather that they have qualitatively different encounters. In practice, many metals are rigorously manipulated by metallurgists into precise alloys intended for specific uses. At this level, every alloy is a hybridisation of human–metal operations. In nature, metal is found in the form of ore, bonded chemically to oxides, sulphides and silicates – a product of geological forces. To be extracted, purified and then alloyed is an event that binds the emergent and natural properties of metal with the desires and intentions of human agency. This has occurred numerous times across the course of history. Deleuze notes the ancient Sumerian expertise in copper alloying as “operations of modulation” within which the artisan engaged (Deleuze, Parnet and Pinhas, 1979).

These operations are determinations of morphogenesis, variables that influence the creation of form from material. Of these variables, speed and duration are significant in the practice of metallurgy, both by themselves and in their effect on temperature and pressure. De Landa explains that “new design” arises from changing the speed or duration (or “timing”) of one factor in relation to another (De Landa, 2002: 97). For pure copper casting, it can be considered that the speed at which copper cools, its duration or memory of heat, is in relation to the speed at which it is poured. These are intensive properties that influence the quality of conformance to the mould. In that molten copper reacts with air, these properties also impact the cavity, creating pressure of gasses within the mould. For copper alloys, this conformance to the mould changes, dependant on the type and quantity of additional metals, which are extensive properties that nonetheless modify the intensive properties of the molten metal, such as the speed at which it pours or cools.

For many, if not most, consumer applications, the production complexities of metal casting (that continue to the present day in the design of the most sophisticated modern alloys) are hidden by industrial consistencies borne from such variables. The vital signs of metals are smoothed away by sophisticated alloying and perfect formation into moulds, or by precision machining and finishing. In my opinion, such processes may diminish the materiality of the metal and hide its human-alloy hybridisation.⁹⁹ This is a consequence of the hylomorphic model of production (Deleuze, Parnet and Pinhas 1979, Deleuze and Guattari, 1987: 409; Smith, 1996: 43).

Precious metals such as gold, silver and copper have great capacity for hylomorphic modulation and it is a factor that explains their historical significance. They change shape effortlessly. Stories of refugees melting down jewellery to pay for their escape from genocide or the Holocaust serve as examples for such amorphous capacities. Yet, jewellery and objects can be worth more than their material value and embody sentiment and memory, functioning as an emotional placeholder for weddings, graduations or other special events. In this normative case, it can be said that hylomorphic techniques are used to encapsulate the metal, locking its material tenacities for movement and change. The copper scoops have been subject to a locking moment too, but are different to conventional cast metal products in that their material capacities for shapeshifting, their morphogenetic capacity, have been arrested in motion, before complete subjugation to the hylomorphic boundary of the mould. Its generative form indicates an arrested-phase state within the production process – a point between one shape and another – and this suggests the opening up of relations to production within the experience of the object.

⁹⁹ I refer here to certain types of products like tablewares and homewares in typical use, but there are always exceptions in which the metal expresses its material conditions through affects and percepts. A basic example is the colour differences between the polished forms of specific alloys of gold, silver or platinum, which are distinguishable to the trained eye. Sound is an especially potent signifier; the clang of the sabre or the swish of the épée indicate the reason swords are forged and not cast. The crash of a car accident suggests why bonnets and chassis are designed and built to crumple, and, on a windy day, the creak of an iron bridge expresses the relationship between the carbon ratio of steel and its flex, and therefore its capacity to carry cars, buses and trains without breaking.

For Deleuze and Guattari, metal has a special place within their concept of machinic phylum and a particular potential to expose that which is hidden by the dominance of the hylomorphic model (Deleuze and Guattari, 1987: 411).¹⁰⁰ The scoop in use and sensation is anomalous, and presents the wildness and vibrancy of copper to the user, perhaps for the first time. Its physical weight and irregular, anomalous features potentialise an affective encounter with the vibrant and emergent material conditions in which it was formed. The user is engaged on a relational field with the vitalistic qualities of pure copper, operating at the level of machinic phylum. Affects that flow from the operations of the copper mine and foundry (figs. 116–118), and the extraction and smelting of copper, are connected to the user on this field of relations. In the remaining pages of this chapter, I will explain in depth the operation and value of this experience of

¹⁰⁰ Metal makes the concept explicit because it has the capacity to “bring to light a life that is proper to matter” (Deleuze and Guattari, 1987: 411). Deleuze and Guattari note that metal is in dispersion throughout organic matter as molecules of “salts and mineral elements” that have a vitalistic “probe-head”, seeking out emergent forms in which to manifest (Deleuze and Guattari, 1987: 411). This probe-head guides its morphogenetic capacities to find diverse actualities: iron carries oxygen in the red blood of vertebrate animals, copper does the same in the blue blood of invertebrates, and both metals work elsewhere in animal bodies (to the extent that humans maintain a circulation of about five milligrams of copper through their bodies, with daily consumption and excretion of one milligram). Such concepts have been explored by Manuel de Landa (1995) and by Jane Bennett in the chapter on metal in her book *Vibrant Matter* (2010). Bennett notes that the typical understanding of metal is something that is inert and resilient to all but extreme temperatures. The mythological adamantite unbreakable chains that lock Prometheus to a rock for eternity and the popularity of phrases like “solid gold hits” or “iron will” are given as examples of cultural tropes that elevate metal to the status of an indomitable material (Bennett, 2010: 55). This may be the day-to-day experience of metal, when driving over a steel bridge or banging a forehead against a kitchen range-hood, for example. Yet, the heat of the foundry and furnace indicates that metal has much greater dynamism. Bennett notes that the granular and crystalline structure of metal is full of intensities and potentialities (Bennett, 2010: 55). Imperfections in the crystalline lattice, in the form of cracks or linear defects, define the material capacities of metal. These lines can run freely through the material or be deflected within it. This is exploited in metallurgy. De Landa notes that scientific research reveals that metals are material systems with capacities to organise into complex structures and forms, and in metal-smithing, the blacksmith brings out emergent qualities of ductility, strength and toughness in metal by exploiting their granular structural transitions using manipulations of force and energy from hammering, heating and quenching (De Landa, 1995). In this way, metal-smithing can modulate the morphogenesis of metal by facilitating line defects in its crystalline structure. The might either run freely, producing metals which flex or bend without breaking, or deflect, producing rigid, but brittle structures.

anomaly, but first I would like to briefly reflect on the implications of the concept of machinic phylum for ecological awareness and sustainable development.

As discussed with regard to Thomas Thwaites's *Toaster Project* in Chapter One, copper mining has profound social and ecological ramifications, both currently and historically. Simply put, copper's material properties of conductivity in its elemental state, and its effects on other metals as an alloy, make it a core technological material of civilisation, but also a significant creator of pollution. While copper mining techniques have improved in recent decades, the risk it poses to the environment remains high for the simple reason that the scale of copper mining has vastly increased (Kircheis, 2014).

The problem is that resource limits may not be reached before ecological limits are reached. This is because pricing mechanisms of supply and demand motivate the extraction of material from scarce resources that are less fruitful and more difficult to process; for example, digging deeper for petroleum or extracting metal from lower grades of ore. Copper mining exemplifies this issue because of the increasing scarcity of high-yield ores. The ores considered economically viable to process in recent decades are, on average, less than one-eighth as concentrated as they were 400 years ago (Young and Ayres, 1992: 108). Metal extraction from less-concentrated ores also increases pollutive potential. Yet, the economic and production logics that drive the use of less-concentrated ores and the exploitation of scarcer resources in general have no sensitivity to ecological limits. These are limits to regeneration or limits that demarcate irreversible tipping points or sustainability envelopes (Beder, 1996: 24–25).

For example, in Chapter Two, I discussed the issue of soil toxicity to illustrate how pollution diminishes ecological, affective powers. It is known that soil pollution has detrimental effects, as evidenced by the success of green movements in the 1960s and 1970s in regulating industrial pollution (Klein in Mark, 2013). However, what is perhaps less well known is that conventional farming practices increasingly weaken soil's ecological capacities over time. For example, farming can erode soil by wind and water at

ten to forty times the rate of soil formulation (Diamond, 2005: 486; Walker 2006: 8). This can be contrasted with forested land, in which soil regenerates faster than it erodes.

The problem of differences between resource limits and ecological limits comprises an argument against the model of 'sustainable development', in which materials are priced by neo-classical economic criteria (Walker, 2005: 10). It has been proposed that scientific and technical knowledge of material ecologies is needed to solve such problems, but it is also necessary to engage with the *political* understanding of scarcity and use of materials across time (Walker, 2005: 11).

It could be that machinic phylum and other concepts of affect pull these two requirements together, in that machinic phylum is a concern for harnessing morphogenetic capacities of material ecologies, as used in designed products, that are capable of transmitting affects in the micropolitical dimension (for the construction of temporal-spatial imaginations of the past, present and future) for macropolitical transformations. Harnessing soil's own morphogenetic properties to regenerate faster than it erodes (as is the case in forestland), or, at least, at the same pace, would inform and alter the design of farming in practice. Whether this is hybrid forest-farm or some other expression, the point is that the farming is sensorially active through its affects, and the affects of its products, rebounding from micro- to macropolitical dimensions. A concept like machinic phylum may give expression to the critical activity of soil, rather than perpetuate a conceptual model that perceives soil as passive or resilient to human activity, when the evidence clearly points to the opposite. This use of machinic phylum as a conceptual tool thereby informs a schema for environmentally concerned designers, as proposed in Chapter Two. Such a schema should help product designers capture the conditions of making, manufacture and production within an object, as sensation, instead of keeping these conditions suppressed.

The role for experimental design in regard to such a schema is the creative deployment of concepts through material practice. For this purpose, I will continue with my analysis of the *Copper Ice Cream Scoops* to illuminate how material practices, based on an

understanding of both (scientific) material and (micro- and macro-) political relations, can leverage the powers of anomaly to potentialise shifts in perception. For the scoops, their macropolitical affects are mediated by normative perceptions of copper, and here the role of experimental design to potentiate the power of anomaly is key. It develops in contrast from the typical uses of copper in product design. It is pertinent that consumers rarely experience the vibrancy of copper in its pure state, because it is often so physically close – hidden inside computers, electronics and electric motors, sheathed in plastic sleeves, buried underground in cables and plumbed in behind the walls of our homes. The typical expression of pure copper in the domestic environment is one of control and micro-precision; copper is typically machined, extruded, die-cast, stamped or electro-formed into thin sheets, plated surfaces and tiny parts for electronics. These production practices constrain the micro-structural capacities of copper to hylomorphic limits. These expressions, unlike the traditional use of brass and bronze in domestic scale objects (such as doorhandles or stair rails), do little to express the scale at which copper mines operate. Perhaps the most prominent use of pure copper in the home was the tin-lined copper saucepan or pot. These have largely been replaced (at least in developed countries) by steel or aluminium and teflon hybrids, with copper saucepans reserved for specialist or boutique cookware. It might be unusual for a member of the public to hold a volume of pure copper in their hand. The *Copper Ice Cream Scoops* weigh more than expected, because it is rare for a domestic kitchen utensil to be so heavy. Its anomalous weight creates the conditions for the perception of an even larger physical scale – the copper mine or foundry. Taking this further, the pits and imperfections of the scoops are seen as expressions of the micro-structural potential of copper. The fury, heat and energy of the copper furnace are carried into sensation by the scoop's voids, irregularities and collapsed edges into the form of the object.

The encounter with the *Copper Ice Cream Scoops* can be summarised as one in which anomalous aspects expand an affective depth of field connecting to issues of production, consumption and ecology. The use of pre-consumer repair initially embodies a sense of future product-crisis-amelioration. The field expands outwards to connect the product to present and the past conditions of production and historical practices of metallurgy. The

anomalous, archaeological qualities of the scoops widen the temporal envelope for compression into a subjective assemblage in the present.¹⁰¹ In this assemblage the vibrancy of copper foregrounds the role of metal in ecology. The scoops disrupt the normative hylomorphic expressions of industrially designed domestic products, opening, I propose, a possibility for engagement with the industrial production of copper and its ecological consequences. These affects create a potential for the sensation of a teleologically urgent ethical crisis arising in a domestic experience; a perception of the weight and presence of copper and its socio-ecological relationships across human history. Admittedly, such a sensibility within the scoops present to the consumer, as Thrift might suggest, a world *with troubles* rather than without troubles. But, my hope is that the scoops are appealing enough in use and appearance to soften this ethically mired passage. The scoops themselves have some aspect of *sprezzatura*, or effortless glamour, through which the force of their affects ebb and flow, and their durations grab and release, to balance tension with more ameliorative affects.

In this chapter, I have attempted to expand upon the findings of Chapter One and Chapter Two to show how concepts of affect can be deployed in design to draw out relationships between sensory experience and socio-environmental issues of production and consumption. The purpose of this chapter has been to show how such experimental design of domestic objects can open up spaces of encounter for novel relations between designers, producers, consumers and the environment. Each work discussed develops the affective analysis iteratively via the deployment of anomalous qualities. The *Marble and Steel Room Divider* attempts to show how framing the presentation of broken and repaired material can enhance the experience of materiality; the weight and presence of the repaired marble is accentuated by the suspension of the marble slab and the association of design components with the tools and machines of the marble industry. The intent is to fold the large and unwieldy scale of global marble production, and its environmental contingencies, into the experience of a domestic object. The matter of speeds and durations, too, is relevant to the ways in which this object is sensed, because

¹⁰¹ The problem of metal production, while exponentially grown since the Industrial Revolution, is evident from antiquity in the form of lead isotopes deposited in Arctic ice, a result of pollution from Roman Empire-era silver mining (Dunlap, et al., 1999).

marble production takes place over long timeframes (considering either human production and transport or the geological timeframes in which marble forms from limestone). The experience of the *Marble and Steel Room Divider* compresses these long durations into a moment of affective intensity that has the potential decompress its relations within sensation and perception instantly, just as the marble slab itself embeds a potential to crash to the floor. Speeds and durations are also evident in *kintsugi*-ware; the instant, concussive force of cracked ceramic is overt, though modulated by the slow durations expressed by the use of gold dressing. *Archaeologic* replaces the quality of permanency expressed by gold in *kintsugi* with a more transient experience of duration – the immediacy of photoluminescent light in the dark, and its fading over the course of the night. In both *kintsugi*-ware and *Archaeologic*, the perception of forces that break and crack are mobilised to express urgency, but are modulated by repair to express a sense of ameliorated danger and the potential to persevere against environmental calamity. One argument proposed by the works of Deleuze and Guattari, Thrift, De Landa and others is that the hylomorphic model and its dominance in industrial design and manufacturing is complicit in the progression towards environmental calamity. To intervene and disrupt this paradigm, the *Copper Ice Cream Scoops* reposition repair to the pre-consumer phase of production. This is achieved during the casting process by leveraging unpredictable tendencies of metal that are conventionally suppressed by techniques of consistency typical to hylomorphic practice. The casting process and its repair is a form of 'matter-following' that opens the object to material relationships. These relationships, aleatory lines of copper repaired and embraced by tin, have an expression of the past invested in them – the history and scale of metal, its mining and environmental contingencies. Yet, is also a potential to imagine a future and, with it, the capacities for humans to engage in practices of repair.

Conclusion

While writing this thesis, I organised for the work *Copper Ice Cream Scoops* to be photographed. Afterwards, the photographer and I noticed that there were some minor, but distracting problems with the images that went unnoticed at the time of the photo-shoot: some lint and hair, a fingerprint on the scoop handle, and so on. Rather than reshoot, the photographer recommended a photographic retouching service located in Thailand. I emailed the images with specific instructions regarding their clean-up. However, the images were returned with almost all the casting imperfections airbrushed away as well, so that the repaired scoops appeared nearly perfect and shiny (fig. 119) – in some way, even more so than conventional, industrially made, commercial aluminium scoops.

This presents a rather fitting illustration of a problem addressed by this thesis. The work of photographic retouchers, in service to the fashion and design industries, typically concerns the removal of imperfections from objects (Kee and Farid, 2011; Clec'h et al., 2005). The retouchers had no particular incentive to overdo the retouching (the price was a flat fee), but, respecting the conventions of their industry, they naturally assumed the casting irregularities in the copper scoops were best removed. Indeed, unknown to me at the time, this precise practice is touted in their services catalogue (fig. 120). This serves as an example of how the design industry is confined by the *sprezzatura* ideal that I discussed in Chapter Two. The issue at hand is the *effort* that systems of production exert to maintain the appearance of *effortlessness*. On reflection, I can question my own immersion in this paradigm, as revealed by my desire to have the photographs retouched in the first place.

Part of the argument I developed, following Deleuze and Guattari's analysis of Simondon, is that hylomorphic practices should be de-privileged in favour of design processes that express the continuous modulation or, as I have employed the term, the machinic

phylum, of material (De Landa, 1997; Deleuze and Guattari, 1987: 335, 368, 407–411; Simondon, 1992: 315). Yet, there are compelling concerns for profit, marketing and economic efficiency behind the industrial design practices discussed in this thesis, which flow from such hylomorphic thinking. My aim has not been to deny the reasons for such practices, but rather to show that there are alternatives to such paradigms. The challenge appears to be that the normative industrial practices I discuss in this thesis have become so ingrained so as to dismiss not just the practice of working differently, but the very *perception* that working differently is possible. In that affects work to potentialise new perceptions, this is a suitable challenge for experimental design practice-based research.

This thesis has proposed that the affective operations of experimental product design can give rise to new perceptions that might create the conditions for new relations between users, designers, producers, consumers and the environment. My works illustrated in this thesis leverage the capacities of specific materials common to furniture and homewares – namely, ceramic, marble and metal. The conditions of failure (cracks, voids and irregularities) of these materials are mobilised to produce a percept of material and environmental emergency, but with the process of repair suggesting new directions for action. This twofold operation depends on the forces and intensities of affect, which flow from what Deleuze and Guattari discuss as sensory compounds, and that I extract from my materials in the compounds of the *crack* and the *clinch*, respectively splitting and pushing away, or binding and pulling together (Deleuze and Guattari, 1994: 168–182). It may be that, beyond its practical applications, repair is unique in its capacity to express such an affective push and pull simultaneously as compounded intensities. In my works, the two forces are deployed to firstly assert the calamitous potential of material/environmental negligence (a push away from normative perception), and secondly to bind the user to new affective relations (a pull towards ecological thinking). The proposition of my works has been to combine repair with anomalous qualities, such as domestically scaled industrial features, glowing cracks or disruption to the typical expression of manufactured products. This is transformative repair. The role of anomaly is to open the affective field, penetrate conventions and bind disparate experiences

together into new assemblages. The anomalous features of a transformative repair practice serve to extend these assemblages towards new possibilities for action.

Yet, despite my intentions, at the moment the images of the copper ice cream scoops were released out of my hands to the photographic retouchers, they encountered an event that pulled their presentation back to a limited, hylomorphic expression. This confirms a few observations from this research, which are, on reflection, limitations to its argument. Experiences are subjective, and designers cannot control the experiences of their products, only influence them. Furthermore, while anomalous conditions open new relations and increase possibilities for action, such possibilities are free ranging and it is possible that they also elicit and incite action that serves competing or alternative interests. Designers work within interconnected production ecologies, which contain habituated, converse practices. Nonetheless, this thesis has intended to understand such operations of normative product design, which should be of interest to experimental, environmentally minded designers. By thinking through such norms within an affect-based framework, it might be understood how these design practices become embodied and habituated.

Producers and consumers operate in a mode of denial about the current state of environmental disaster, maintaining their own habits and behaviour. Many of these practices seem to defy common sense, such as shipping marble around the world to places that already have their own marble. As Branzi has observed, this is the logical outcome of complex, interconnected systems of markets, economics and globalised relations (Branzi, 1984: 47–55). The affective analyses of this thesis indicate that design products are imbricated in these systems and may serve to maintain their undesirable trajectories. Yet, given the right conditions or collection of features, a designed object can have an agency and capacity to influence in powerful and unexpected ways. The case study of the Thonet chair makes this explicit in the way it transformed an array of social and environmental conditions, including labour relations, cafe culture, tree ecologies and the perceptions of industry.

Designers tend to perceive their influence as limited within the interactions of their products, but concepts of affect show us that the encounters with products shift the relationships of all things, and propagate their affects to other objects, people, systems and ecologies. These are micro- to macropolitical passages of affect. In Chapter One, I noted Rawsthorn's proposition that a significant aspect of Jongerius' practice may be its effect on the manufacturers that produce it, maybe more so than the consumers who buy it (Rawsthorn, 2010: 75–76). In Chapter Three, I demonstrated that, with an expanded, affective inquiry, the relations of *kintsugi* stretch far and wide, and go deep into the cultural and geological conditions of the Japanese world. Repair as an affective practice pivots from this analysis, and serves to show how it can embody an attitude, perspective, a set of relations and an action-potential to stop, survey and improve the conditions of the world, instead of continuing to deny damage. For experimental design, transformative repair holds greater potential again, as a practice that can grasp the power of anomaly and thrust it into the world. It is the tacit understanding of material properties and their morphogenetic potential matter-flows that can enable experimental designers to create compelling object-forms with the potential to shift perceptions about the environment.

There are more directions in which to pursue this research, especially at the levels of materials and forces. At a material level, I have explored the repair of cracks, voids and irregularities in stone, ceramic and metal. There are options, then, to develop new practices of repair in other materials, such as plastic, wood or concrete. This extends to the repair of damages resulting from forces different to those that crack ceramic and stone, or that collapsed the metal casts of the scoops. These include flooding, fire and other forces of temperature, pressure, chemical or electrical interaction, all of which may damage products in current, domestic use. The exploration is to discover new material expressions that surpass the hylomorphic limits typical to industrial production.¹⁰²

¹⁰² A corollary to this observation is that transformative repair may be difficult when damaged products are materially and technologically complex. So, it is necessary to note that complex consumer electronics (as exemplified by the picture of broken iPhones opening this thesis) perhaps present the biggest challenge for transformative repair.

There is a need for more research on transformative repair within systems of production. The *Copper Ice Cream Scoops* inserted a repair process into a pre-consumer system of production with a material change disrupting a normative casting practice. Practices such as this applied to different materials and industrial processes warrant further investigation. Disruptive practice, and the subsequent repair of its outcomes, could be applied conceptually to all manner of systems. With regard to affective approaches to design, Marenko argues that active forms of consumption exemplified by hacking and modding cultures may catalyse a shift of power away from centralised production (Marenko, 2010: 146). This is conceivable for new forms of repair culture too, without inferring that such a shift would necessarily be environmentally beneficial. A future task could be to interrogate such propositions via the operations of affect established in this thesis, with a concern for modulating their systemic processes towards positive environmental outcomes.

This thesis has argued that at the individual, social, environmental and ecological levels, there are potential benefits to be gained via processes of affective transformative repair. I have discussed those designs and objects that are proximate to my own practice and concerns. I have examined strategies to shift our sensorial encounters with domestic objects and damaged materials such as stoneware, ceramic and metal. These strategies mobilise a concern for the environmental effects of deploying and reusing such materials, and concern for the detrimental consequences of contemporary industrial technologies in general. My overall strategy is one of transformative repair, facilitating a positive encounter so that these concerns intensify rather than abate possibilities for action. The socio-environmental actions that may follow from such strategies are wide ranging, and may include such things such as reducing waste or extending the life of products. But within the scope of this thesis, such things can only be framed as possibilities and not definitive outcomes. What I have shown is that experimental design practices that modulate the sensibility of repair *do generate* new options for environmentally beneficial living. This motivates and is embedded in the practice-based research of this thesis, which has sought to develop strategies for experimental designers that shift us toward new sensory encounters with domestic products.

Bibliography

Books & Monographs

Adamson G., & Pavitt, J. (2011). *Postmodernism style and subversion, 1970–1990*. London: V & A Publishing.

Ambasz, E. & Museum of Modern Art (1972). *Italy: the new domestic landscape; achievements and problems of Italian design*. New York: Distributed by New York Graphic Society, Greenwich, Conn.

Antonelli, P. (2008). *Design and the elastic mind*. New York: Museum of Modern Art.

Attfield, J. (2000). *Wild things: the material culture of everyday life*. Oxford: Berg.

Beder, S. (1993). *The nature of sustainable development*. Newham, Vic: Scribe Publications.

Bennett, J. (2010). *Vibrant matter: a political ecology of things*. Durham: Duke University Press.

Betts, P. (2004). *The authority of everyday objects: a cultural history of West German industrial design*. Berkley, CA: University of California Press.

Bogue, R. (2003). *Deleuze on cinema*. New York: Routledge.

Bosoni, G. (2006). *Il modo italiano: Italian design and avant-garde in the 20th century*. Montréal: Montreal Museum of Fine Arts.

Branzi, A. (1984). *The hot house: Italian new wave design*. Cambridge, Mass.: MIT Press.

Branzi, A. (1988). *Learning from Milan: design and the second modernity*. Cambridge, Mass: MIT Press.

Brower, C., Mallory, R., & Ohlman, Z. (2009). *Experimental eco-design: architecture, fashion, product*. Crans-Près-Céligny: RotoVision.

Brown, P. E. (2009). *Plastic green: designing for environmental transformation*. Melbourne, Vic.: RMIT Publishing.

Buchanan, I., & Lambert, G. (2005). *Deleuze and space*. Edinburgh: Edinburgh University Press.

Cache, B. (1995). *Earth moves: the furnishing of territories*. Cambridge, Mass. and London: MIT Press.

Centraal Museum (Utrecht, Netherlands). (2000). *Droog & Dutch design*. Utrecht: Centraal Museum.

Clark, C. (1997). *Radium girls, women and industrial health reform: 1910-1935*. Chapel Hill, NC: University of North Carolina Press.

Clech, M. L., Eckstein, R., & Niemetzky, G. (2005). *Photo retouching with Photoshop: a designers' notebook*. Beijing: O'Reilly.

Coles, A., & Rossi, C. (2013). *EP/ Volume 1: the Italian avant-garde, 1968-1976*. Berlin: Sternberg Press.

Colman, F. (2011). *Deleuze and cinema the film concepts*. Oxford: Berg Publishers.

Davis, J. R. (2001). *Copper and copper alloys*. Materials Park, Ohio: ASM International.

De Landa, M. (2002). *Intensive science and virtual philosophy*. London, Continuum.

Deleuze, G. (1972). *Proust and signs*. New York: G. Braziller.

Deleuze, G. (1988). *Spinoza: practical philosophy*. San Francisco: City Lights Books.

Deleuze, G. (1995). *Negotiations, 1972-1990*. New York: Columbia University Press.

Deleuze, G. (2004). *Francis Bacon: the logic of sensation*. London: Continuum.

Deleuze, G. (2005a). *Cinema 1: the movement-image*. London: Continuum.

Deleuze, G. (2005b). *Cinema 2: the time image*. London: Continuum.

Deleuze, G. (2006). *The fold*. London: Continuum.

- Deleuze, G. & Guattari, F. (1987). *A thousand plateaus: capitalism and schizophrenia*, translation and foreword by Brian Massumi. Minnesota: University of Minnesota Press.
- Deleuze, G. & Guattari, F. (1994). *What is philosophy?*. New York: Columbia University Press .
- Deleuze, G., & Lapoujade, D. (2007). *Two regimes of madness: texts and interviews, 1975-1995*. New York: Semiotext(E).
- Diamond, J. (2005). *Collapse: How societies choose to fail or succeed*. New York: Viking Penguin.
- Disalvo, C. (2012). *Adversarial design*. Cambridge, Mass: MIT Press.
- Dunne, A. (1999). *Hertzian tales: electronic products, aesthetic experience and critical design*. London: RCA CRD Research Publications.
- Dunne, A., & Raby, F. (2001). *Design noir the secret life of electronic objects*. London: August.
- Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. Cambridge, Mass: MIT Press.
- Fischer, T. and Herr, C. (2002). *Teaching generative design*, Hong Kong: Hong Kong University and Hong Kong Polytechnic University.
- Fitch, N. R., & Midgley, A. (2006). *The grand literary cafés of Europe*. London: New Holland.
- Folkmann, M. N. (2013). *The aesthetics of imagination in design*. Cambridge, Mass: MIT Press.
- Frazer, J.H. (1995). *An evolutionary architecture*. London: Architectural Association.
- Freeman, T. (2004). *Environmental geology laboratory*. New York, John Wiley & Sons.
- Fry, T. (1994). *Remakings: ecology, design, philosophy*. Sydney, NSW: Envirobook.
- Fry, T. (2011). *Design as politics*. New York: Berg.
- Goodchild, P. (1996). *Deleuze and Guattari: an introduction to the politics of desire*. London: Sage.
- Gregg, M., & Seigworth, G. J. (Eds.) (2010). *The affect theory reader* (pp. 289–308). Durham, NC: Duke University Press.

Grosz, E. A. (2008). *Chaos, territory, art: Deleuze and the framing of the earth*. New York: Columbia University Press.

Guattari, F. (2000). *The three ecologies*. London: Athlone Press.

Herbert F. Johnson Museum of Art & Museum für Lackkunst. (2008). *Flickwerk: the aesthetics of mended Japanese ceramics*. Münster: Museum für Lackkunst.

Horn, R. (1985). *Memphis—objects, furniture, and patterns*. Philadelphia: Running Press.

Jongerius, H., & Schouwenberg, L. (2003). *Hella Jongerius*. London: Phaidon.

Julier, G. (2000). *The culture of design*. London: SAGE.

King, E. (2013). *M to M of M/M (Paris)*. New York, Rizzoli International Publications.

Illouz, E. (2007). *Cold intimacies: the making of emotional capitalism*, Cambridge: Polity Press.

Lang, P., & Menking, W. (2003). *Superstudio: life without objects*. Milan: Skira.

Loewy, R. (1979). *Industrial design*. Woodstock, New York: Overlook Press.

Mallgrave, H. F. (2013). *Architecture and embodiment: the implications of the new sciences and humanities for design*. London; New York: Routledge.

Massumi, B. (2002). *Parables for the virtual: movement, affect, sensation*. Durham, NC: Duke University Press.

Massumi, B. (2011). *Semblance and event activist philosophy and the occurrent arts*. Cambridge, Mass: MIT Press.

McDonough, W. & Braungart, M. (2002). *Cradle to cradle : remaking the way we make things*. New York: North Point Press.

Mellini, A. (1989). *Alessandro Mendini*. Giancarlo: Politi Editore.

Miller, J. (2005). *Furniture*. London: Dorling Kindersley.

Moggridge, B. (2007). *Designing interactions*. Cambridge, Mass: MIT Press.

The Museum of Modern Art. (2004). *MoMA Highlights* (Rev. ed.). New York: The Museum of Modern Art.

Nemerow, N. L. (2009). *Environmental engineering*. Hoboken, New Jersey: Wiley.

Norman, D. (2004). *Emotional design*. New York: Basic Books.

Oates, P. B., & Seymour, M. (1998). *The story of Western furniture*. Landham, MD: New Amsterdam Books.

Papanek, V. J. (1972). *Design for the real world: human ecology and social change*. New York: Pantheon Books.

Parr, A. (2010). *The Deleuze dictionary revised edition*. Edinburgh, Edinburgh University Press.

Pisters, P. (2003). *The matrix of visual culture: working with Deleuze in film theory*. Stanford, Calif: Stanford University Press.

Protevi, J. (2001). *Political physics Deleuze, Derrida, and the body politic*. London: Athlone Press.

Radice, B. (1993). *Ettore Sottsass; a critical biography*. London: Thames & Hudson.

Ramakers, R. (1998). *Droog-design: spirit of the nineties*. Rotterdam: 010 Publishers.

Ramakers, R. (2002). *Droog design in context: less + more*. Rotterdam: 010 Publishers.

Sato, K., & Mendini, A. (1985). *Alchimia: never-ending Italian design*. [S. l.]: Rikuyo-sha.

Sennett, R. (2008). *The craftsman*. New Haven: Yale University Press.

Simon Thomas, M. (2008). *Dutch design: a history*. London: Reaktion.

Slade, G. (2006). *Made to break: technology and obsolescence in America*. Cambridge, Mass: Harvard University Press.

Sparke, P. (1988). *Italian design: 1870 to the present*. London: Thames and Hudson.

Spencer, D. (1991). *Total design: objects by architects*. San Francisco: Chronicle Books.

Thackara, J. (2005). *In the bubble: designing in a complex world*. Cambridge, Mass: MIT Press.

Thwaites, T. (2011). *The toaster project: or a heroic attempt to build a simple electric appliance from scratch*. New York: Princeton Architectural Press.

Vegesack, A. V., Thonet, M., Pauley, B., & Ellenberg, P. (1996). *Thonet : classic furniture in bent wood and tubular steel*. New York: Rizzoli.

Walker, S. (2006). *Sustainable by design: explorations in theory and practice*. London, Earthscan.

Whitney, W. (1995). *In a door, into a fight, out a door, into a chase: moviemaking remembered by the guy at the door*. [S.l.]: McFarland.

Williams, G. (2006). *The furniture machine: furniture since 1990*. London: Victoria & Albert Museum.

van der Zanden, J. (2011). *Curatorial cooking*. The Netherlands: De Jonge Hond.

Zijl, I. V., & Boyer, M. (1997). *Droog design, 1991-1996*. Utrecht: Centraal Museum.

Book Chapters, Articles, Theses and Catalogues

Alvera, A. (1987). Michael Thonet and the development of bent-wood furniture industry 1869-1914. In Ostergard, D. E., & Alvera, A. (Eds.), *Bent wood and metal furniture, 1850-1946*. Seattle: University of Washington Press.

Antonelli, P. (1998). Nothing cooler than dry. In Ramakers, R. (1998). *Droog-design: spirit of the nineties*. Rotterdam, 010 Publishers.

Antonelli, P. (2001). Italian design between globalism and affectivity. In Bosoni, G. (Ed.), *Italy: contemporary domestic landscapes : 1945-2000* (pp. 22-37). Milan: Skira.

Antonelli, P. (2011). States of design 04: critical design: A design report from New York. *Domus*, 31 August. Retrieved from <http://www.domusweb.it/en/design/2011/08/31/states-of-design-04-critical-design.html>

Antonelli, P. (2013). MOMAs *Italy: the New domestic landscape* revisited. In Coles, A., & Rossi, C. (Eds.). *EP/ Volume 1: the Italian avant-garde, 1968-1976* (pp.23-43). Berlin: Sternberg Press.

Anusas, M. & Ingold, T. (2013). Designing environmental relations: from opacity to textility. *Design Issues*, 29(4), doi:10.1162/DESI_a_00230

Aureli, P. V. (2013). More money/Less work: Archizoom. In Coles, A., & Rossi, C. (Eds.). *EP/ Volume 1: the Italian avant-garde, 1968-1976* (pp.146–164). Berlin: Sternberg Press.

Baas, F., Farresin, S. & Trimarchi, A. (2014). Prima materia or How to master matter and influence people: An interview with Andrea Trimarchi and Simone Farresin. In Sellers, L., Baas, F., Petroni, M., Edelkoort, L., Rawsthorn, A., & Warndorff, J. (Eds.), *Formafantasma* (pp.37–68). Eindhoven: Lecturis.

Balko, R. (2009). I, Toaster. A British artist inadvertently brings Leonard Reads classic essay "I, Pencil" to life. *Reason* magazine, 24 June. Retrieved from <http://reason.com/archives/2009/06/24/i-toaster>

Bartlett, C. (2008). A tearoom view of mended ceramics. In *Flickwerk: the aesthetics of mended Japanese ceramics*. Herbert F. Johnson Museum of Art, & Museum Für Lackkunst. Münster: Germany.

Bogue, R. (1996). Gilles Deleuze: the aesthetics of force. In Patton, P. (Ed.), *Deleuze: A critical reader* (pp. 259–269). Oxford and Cambridge: Blackwell Publishers.

Bonsiepe, G. (2010). Design and democracy. *Design Issues*. 22, pp. 27-34.

Branzi, A. (1987). We are the primitives. *Design Issues*, 3(1), pp. 23–27, <http://www.jstor.org/stable/1571638>

Buchanan, I. (2015). Assemblage theory and its discontents. *Deleuze Studies*, 9, 3, pp. 382-392.

Buchanan, R. (1995). Rhetoric, humanism and design. In Buchanan, R., & Margolin, V. (Ed.s), *Discovering design: explorations in design studies* pp. 23-66. Chicago: University of Chicago Press.

Center for Studies and Industrial Prospective (CEPI) (2004). Brief No. 6: Strategic Positioning Study of the Marble Branch, 5 June. Retrieved from <http://www.tunisianindustry.nat.tn/en/download/CEPI/IMCCV02.pdf>

Clarke, A.. (2013). Ettore Sottsass: the design ethnologist. In Coles, A., & Rossi, C. (Eds.), *EP/ Volume 1: the Italian avant-garde, 1968-1976* (pp. 67–78). Berlin: Sternberg Press.

Coole, D., & Frost, S. (2010). Introducing the new materialisms. In Coole, D., & Frost, S. (Eds.), *New materialisms: ontology, agency, and Politics* (pp. 1–43). Durham, NC: Duke University Press.

Crowley, D. (2012). From homelessness to homelessness. In Schuldenfrei, R. (Ed.), *Atomic dwelling : anxiety, domesticity, and postwar architecture*. pp. 277–290. London: Routledge.

Cowell, S. (2011). The Milan four: Alessandro Mendini. *interview with Alessandro Mendini*, Architonic. Retrieved from <http://www.architonic.com/ntsht/the-milan-four-alessandro-mendini/7000604>

De Landa, M. (1997). The machinic phylum. In *TechnoMorphica* pp. 76–79. Rotterdam: V2

De Landa, M. (1995). Uniformity and variability: an essay in the philosophy of matter. Paper presented at the *Doors of Perception 3* conference, Netherlands, Design Institute, Amsterdam, 7–11 November.

DeLanda, M. (2004). Material Complexity. In Leach, N., Turnbull, D. and Williams C. (eds.), *Digital Tectonics*, London: Wiley.

Deleuze, G. (2002). The actual and the virtual. In Deleuze, G., & Parnet, C. (Eds.), *Dialogues II* (Rev. ed., trans. Eliot Ross Albert). (pp. 148–152). New York and Chichester: Columbia UP.

Deleuze, G. & Foucault, M. (1977). Intellectuals and Power. Discussion in Foucault, M., & Bouchard, D. F., *Language, counter-memory, practice: selected essays and interviews*. Ithaca, N.Y., Cornell University Press.

Deleuze, G., Parnet C., & Pinhas, R. (1979). Metal, metallurgy, music, Husserl, Simondon. *Deleuze / Anti-Oedipe et Mille Plateaux: Cours Vincennes-27/02/1979*. Retrieved from <http://www.webdeleuze.com>.

DiSalvo, C. (2009). Design and the construction of publics. *Design Issues*, 25, pp. 48–63.

DiSalvo, C., et al. (2011). The collective articulation of issues as design practice. *CoDesign*, 7 (3-4), pp. 185–197, doi: 10.1080/15710882.2011.630475

Dunlap, C. E., et al. (1999). A synthesis of lead isotopes in two millennia of European air. *Earth and Planetary Science Letters* 167, pp. 81–88.

Dunne, A., & Seago, A. (1999). New methodologies in art and design research: the object as discourse. *Design Issues*, 15(2), pp. 11–17.

Edelkoort, L. (2014). Art d'eco. In Sellers, L., Baas, F., Petroni, M., Edelkoort, L., Rawsthorn, A., & Warndorff, J. (Eds.), *Formafantasma* (pp. 69–116). Eindhoven: Lecturis.

Egginks, W. (2011). The rules of unruly product design, from the proceedings of IASDR2011, the 4th World Conference on Design Research, TU Delft, Netherlands.

Escallon, C. (2010). Droog design: sense and experience. Masters Thesis, Graduate Program in Art, History and Design, Notre Dame University, Indiana.

Experimental Jetset. (2013). Socialism as a graphic language: Ettore Vitale. In Coles, A., & Rossi, C. (Eds.), *EP Volume 1/ the Italian avant-garde 1968-1976* (pp. 119-126). Berlin: Sternberg Press.

European Commission (2008). European IPPC Directive 96/61/EC: Best Available Techniques in the Ceramic Manufacturing Industry August 2007. Retrieved from http://eippcb.jrc.ec.europa.eu/reference/BREF/cer_bref_o8o7.pdf

Fairs, M. (2005). Droog. *Icon* issue 21. Retrieved from <http://www.iconeye.com/architecture/features/item/2642-droog-%7C-icon-021-%7C-march-2005>

Faust, J. (2008). Design Discourse and Discourse Design: Reflections on “Conveyence Matter”. In *New realities: being syncretic : IXth consciousness reframed conference*, Vienna, 2008, University of applied arts, July 3-5, 2008. Wien, Springer.

Figlerowicz, M. (2012). Affect theory dossier: an introduction, *Qui Parle: Critical Humanities and Social Sciences*, 20 (2), pp. 3–18.

Fritsch, J. (2011). Affective experience in interactive environments, *The Fibreculture Journal*, 19.

Fuksas, M. (2002). Fuksas looks to the future, interview with Massimiliano Fuksas, Royal Academy of Arts, 22 June. Retrieved from <http://www.royalacademy.org.uk/architecture/architecture-resources/interviews/fuksas-looks-to-the-future,215,AR.html>

Fusselman, A. (1999). The curious Mr. Sottsass: a visit with Ettore Sottsass, Jr. *ArtNet*, 17 August. Retrieved from http://www.artnet.com/magazine_pre2000/features/fusselman/fusselman8-17-99.asp

Glancey, J. (2003). Anti-matter: Italy's Superstudio hated both the bland future and the twee past. Jonathan Glancey on a timeless vision. *The Guardian*, 31 March. Retrieved from <http://www.guardian.co.uk/artanddesign/2003/mar/31/architecture.artsfeatures>

Gopnik, B. (2009). At Freer, Aesthetic Is Simply Smashing. *The Washington Post*, 3 March.

Grafe, C. (2007). The architecture of cafes, coffee houses and public bars. In Grafe, C., & Bollerey, F. (Eds.), *Cafes and bars: the architecture of public display*. Hoboken: Taylor & Francis.

Grima, J., Mendini, A., Sacchetti, V. (2013). The role of radical magazines. In Coles, A., & Rossi, C. (Eds.), *EP Volume 1/ The Italian Avant-Garde 1968-1976*. Berlin: Sternberg Press.

Hallnäs, L., Jaksetic, P., Ljungstrand, P., Redström, J., Skog, T. (2001). Expressions - towards a design practice of slow technology. *INTERACT conference, IFIP TC.13*, pp. 447–454.

Hanieh, A. AbdElall, S. and Afif Hasan (2014). Sustainable Development of Stone and Marble Sector in Palestine. In *Journal of Cleaner Production* 84 (1 December): 581–88. Retrieved from <http://dx.doi.org/10.1016/j.jclepro.2013.10.045>

Harwood, B., R. (1994). Two early Thonet imitators in the United States: The Henry I. Seymour Chair Manufactory and the American Chair-Seat Company, *Studies in the Decorative Arts*, 2(1), pp. 92–113.

Herman, L., E. (1975). The designs of Raymond Loewy. in Loewy, R. *The designs of Raymond Loewy* [exhibition at the Renwick Gallery of the National Collection of Fine Arts, Smithsonian Institution, Washington, D.C., August 1-November 16, 1975]. Washington: Smithsonian Institution Press.

Hirokuni, K., (2011). Designers prophesize the future shape of society. *AXIS*, 150 (April), 92–95.

Holland, J.H. (2008). Mending ceramics – an anthropological context. In *Flickwerk: the aesthetics of mended Japanese ceramics*. Herbert F. Johnson Museum of Art, & Museum Für Lackkunst (Münster, Germany).

Ingold, T. (2010). The textility of making. *Cambridge Journal of Economics*. 34, 91-102.

IPCC (2013). Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Iten, C. (2008). Ceramics mended with lacquer – Fundamental Aesthetic Principles, Techniques and Artistic Concepts, in *Flickwerk: the aesthetics of mended Japanese ceramics*. Herbert F. Johnson Museum of Art, & Museum Für Lackkunst (Münster, Germany). (2008)

Johnston, L. (2013). Culture hack: we're all developers now. In *The Guardian*, published Friday 1 February 2013 22.29 AEDT. Retrieved from: <http://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2013/feb/01/culture-hack-culture-professionals-technology>

Jongerius, H. (2006). Hella Jongerius. *Contract.*, 48(12), pp. 42–43.

Kabat, J. (2010). The cost of convenience, *Metropolis*, 29(8), pp. 106–109, 122–123.

Kee, E. and Farid, H. (2011). A perceptual metric for photo retouching, *Proc. National Academy of Sciences*, 108(50), pp.19907–19912.

Keulemans, G. (2012). The trajectories of yachts and snot: strategies for generative designers. *Deleuze Studies*, 6, pp. 72–88.

Klein, N. (2013). How science is telling us all to revolt. *New Statesman*. 29 October. Retrieved from <http://www.newstatesman.com/2013/10/science-says-revolt>

Kopplin, M. (2008). Foreword to *Flickwerk: the aesthetics of mended Japanese ceramics*. Herbert F. Johnson Museum of Art, & Museum Für Lackkunst (Münster, Germany). (2008)

Kristal, M. (2011). Postmodernism at the V&A museum, *Dwell*, October 17. Retrieved from <http://www.dwell.com/event-spotlight/article/postmodernism-va-museum>

van der Kroef, S. (2010). Ettore sottsass. In *Artforum International*, 48, 267. Retrieved from <http://search.proquest.com/docview/314073516?accountid=12763>

Kyriazidou, E. & Pesendorfer, M. (1999). Viennese chairs: a case study for modern industrialization, *The Journal of Economic History*, 59(1), pp. 143–166. Retrieved from <http://www.jstor.org/stable/2566500>

Lan, L., Li, J. (2014). Foxconn to increase robot usage to curb worker suicide rates. *China Daily/Asia News Network*, 14 July. Retrieved from <http://www.chinapost.com.tw/taiwan/business/2014/07/14/412297/Foxconn-to.htm>

Lazzarato, M. (2006). The concepts of life and the living in the societies of control. In Fuglsng M. and Sorensen B.M. (Eds.), *Deleuze and the Social* (pp. 170–190). Edinburgh: Edinburgh University Press.

Lee, S. Y. (2014). Samsung electronics co halts business with China supplier on child labour concerns. *Financial Post*, 14 July. Retrieved from http://business.financialpost.com/2014/07/14/samsung-electronics-co-halts-business-with-china-supplier-on-child-labour-concerns/?__lsa=79e7-44fc

Liguori, V., Rizzo, M. and Traverso, M. (2008). Marble Quarrying: An Energy and Waste Intensive Activity in the Production of Building Materials. In *WIT Transactions on Ecology and the Environment*: 108: 197–207.

Lobsinger, M. L. (2012). Domestic environments: Italian neo-avant-garde design and the politics of post-materialism. In Schuldenfrei, R. (Ed.), *Atomic dwelling: anxiety, domesticity, and postwar architecture* / (pp. 186–204). Abingdon, Oxon: Routledge.

Lorraine, T. (2005). Ahab and becoming-whale: the nomadic subject in smooth space. In Buchanan, I. & Lambert, G. (Eds.), *Deleuze and Space* (pp. 159–175). Edinburgh: Edinburgh University Press.

Lowry, G. D. (2008). Foreword. In Antonelli, P. (2008). *Design and the elastic mind* (pp.4–7). New York: Museum of Modern Art.

Lu, C. (2014). Xinhua Insight: Goldfever and other ailments of Chinas e-trash industry. *Xinhua News Agency*, 15 July. Retrieved from <http://www.globalpost.com/dispatch/news/xinhua-news-agency/140714/xinhua-insight-goldfever-and-other-ailments-chinas-e-trash-i>

Madge, P. (1997). Ecological Design: A new critique, 1997, *Design Issues* vol. 13 no. 44–54

Madge, P. (1993). Design, Ecology, Technology: A Historiographical Review, *Journal of Design History*, Vol. 6, No. 3 (1993), pp. 149-166

MAKE Magazine. (n.d.). California, USA: Maker Media Inc.

Malpass. M. (2009). Contextualising critical design: classification of critical design practices. From *8th European Academy of Design Conference* , 1–3 April. Aberdeen, Scotland: Robert Gordon University.

Manzini, E. & Cullars, J. (1992). Prometheus of the everyday: the ecology of the artificial and the designers responsibility, *Design Issues*, 9(1), pp. 5–20.

Marenko, B. (2009). Object-relics and their effects: for a neo-animist paradigm. In Darras, B. and Belkhamisa, S. (Eds.), *MEI. Médiation et Information* n.30-31 *Objets & Communication*. Pairs, Editions de l'Harmattan

Marenko, B. (2010). Contagious affectivity: the management of emotions in late capitalist design. *6th Swiss Design Network Conference*, Basel, Switzerland.

Mark, J. (2013). Naomi Klein: 'Big green groups are more damaging than climate deniers'. In *Earth Island Journal*, Guardian Environment Network. 11 September. Retrieved from <http://www.theguardian.com/environment/2013/sep/10/naomi-klein-green-groups-climate-deniers>

Margolin, V. (2007). Design: the future and the human spirit. *Design Issues*, 23(3), pp. 4–15.

Margolin, V. & Margolin, S. (2002). A "social model" of design: issues of practice and research. *Design Issues*. 18, 24–30.

Massumi, B. (2000). Too-blue: colour-patch for an expanded empiricism, *Cultural Studies* 14(2), pp. 177–226.

Massumi, B. and McKim, J. (2009). Of micropolitics and micropereception [interview], in *Inflexions* 3, November.

McDonough, W. (2000). A world of abundance. *Interfaces* 30(3), pp. 55–65.

Mekinda, J. (2012). Designing the house of man: Franco Albini and the place of neorealism in Italian design, 1930-1960. In *ICDHS: Design Frontiers: Territories, Concepts, Technologies* proceedings.

Mellini, A. (1972). The land of good design. In Ambasz, E. & Museum of Modern Art (1972). *Italy: the new domestic landscape; achievements and problems of Italian design*. pp. 370-379. New York: Distributed by New York Graphic Society, Greenwich, Conn.

Merchant, B. (2013). How disaster-hungry pop culture ignored the biggest disaster of all. *Motherboard*, 10 October. Retrieved from <http://motherboard.vice.com/blog/pop-culture-and-climate-change>

Meroz, J. O. A. (2014). Facts and artefacts: politics and aesthetics in the work of Formafantasma. In Sellers, L., Baas, F., Petroni, M., Edelkoort, L., Rawsthorn, A., & Warndorff, J. (Eds), *Formafantasma* (pp. 177–187). Eindhoven: Lecturis.

Mitchell, S. (2011). Objects in flux: the consumer modification of mass-produced goods. A thesis submitted in fulfilment of the requirements for Doctor of Philosophy, School of Architecture and Design, Design and Social Context Portfolio, RMIT University, Melbourne, Australia. March 2011

Mitchell, V. (2006). Drawing threads from sight to site, *Textile*, vol. 4, no. 3, 340–61

Moline, K. (2012a). The relationship between experimental design and the artistic avant-gardes (1998–2007). PhD Thesis, Submitted to the School of Art History and Art Education, College of Fine Arts, The University of New South Wales.

Moline K. (2012b). Legacy of historical design collectives in contemporary experimental design: a case study of global tools and digestion. In Edquist, H. & Vaughan, L. (Ed.), *The design collective: an approach to practice* (pp. 121–140). Newcastle upon Tyne: Cambridge Scholars Publishing.

Moline, K. (2006). Authorship, entrepreneurialism and experimental design. *The Research Journal of the Australian Graphic Design Association*, 2(2), pp. 57–66.

Moline, K. (2014). Dingo Logic: Feral Experimental and New Design Thinking. Introduction for the exhibition catalogue *Feral Experimental*. Sydney: National Institute for Experimental Arts. Retrieved from <http://www.niea.unsw.edu.au/sites/default/files/Feral%20Experimental%20Exhibition%20Catalogue.pdf>

Monbiot, G. (2012). Guardian Weekly: comment: your gift at Christmas will soon be junk: Every year we splurge on pointless products that trash the planet. Why not just bake a cake or write a poem? *The Guardian*, 11 December. Retrieved from: <http://www.theguardian.com/commentisfree/2012/dec/10/on-12th-day-christmas-present-junk>

Monbiot, G. (2013). My search for a smartphone that is not soaked in blood: Phone companies do too little to ensure the minerals they use are conflict-free. Here's what you can do to hold them to account. *The Guardian*, 12 March. Retrieved from <http://www.theguardian.com/commentisfree/2013/mar/11/search-smartphone-soaked-blood>

Mulk, S. et al. (2015). Impact of Marble Industry Effluents on Water and Sediment Quality of Barandu River in Buner District, Pakistan. In *Environmental Monitoring and Assessment* 187 (2): 4221–228. doi: 10.1007/s10661-014-4221-8

Nakajima, K. (2008). What is critical design? *AXIS* 132, pp. 72–75.

Papadimitriou, D. (2014). The coming tsunami of debt and financial crisis in America: forces that caused the world economy to collapse, including income inequality and debt, are again in action, and could drag corporations down in their wake, *The Guardian*, 16 June. Retrieved from <http://www.theguardian.com/money/2014/jun/15/us-economy-bubble-debt-financial-crisis-corporations>

Patel-Predd, P. (2008). Electronics Industry changes the climate with new greenhouse gas: An effort to be more environmentally friendly when making semiconductors may have real climate-changing consequences, *Scientific American*, 3 November. Retrieved from <http://www.scientificamerican.com/article/electronics-industry-contributes-new-greenhouse-gas/>

Park, S. C. (1984). The repair and thermal upgrading of historic steel windows. *Preservation Brief* 13. Retrieved from <http://www.nps.gov/tps/how-to-preserve/briefs/13-steel-windows.htm>

Palmer, A. R. & Zen, E. (2000). The context of humanity: understanding deep time. In *Critical Issues Committee*. Geological Society of America. Retrieved from <http://bcn.boulder.co.us/basin/local/sustain2.htm>

Parkes, G. (2011). Japanese Aesthetics. *The Stanford Encyclopedia of Philosophy*. Retrieved from <http://plato.stanford.edu/archives/win2011/entries/japanese-aesthetics/>

Petroni, M. (2014). Design for survival. In Sellers, L., Baas, F., Petroni, M., Edelkoort, L., Rawsthorn, A., & Warndorff, J. (Eds.). *Formafantasma* (pp. 13–15). Eindhoven: Lecturis.

Portell, J. D. (2003). Prior Repairs: When Should They Be Preserved? In *Journal of the American Institute for Conservation*, 1 July 2003, Vol.42(2), pp.363-380

Rawsthorn, A. (2008). No. 14: The chair that has seated millions. *New York Times*, 7 November. Retrieved from <http://www.nytimes.com/2008/11/10/arts/10iht-design10.1.17621906.html>

Rawsthorn, A. (2010). The human factor. In Schouwenberg, L., Rawsthorn, A. & Antonelli, P. (Eds.), *Hella Jongerius: Misfit* (p.76). London: Phaidon Press Limited.

Rawsthorn, A. (2012). Defining the emotional cause of affect, *New York Times*, 3 December. Retrieved from http://www.nytimes.com/2012/12/03/arts/design/defining-the-emotional-cause-of-affect.html?_r=0

Reinewald, C. (2004). The ten year itch in Dutch design. In Krol, A., & De Rijk, T. (Eds), *Yearbook Dutch design 03/04*. pp. 30-39. Rotterdam: Episode Publishers.

Rickenberg, R. (2009). Interpretation, collaboration and critique: interview with Anthony Dunne. *The Journal of Design and Management*, 3(1), pp. 22–28. Retrieved from www.dunneandraby.co.uk/content/bydandr/465/o

de Rijk, T. (2010). So-called craft: the formative years of Droog design, 1992–1998. *The Journal of Modern Craft*, 3(2), pp. 161–178.

Roberts T. (2012). From new materialism to machinic assemblage: agency and affect in IKEA. *Environment and Planning*, 44(10), pp. 2512–2529

Rock, M. (2004). Mad Dutch disease: the strange case of Dutch design and other contemporary contagions. In Krol, A., & De Rijk, T. (Eds.), *Yearbook Dutch design 03/04* (pp. 64–80). Rotterdam: Episode Publishers.

Rossi, C. (2013a). Craftica by Formafantasma. *Domus*, 14 February 2013. Retrieved from <http://www.domusweb.it/en/design/2013/02/14/craftica-by-formafantasma.html>

Rossi, C. (2013b). Between nomadic and the impossible. In Coles, A., & Rossi, C. (Eds.), *EP Volume 1/ The Italian Avant-Garde 1968-1976*. Berlin: Sternberg Press.

Simondon, G. (1992). The genesis of the Individual. In Crary, J. & Kwinter, S (Eds.), *Incorporations* (pp.297–319). New York: Zone Books.

Smith, D.W. (1996). Deleuze's theory of sensation: overcoming the Kantian duality. In Patton, P. (Ed.), *Deleuze: a critical reader* (pp. 29–56). Oxford and Cambridge: Blackwell Publishers.

Sommariva, E. (2009). Stop recycling. Start repairing, *Domus*, 31 March. Retrieved from <http://www.domusweb.it/it/notizie/2009/03/31/stop-recycling-start-repairing.html>

Sottsass, E. (1972). Untitled. In Ambasz, E. & Museum of Modern Art (New York, N.Y.).(1972). *Italy: the new domestic landscape; achievements and problems of Italian design*. New York, Distributed by New York Graphic Society, Greenwich, Conn. pp:163-4.

Sparke, P. (1990). A home for everybody?: design, ideology and the culture of the home in Italy, 1945–1972. In Greenhalgh, P. (Ed.), *Modernism in design*. London: Reaktion Books.

- Stewart, N. (1984). The talk of the town: the Young Lions. *The New Yorker*, 9 January, pp. 28–30.
- Stock, A. (2011). The Future of the Stone Industry in Australia. In *Discovery Stone* 20: 46–50.
Retrieved from <http://www.infotile.com/pdfFile/advicetopic/7122011113635.pdf>
- Tan, J. (2014). Prima Materia by Formafantasma. Retrieved from
http://www.design.nl/item/prima_materia_by_formafantasma
- Thrift, N. (2010). Understanding the material practices of glamour. In Gregg, M., & Seigworth, G. J. (Eds.), *The affect theory reader* (pp. 289–308). Durham, NC: Duke University Press.
- Tonkinwise, C. (2011). I (heart) sustainability (because necessity no longer has agency). *Design philosophy papers*, 2.
- Valeur, B., Berberan-Santos, M. N. (2011). A Brief history of fluorescence and phosphorescence before the emergence of quantum theory, *Journal of Chemical Education*, 88 (6), pp. 731–738.
- Vince, G. (2012). The high cost of our throwaway culture. In *BBC*, 29 November 2012, Retrieved from: <http://www.bbc.com/future/story/20121129-the-cost-of-our-throwaway-culture>
- Walrecht, B. (2002). Home made Holland: how craft and design mix. In *Crafts Council*. London: Crafts Council.
- White, C., Odegard, N. (2007). Patterns of adhesive use in prehistoric and modern repairs of southwestern pottery at the Arizona State Museum, *Canadian Conservation Institute* (CCI).Conference - Preserving Aboriginal Heritage: Technical and Traditional Approaches. 24–28 September.
- Williams, G. (2007). Radical thinking and doing. *The Financial Times* (London, England), 8 September, p.10.
- Wylant, B. (2010). Design thinking and the question of modernity. *The Design Journal* 13 (2), pp. 217–231.
- Yee, J. S. R. (2010). Methodological innovation in practice-based design doctorates. *Journal of Research Practice*, 6(2), Retrieved from <http://jrp.icaap.org/index.php/jrp/article/view/196/193>
- Young, J. E., & Ayres, E. (1992). Mining the earth. In Brown, L. R., & Worldwatch Institute. (1992). *State of the world, 1992: A Worldwatch Institute report on progress toward a sustainable society*. New York: Norton.

Online Resources (websites and other online sources)

Dunne, A., & Raby, F. (2014a). Critical Design FAQ, Dunne & Raby website. Retrieved from <http://www.dunneandraby.co.uk/content/bydandr/13/o>

Dunne, A., & Raby, F. (2014b). Is This Your Future? 2004, Dunne & Raby website. Retrieved from <http://www.dunneandraby.co.uk/content/projects/512/o>

Fairs, M. (2007). Dutch Design Ready to Go. Retrieved from http://www.design.nl/tokyo/uk/holland_dutchdesign.html

Farresin, S., & Trimarchi, A. (2012). Formafantasma website. Retrieved from <http://www.formafantasma.com/>

Fairs, M., Farresin, S., & Trimarchi, A. (2012). Peroni Collaborazioni Talk with Formafantasma part 1 and 2 (transcripts). June 2012. Retrieved from <http://www.dezeen.com/2012/06/19/movie-peroni-collaborazioni-talk-with-formafantasma-part-1/>
& <http://www.dezeen.com/2012/06/20/movie-peroni-collaborazioni-talk-with-formafantasma-part-2/>

Foresman, C. (2011). Apple “screwing” new iPhones out of simple DIY repair: Apple is purposefully making it harder to get inside its devices buy using ... *ARS Technica*, 21 January. Retrieved from <http://arstechnica.com/apple/2011/01/apple-screwing-new-iphones-out-of-simple-diy-repair/>

Hendriks, A. & Schmidt, M. (2010). Platform21: Stop Recycling. Start Repairing. Exhibiton at Ars Electronica, 2nd to 7th June, 2010 (Curators).

Idea Magazine (2014). Progetto e Passione, Enzo Mari / Proposta per unautoprogettazione / 1973 / for Galleria Milano, ideamagazine.net via circondaria 56/1 50127 firenze – italy. Retrieved from http://www.ideamagazine.net/it/progetto_design/enzo_mari_progetto_e_passione/20jv.htm

Jasper, D. (2007). Products of our time at the Goldstein Museum of Design. Retrieved from <http://goldstein.design.umn.edu/exhibitions/previous/Products.html>

Jongeriuslab (2014). *Soft Urn*. Retrieved from <http://www.jongeriuslab.com/work/soft-urn>

Kircheis, F. (2014). History shows mining’s consequences: Rules to protect Maine’s environment are insufficient, Special to the BDN, *Bangor Daily News*, 26 March. Retrieved from

<http://bangordailynews.com/2014/03/26/opinion/contributors/history-shows-minings-consequences-rules-to-protect-maines-environment-are-insufficient/>

Reed, C. (unknown). Pueblo Pottery Restoration; Conservation of The Past, Material Insight Ceramic and Pottery Restoration. Retrieved from <http://www.material-insight.com/PuebloPotteryRestoration.htm>

VanHemert, K. (2011). Apple's making it impossible to open up your iphone by secretly swapping its screws, *Gizmodo*, 20 February. Retrieved from <http://gizmodo.com/5738887/apples-new-screws-make-it-impossible-to-open-up-your-iphone>

Films, television and video media

Colbert., S., & Thwaites, T. (2011). Designer Thomas Thwaites explains the process of building a toaster from scratch and shares his final product. *The Colbert Report*, 4 November. Retrieved from <http://www.colbertnation.com/the-colbert-report-videos/402225/november-14-2011/thomas-thwaites>

Hustwit, G., Beshenkovsky, J., Geissbuhler, L., & Dunn, K. (2009). *Objectified* [DVD video]. London: Swiss Dots Limited.

Lynn, G. (2004). The Future of Architecture and Philosophy. Lecture at the European Graduate School, January 11. Retrieved from http://www.youtube.com/watch?v=1u_IEgjmIZs

Seymour, R. (2011). *How beauty feels* [Transcript], TEDSalon, London, May. Retrieved from https://www.ted.com/talks/richard_seymour_how_beauty_feels/transcript?language=en

Thwaites, T. (2010). *Thomas Thwaites: How I built a toaster – from scratch* [Video file], TEDSalon, November. Retrieved from http://www.ted.com/talks/thomas_thwaites_how_i_built_a_toaster_from_scratch.html

Boutang, P.A., Deleuze, G., & Parnet, C. (2011). *Labécédaire de Gille Deleuze avec Claire Parnet*. Los Angeles, CA, Semiotext(e).

Doick, S. (2009). Thonet Nr. 14 Chair, 1859. *Design Icons* (01). Report by Stephen Doick. Produced by: Deutsche Welle / euromaxx.

Exhibitions

Beumer, G. and Smits, L. (2009). We Were Exuberant and Still Had Hope Ettore Sottsass: works from Stockholm, 1969, Notes: Guy Keulemans, Cristina Ricupero and Paul Elliman. At the Marres Centre for Contemporary Culture, Maastricht, The Netherlands. Catalogue: http://old.marres.org/downloads/persbericht_sottsass_EN.pdf

Hardiman, D. and Henty, S. (2014). Object Future II. Melbourne, Australia, June & July.

Keulemans, G., & Wilson, H. (2011). Archaeologic. At Studio One, Redfern, Australia. July 30 to Aug 14

Nicol, R. (2013b). Domestic Renewal: Jam Factory. At *Jam Factory Gallery*, Adelaide, Australia. Oct. to Dec. Catalogue: http://jamfactory.com.au/admin/cms-jamfactory/_images/6041307915257a0ef1e027.pdf

Nicol, R. (2013a). Domestic Renewal: Craft Cubed Festival. At *Craft Victoria*, Melbourne, Australia. Aug. 2013

Nicol, R. (2012). Domestic Renewal; a table re:set. At *Craft ACT: Craft and Design Centre*, Canberra, Australia, Nov. to Dec. 2012. Catalogue: http://jamfactory.com.au/admin/cms-jamfactory/_images/2071108187525dc7a671c16.pdf

Simpson, A. (2013). Interpretations III: Stone. At *Object Australian Design Centre*, Sydney, Australia, Feb. to Mar. 2013

Temple & Webster (2014). Temple and Webster's Emerging Design Award Nominees exhibition. At *The School*, Sydney, Australia, May.

List of Illustrations

Figure 1–8.....	174
Broken Apple iPhones, photographed by Guy Keulemans (2012-14).	
Top and middle rows: university student iPhones, bottom row: broken casings decorate a mobile phone repair shop in Adelaide, Australia.	
Figure 9.....	175
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 10.....	176
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 11.....	177
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 12.....	178
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 13.....	179
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 14.....	180
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 15.....	181
Guy Keulemans, Marble and Steel Room Divider (2013). Photograph by Guy Keulemans.	
Figure 16.....	182
Screenshots from Marble and Steel Room Divider, Video (2013) (single-channel video, stereo audio). (3:06), a video of found and original footage mapping out the relational field of commercial marble production. Videography, design and art direction by Guy Keulemans, videography and editing by Neil Harvey. Video can be seen at: http://vimeo.com/user4072939	
Figures 17–18	183
Guy Keulemans, Archaeologic 1, small bowl (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	
Figures 19–20	184
Guy Keulemans, Archaeologic 1, vase (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	

Figures 21–22	185
Guy Keulemans, <i>Archaeologic 1</i> , large plate (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	
Figure 23	186
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (2012). Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	
Figures 24–25.....	187
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (2012).	
Top: repaired with tin, bottom: repaired with epoxy resin. Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	
Figure 26.....	188
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (2012). The scoops as they appear straight out of the mould, prior to repair. Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.	
Figure 27.....	189
Michael Thonet, No. 14 chair (1859).	
Figures 28–29.....	190
Formafantasma, <i>Botanica</i> (2011). Curated by Marco Petroni. Photo: Luisa Zanzani. From Sellers et. al. (2014)	
Figures 30–31.....	191
Formafantasma, <i>Botanica</i> (2011). Curated by Marco Petroni. Photo: Luisa Zanzani. From Sellers et. al. (2014)	
Figures 32–33.....	192
Thomas Thwaites, <i>The Toaster Project</i> (2011) Top: plastic casing on, bottom: plastic casing off (Thwaites, 2011).	
Figures 34–35.....	193
Thomas Thwaites, <i>The Toaster Project</i> (2011). Top: disassembled industrially-made toaster, bottom: copper extraction from waste water by electrolysis (Thwaites, 2011)	
Figures 36–37.....	194
Thomas Thwaites, <i>The Toaster Project</i> (2011). Top: smelting iron using a microwave, bottom: shroud moulding (Thwaites, 2011).	
Figures. 38–41.....	195
Archizoom, <i>No-Stop City</i> (1969). Retrieved from http://architizer.com/blog/archizoom-retrospective/	
Figures. 42–45.....	196
Ettore Sottsass, <i>Superboxes</i> (c.1966). Retrieved from http://guykeulemans.com/2009/03/ettore-sottsass-rational-irrational.html	

Figures 46–47.....	197
Ettore Sottsass, untitled (or Ambiente Sperimentale) (1972) from Bosoni (2006).	
Figures 48–49.....	198
Superstudio, The Continuous Monument (1969). From Ambasz (1972).	
Figure 50.....	199
Superstudio, the Misura series (1970). Retrieved from http://www.domusweb.it/en/from-the-archive/2011/07/21/-superstudio-misura-series.html	
Figure 51.....	199
Superstudio, Quaderna table from the Misura series (1970). Retrieved from http://www.icollector.com/Superstudio-Misura-M-desk_i8644491	
Figures 52–53.....	200
Paolo Lomazzi, Donato D'Urbino and Jonathan De Pas, Blow chair (1967). Retrieved from http://www.kensa-creative.com/blog/inspired-by-the-blow-chair/	
Figure 54.....	201
Enzo Mari, Proposta per un'autoprogettazione (1974) (Idea Magazine, 2014).	
Figure 55.....	201
Cover of Casabella by Alessandro Mendini, April 1975 (400th issue) (Grima et al., 2013).	
Figure 56.....	202
Partito socialista italiano grafica [Italian Socialist Party graphic] by Ettore Vitale (1973). Retrieved from http://www.csmovimenti.org/it/festa-grande-daprile/	
Figure 57.....	203
Tejo Remy, 'Ladenkast' or Chest of Drawers by Tejo Remy (1991). Retrieved from http://www.detnk.com/node/3489	
Figure 58.....	204
Hella Jongerius, Soft Urn (1994) (Jongeriuslab, 2014).	
Figure 59.....	204
Hella Jongerius, Soft Urn (1994). Retrieved from http://www.mydesignlife.tv/images/rotator/soft-urn.jpg	
Figure 60	205
Hella Jongerius, B-set (stacked plates) by (1997). Retrieved from http://www.jongeriuslab.com/work/b-set	
Figure 61–62.....	206
Hella Jongerius, Nymphenburg Sketches – Animal Bowls by (2004). Retrieved from http://www.jongeriuslab.com/work/nymphenburg-sketches-animal-bowls	

Figures 63-65.....	207
Dunne and Raby, Blood/Meat Energy Future from “Is This Your Future” (2004). Retrieved from http://www.dunneandraby.co.uk/content/projects/512/o	
Figure 66.....	208
Anatomy of a Thonet No. 14 chair at the MAC in Vienna. Retrieved from http://iveseenthat.tumblr.com/post/58943012822/anatomy-of-a-thonet-chair-at-the-mac-in-vienna	
Figure 67.....	208
Michael Thonet, No. 14 chair (demonstration of the chair packed for shipping) , Thonet (1859) (Vegesack, 1997).	
Figures 68–69.....	209
Thonet factory in Bistritz c. 1920 (Vegesack, 1996: 70).	
Figure 70	210
Martino Gamper Conran Collection (2008) modified Thonet chairs. Retrieved from http://www.designboom.com/design/conran-inspirations-by-martino-gamper/	
Figure 71.....	210
Technical drawing from one of Thonet's patent applications (n.d.). Retrieved from http://objectguerilla.com/blog/2014/5/12/michael-thonet-gamper/	
Figure 72.....	211
214k chair (2009). Adapted by the Thonet company in 2009 (credited to Michael Thonet). Retrieved from http://www.showhome.nl/nieuwsitem/design-in-de-knoop/	
Figure 73.....	211
Steam bent wood sample, Thonet Catalogue (2014). Photo: Mirko Krizanovic. Retrieved from http://en.thonet.de/	
Figure 74.....	211
M/M Paris, Thoumieux Chair (2011) (King, 2013: 427).	
Figure 75.....	212
Pablo Reinoso, TH 24, Série Thoneteando, (2007). Photo Credit: Estudio Cavallero. Retrieved from http://www.pabloreinoso.com/en/Art-9-thoneteando.html	
Figure 76.....	213
French Thonet chair labels advising the occasional re-tightening of screws. Retrieved from http://www.aubonusage.com/signaturesetiquette/index-en.html	
Figure 77.....	214
Clyde Beatty (c. 1930s) from Harvard Library, President and Fellows of Harvard College.	
Figures 78-79.....	214
Pat English (1940). Photos by John Phillips for Time Life Pictures. Retrieved from http://www.gettyimages.co.uk/	

Figure 80.....	215
Clyde Beatty and Pat English (1940), photo by John Phillips for Time Life Pictures. Retrieved from http://www.gettyimages.co.uk/	
Figures 81–82.....	216
Thonet Factory at Bistritz. Top: 1890, bottom: 1911 (Vegesack et al., 1996).	
Figures 83–84.....	217
Formafantasma, Craftica (2012). Photos by Luisa Zanzani. Retrieved from http://www.formafantasma.com/craftica	
Figures 85–88.....	218
Formafantasma, Craftica (2012). Photos by Luisa Zanzani. Retrieved from http://www.formafantasma.com/craftica	
Figures 89.....	219
Guy Keulemans, <i>Marble and Steel Room Divider</i> (2013), with simulated domestic installation into floorboards. Photograph by Dean McCartney. Art direction by Guy Keulemans and Dean McCartney.	
Figure 90.....	220
Guy Keulemans, <i>Marble and Steel Room Divider</i> (2013), with hazard striped feet for exhibition presentation. Photograph by Dean McCartney. Art direction by Guy Keulemans and Dean McCartney.	
Figures 91–93.....	221
Guy Keulemans, development drawings for <i>Marble and Steel Room Divider</i> (2013).	
Figure 94.....	222
Tea bowl by unknown Raku-ware workshop, c.nineteenth century, Dosai, Edo period. Raku-type clay with Black Raku glaze; gold lacquer repairs. Courtesy of the Freer+Sackler Galleries, Freer Gallery of Art.	
Figure 95.....	223
Unknown, Tea bowl (chawan), c. 16th century. Korean Karatsu-ware, repaired with a Japanese pattern using kintsugi lacquer technique (Herbert F. Johnson Museum of Art and Museum Für Lackkunst, 2008).	
Figure 96.....	224
“The owner of a ceramic shop checks his damaged wares following the massive 8.9- magnitude earthquake in Tokyo.” 11 March 2011. Source: AAP. Retrieved from http://www.sbs.com.au/news/article/1498702/Earthquake-largest-ever-to-hit-Japan	
Figure 97.....	224
Twitpic user: @jefferrson, A crack in the earth in Japan, 14 March 2011 (2011). Retrieved from http://twitpic.com/48e39x	
Figure 98.....	225

“Cracks are seen on the snow-covered ground in woodlands near the earthquake and tsunami-devastated town of Sendai, March 12, 2011.” Photo by Reuters/Jo Yong-Hak (2011).	
Figure 99.....	225
“A father and son walk alongside sidewalk cracks—the aftermath of a 6.5-magnitude earthquake at Yaizu port in Japan.” 11 August 2009. Photo by Itsuo Inouye/AP (2009).	
Figures 100–101.....	226
Guy Keulemans, <i>Archaeologic 2</i> (2011). Production by Guy Keulemans and Henry Wilson. Photos and art direction by Guy Keulemans.	
Figure 102.....	227
“Phosphorescent paint pigment (lume) applied on a Citizen Promaster Eco-Drive BJ8050-08E Diver's 300 m (tool watch suitable for mixed breathing gas diving) to make it readable in low light conditions, 26 April” (2008). Author: Francis Flinch. Retrieved from http://commons.wikimedia.org/wiki/File:Luminescent_paint_pigment_applied_on_a_dive_r%E2%80%99s_watch_to_make_it_readable_in_low_light_conditions.jpg	
Figure 103.....	227
“A wholemount human retina triple labelled with fluorescent antibodies that stain blood vessels (blue), astrocytes (red) and microglia (green). Specimen imaged on a Zeiss 710 Confocal Microscope and is merged from 46 optical Z sections.” September 28, (2012)	
Figure 104.....	228
“Out of the blue: Melbourne forensic biologist Steven Fowler and a trail of blood made visible with the use of the reagent luminol. This demonstration was done using pig's blood.” Photo: Craig Sillitoe, <i>The Age</i> , 9 July (2006).	
Figure 105.....	229
Advertisement for Undark radium paint, <i>The Literary Digest</i> , November (1920). Retrieved from http://www.roger-russell.com/radioactive/radioactive.htm	
Figure 106.....	230
Screenshot of a web advertisement for a Do-It-Yourself kintsugi kit ready for export from Japan (2014), Mejiro Co., Ltd. Screenshot taken 28 July 2014 from: http://www.mejiro-japan.com/en/product/kintsugi-repair-kit-low-allergenic-urushi	
Figure 107.....	231
Sherman L. Kelly's patent drawings of the ice cream scoop (1935). US Patent Office.	
Figure 108.....	232
Zeroll icecream scoop (2014) sold by Williams Sonoma. Retrieved from http://www.williams-sonoma.com.au/zeroll-ice-cream-scoop	

Figure 109.....	232
A collection of Zeroll scoops, and Zeroll-type scoops from other manufacturers, dating from various times. Photography by Guy Keulemans (2012). For more information please see http://guykeulemans.com/2012/09/ice-cream-scoops.html	
Figure 110.....	233
Guy Keulemans, raw casts of the Copper Ice Cream Scoops prior to repair.	
Figure 111.....	233
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (2012) during repair production: removal from a second mould after filling and coating with epoxy resin.	
Figure 112–113.....	234
Guy Keulemans, drawings for exhibition display stands for the <i>Copper Ice Cream Scoops</i> (2014).	
Figure 114–115.....	235
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (2012) exhibited at Object Future, Melbourne, curated by Dale Hardiman & Suzannah Henty, June & July, 2014	
Figure 116.....	236
“Open-pit copper mine outside Bisbee, AZ. Scale, tremendous. Environmental impact, off the chart.” Mike St. Jean (2012). 5 March 5 2012, Bisbee, Arizona, US. Retrieved from https://secure.flickr.com/photos/stjeanm/6986243895/	
Figure 117.....	236
“A vulcaniser monitors our daily “anode pour”, where molten copper is cast into 750 kilogram copper anode blocks.” (n.d.) Photo: Mount Isa Mines. Retrieved from http://www.mountisamines.com.au/EN/Media/Pages/Gallery.aspx	
Figure 118.....	237
“Molten copper is poured at the KGHM copper and precious metals smelter processing plant in Glogow.” 10 May (2013). REUTERS/Peter Andrews. Retrieved from http://www.theglobeandmail.com/report-on-business/international-business/european-business/molten-metal-pouring-bars-of-silver-at-polands-glogow-smelter/article11946869/	
Figure 119.....	238
Guy Keulemans, <i>Copper Ice Cream Scoops</i> (retouched) (2012). Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney. Photographic retouching by a Clipping Path Asia Co. Thailand.	
Figure 120.....	238
Image extracted from promotional material for Clipping Path Asia Co. Thailand (2012). Retrieved from http://www.clipping-path-asia.com/	

Illustrations

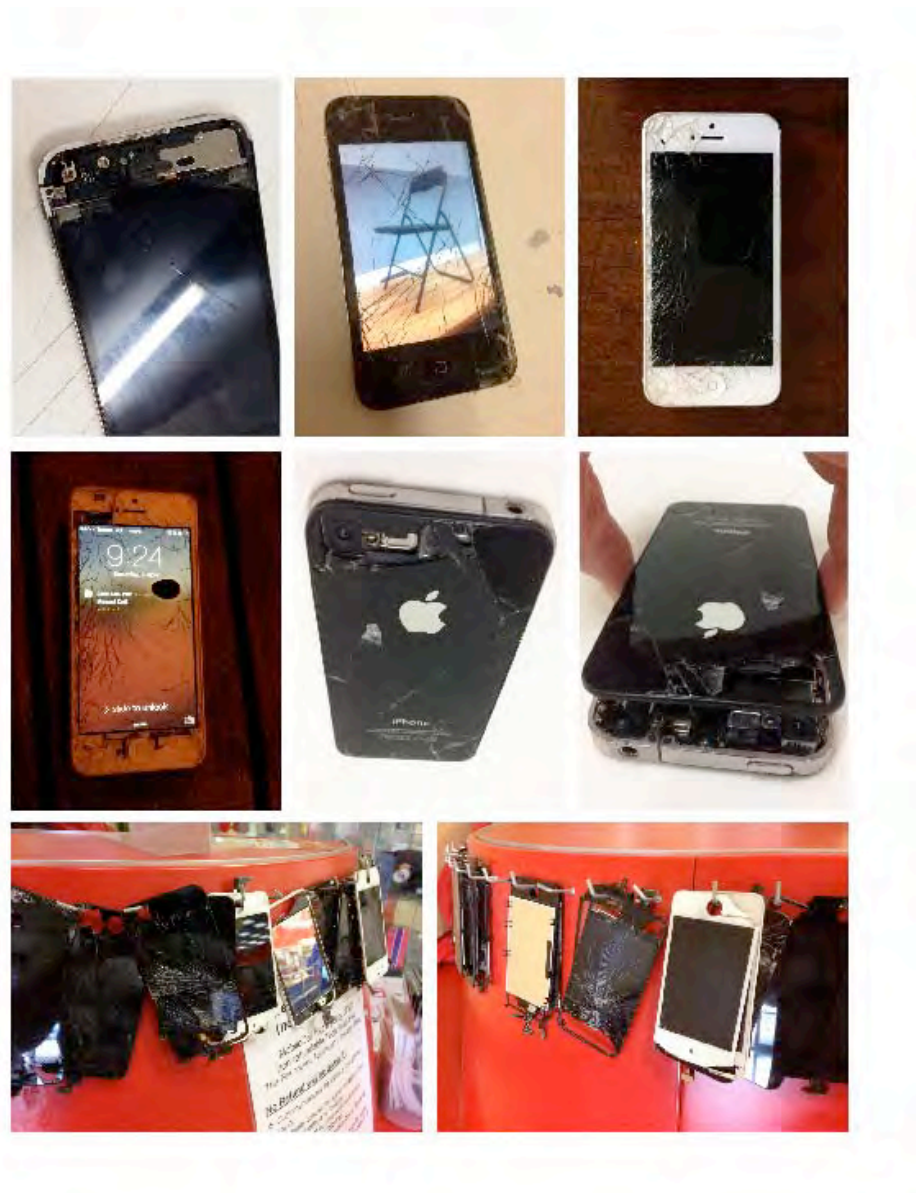


Figure 1–8

Broken Apple iPhones, photographed by Guy Keulemans (2012-14).

Top and middle rows: university student iPhones, bottom row: broken casings decorate a mobile phone repair shop in Adelaide, Australia.



Figure 9

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.



Figure 10

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.



Figure 11

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.



Figure 12

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.

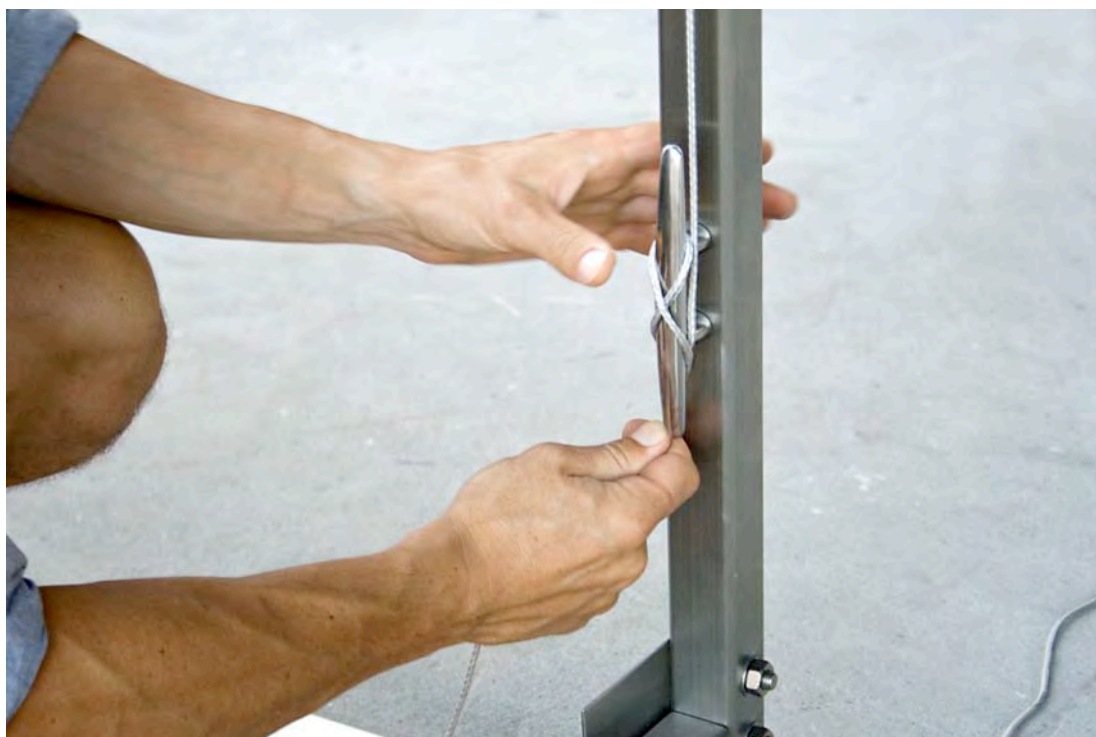


Figure 13

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.



Figure 14

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.



Figure 15

Guy Keulemans, *Marble and Steel Room Divider* (2013). Photograph by Guy Keulemans.

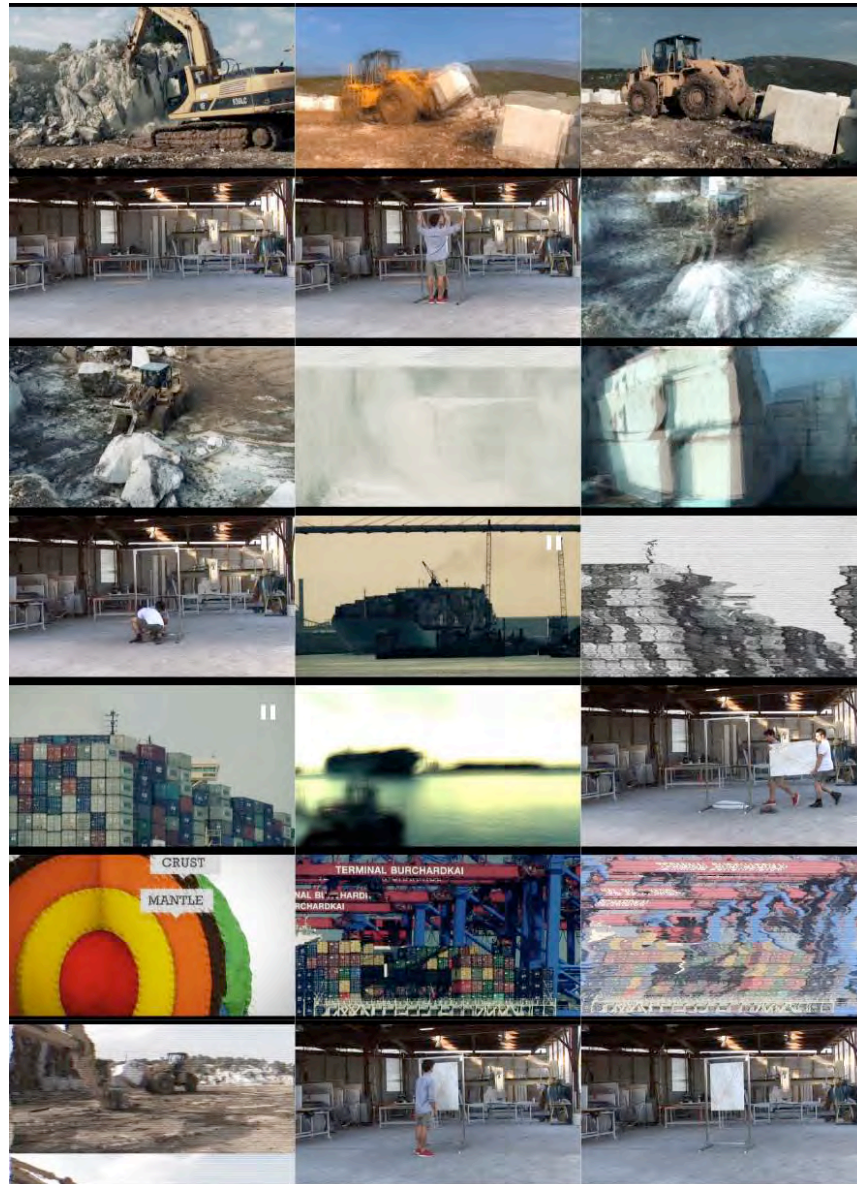
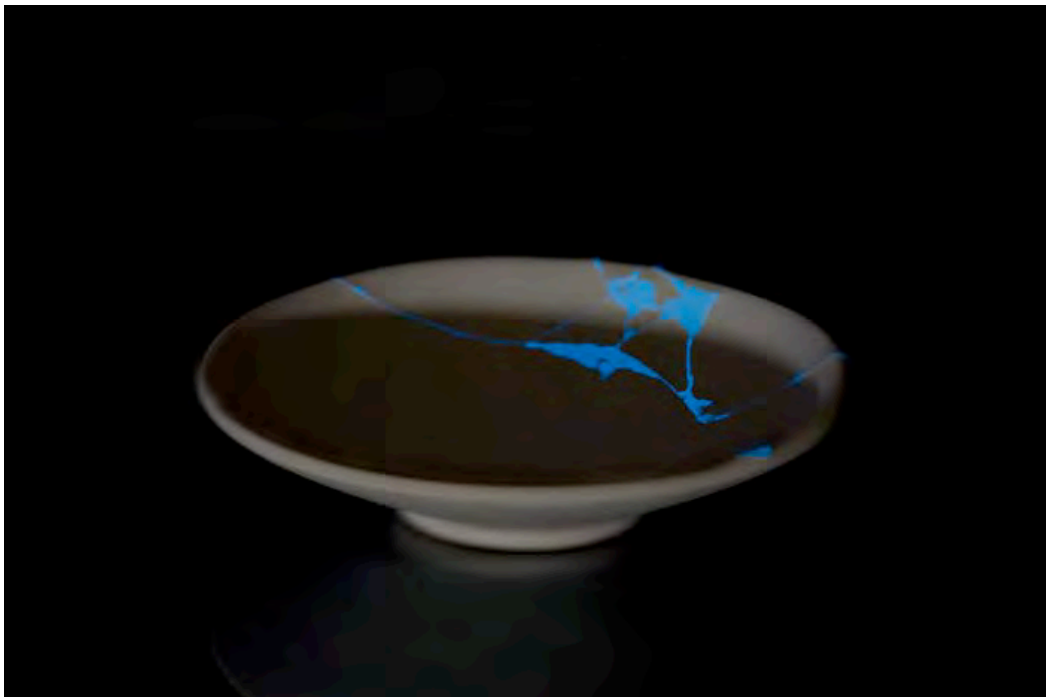


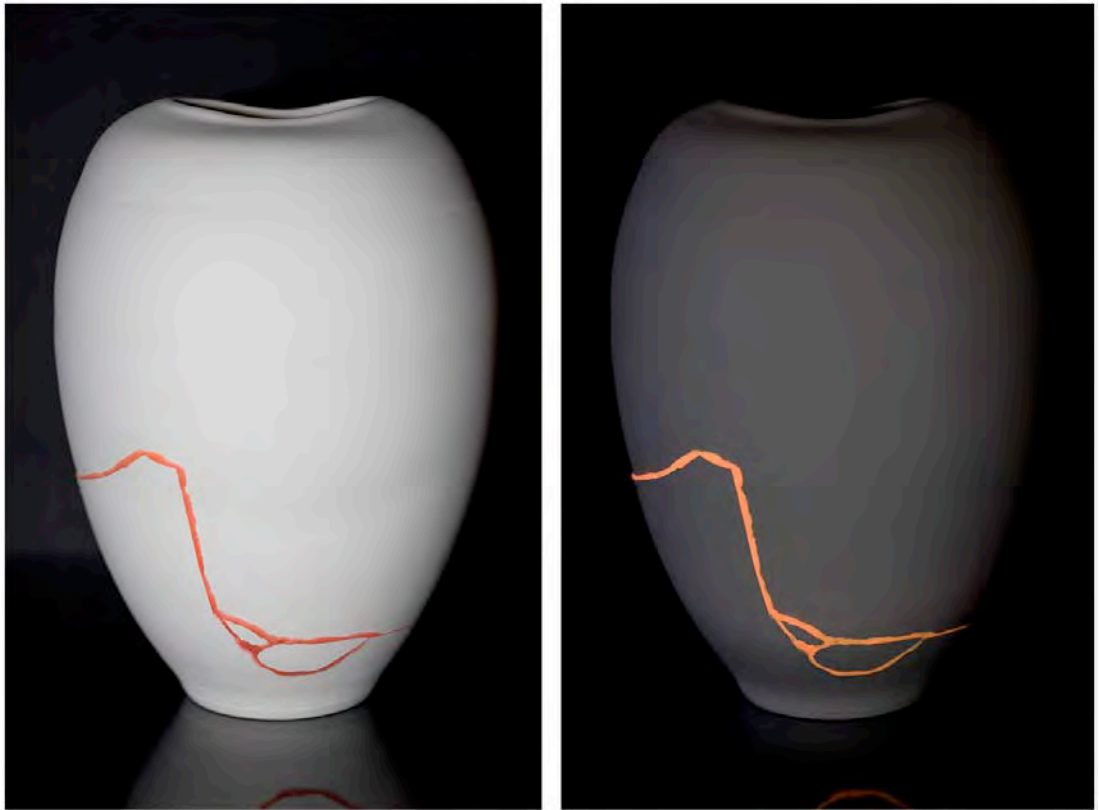
Figure 16

Screenshots from *Marble and Steel Room Divider, Video* (2013) (single-channel video, stereo audio). (3:06), a video of found and original footage mapping out the relational field of commercial marble production. Videography, design and art direction by Guy Keulemans, videography and editing by Neil Harvey. Video can be seen at: <http://vimeo.com/user4072939>



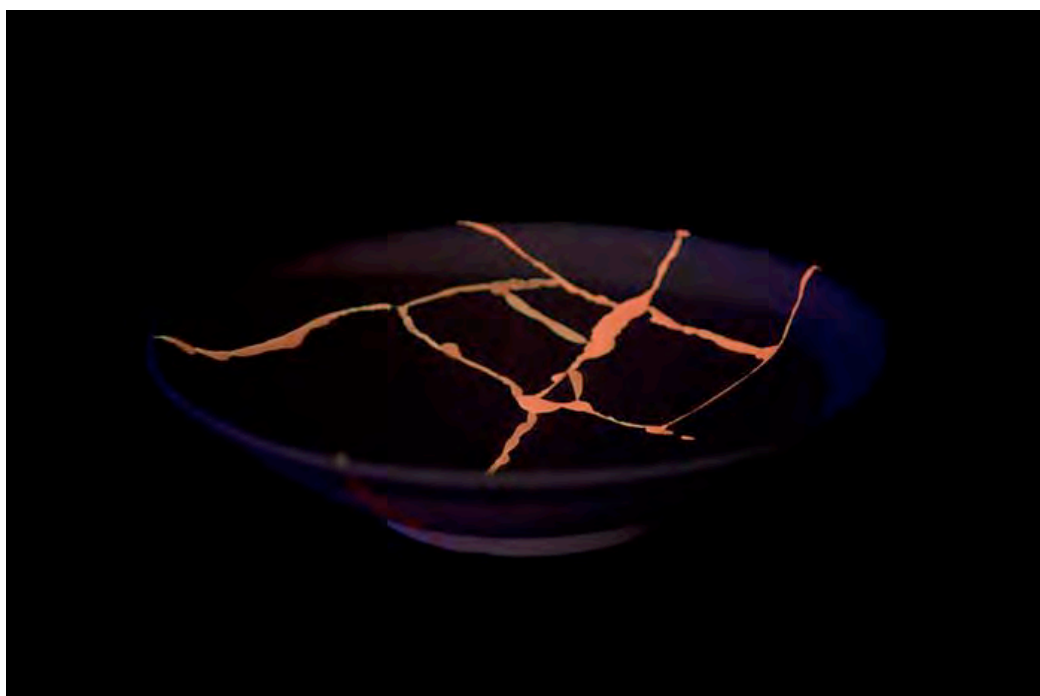
Figures 17–18

Guy Keulemans, *Archaeologic 1, small bowl* (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.



Figures 19–20

Guy Keulemans, *Archaeologic 1, vase* (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.



Figures 21–22

Guy Keulemans, *Archaeologic 1, large plate* (2011). Photos by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.

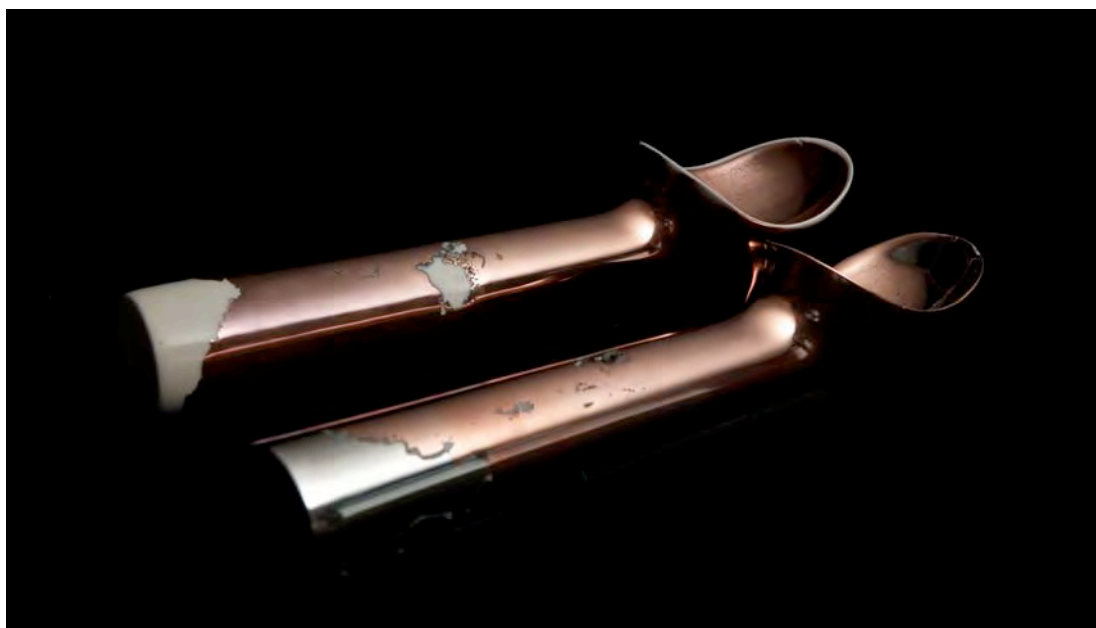
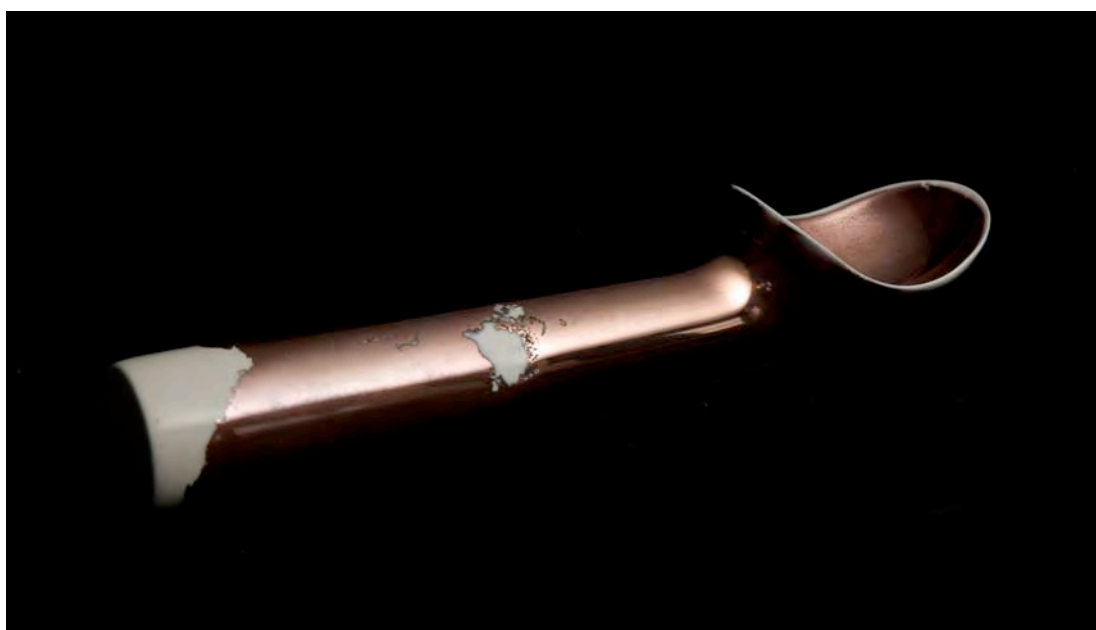
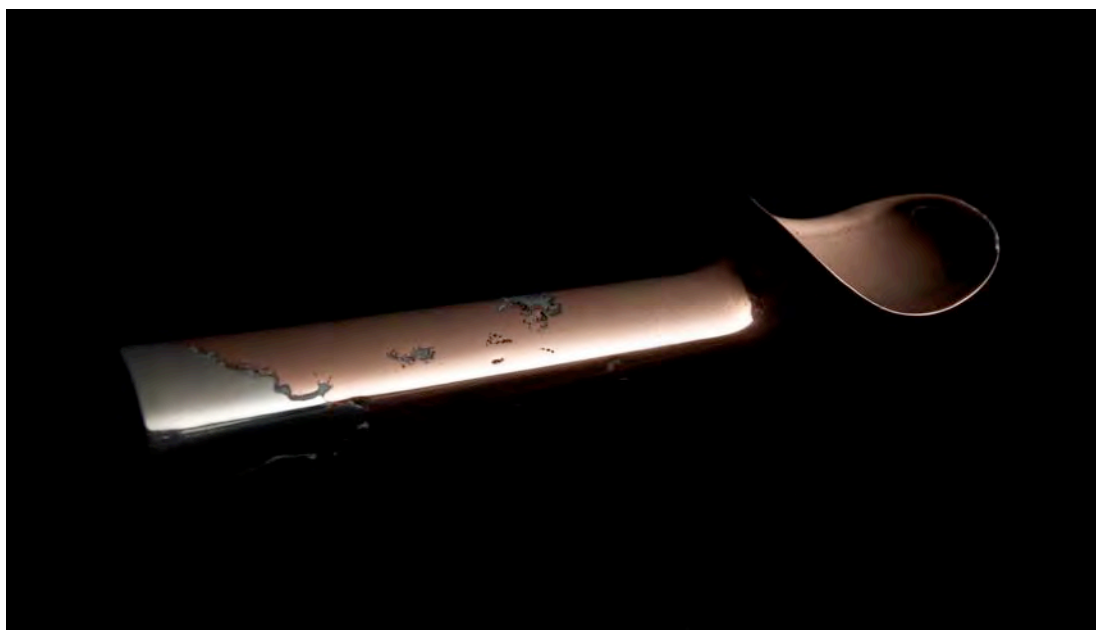


Figure 23

Guy Keulemans, *Copper Ice Cream Scoops* (2012). Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.



Figures 24–25

Guy Keulemans, *Copper Ice Cream Scoops* (2012).

Top: repaired with tin, bottom: repaired with epoxy resin. Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.



Figure 26

Guy Keulemans, *Copper Ice Cream Scoops* (2012). The scoops as they appear straight out of the mould, prior to repair. Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney.



Figure 27
Michael Thonet, *No. 14* chair (1859).



Figures 28–29

Formafantasma, *Botanica* (2011). Curated by Marco Petroni. Photo: Luisa Zanzani. From Sellers et. al. (2014)



Figures 30–31

Formafantasma, *Botanica* (2011). Curated by Marco Petroni. Photo: Luisa Zanzani. From Sellers et. al. (2014)



Figures 32–33

Thomas Thwaites, *The Toaster Project* (2011) Top: plastic casing on, bottom: plastic casing off (Thwaites, 2011).



Figures 34–35

Thomas Thwaites, *The Toaster Project* (2011). Top: disassembled industrially-made toaster, bottom: copper extraction from waste water by electrolysis (Thwaites, 2011)



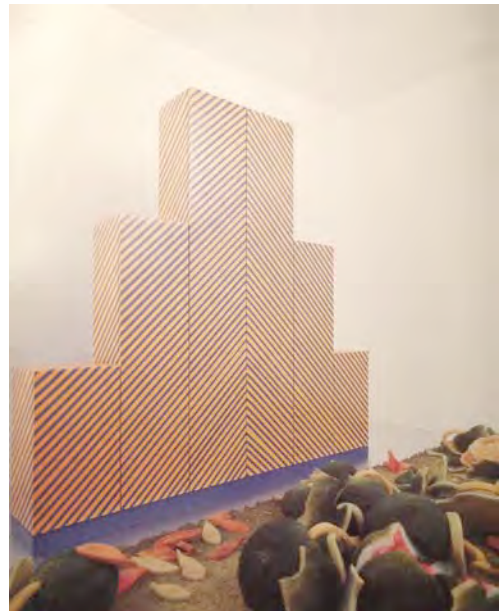
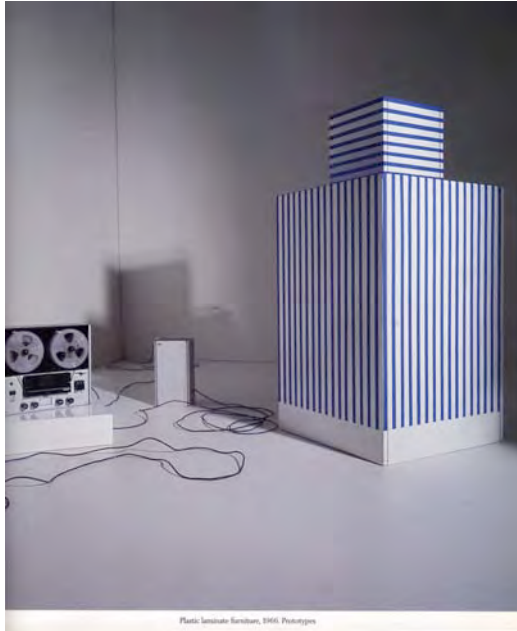
Figures 36–37

Thomas Thwaites, *The Toaster Project* (2011). Top: smelting iron using a microwave, bottom: shroud moulding (Thwaites, 2011).



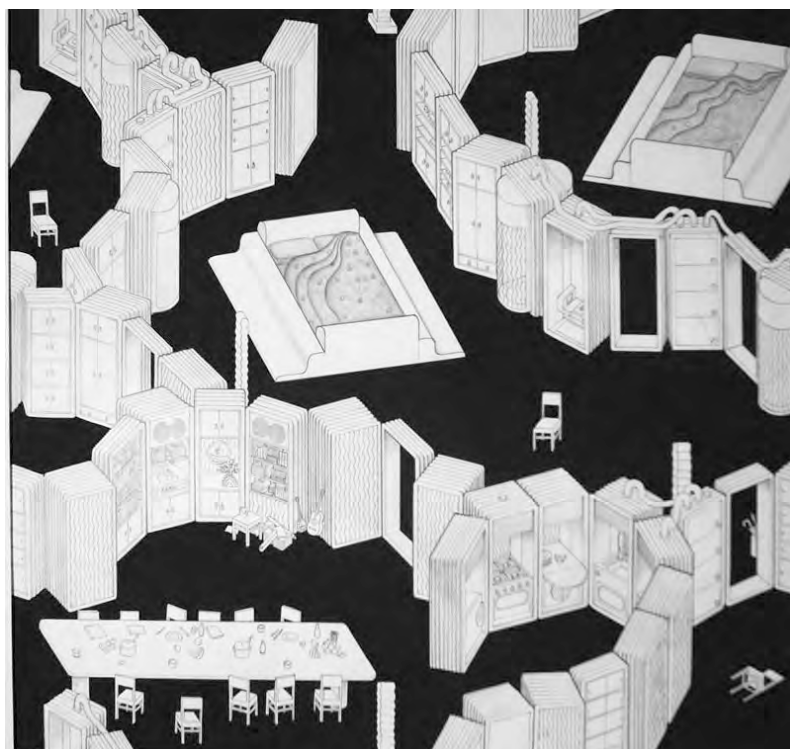
Figures. 38–41

Archizoom, *No-Stop City* (1969). Retrieved from <http://architizer.com/blog/archizoom-retrospective/>



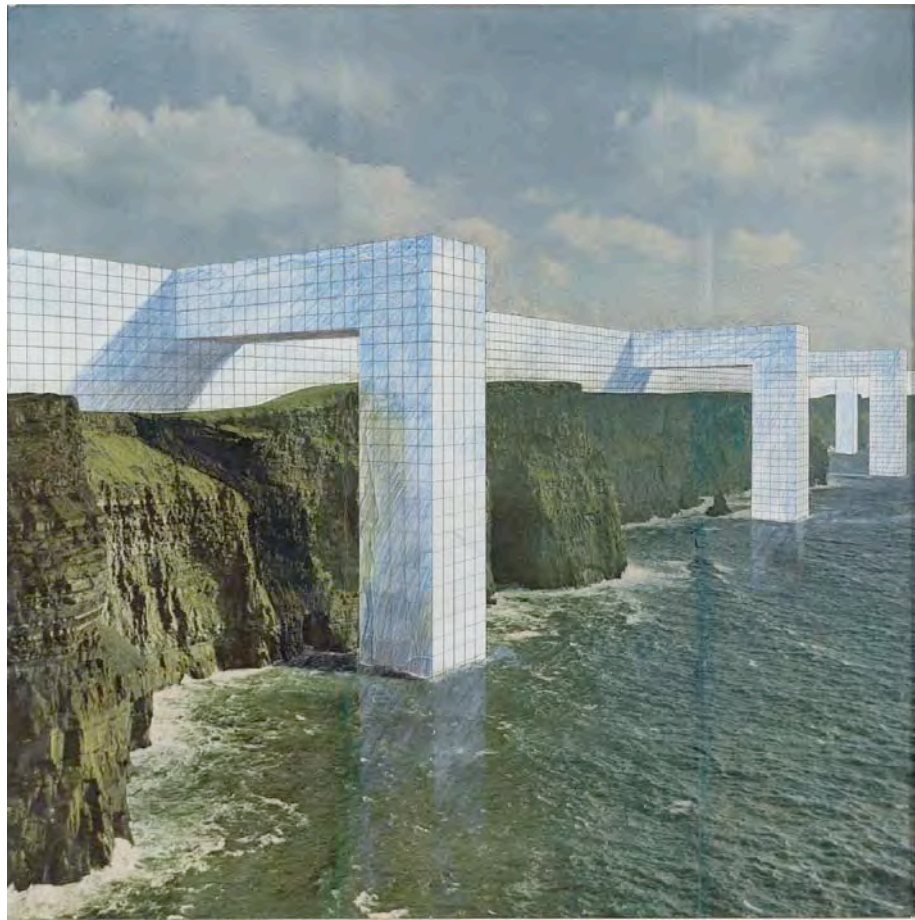
Figures 42–45

Ettore Sottsass, *Superboxes* (c.1966). Retrieved from <http://guykeulemans.com/2009/03/ettore-sottsass-rational-irrational.html>



Figures 46–47

Ettore Sottsass, untitled (or *Ambiente Sperimentale*) (1972) from Bosoni (2006).



Figures 48–49

Superstudio, *The Continuous Monument* (1969). From Ambasz (1972).

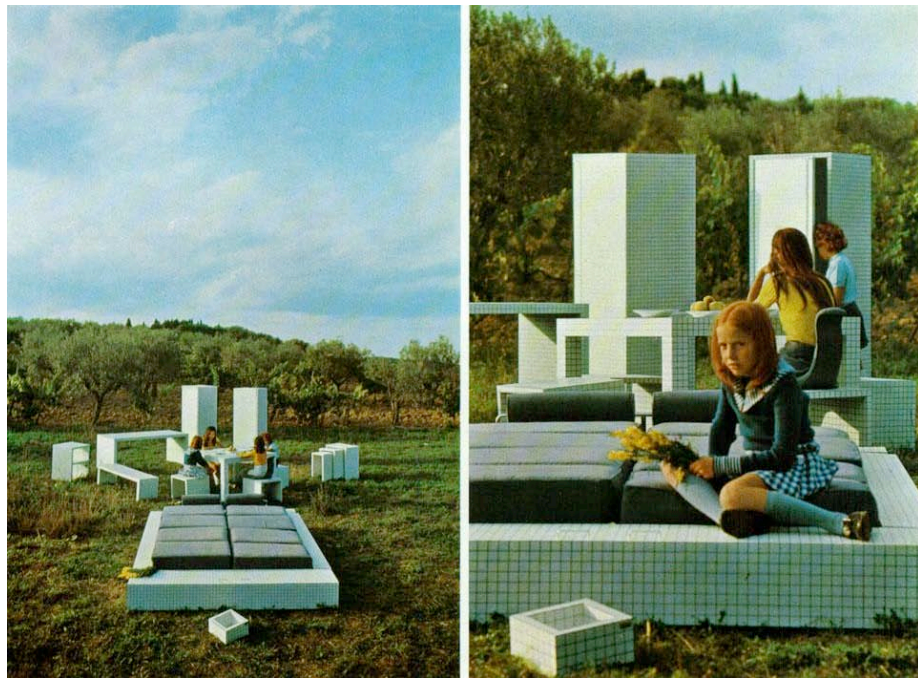


Figure 50

Superstudio, the *Misura* series (1970). Retrieved from <http://www.domusweb.it/en/from-the-archive/2011/07/21/-superstudio-misura-series.html>



Figure 51

Superstudio, *Quaderna* table from the *Misura* series (1970). Retrieved from http://www.icollector.com/Superstudio-Misura-M-desk_i8644491



Figures 52–53

Paolo Lomazzi, Donato D'Urbino and Jonathan De Pas, *Blow chair* (1967). Retrieved from <http://www.kensa-creative.com/blog/inspired-by-the-blow-chair/>



Figure 54

Enzo Mari, *Proposta per un'autoprogettazione* (1974) (Idea Magazine, 2014).



Figure 55

Cover of *Casabella* by Alessandro Mendini., April 1975 (400th issue) (Grima et al., 2013).



Figure 56

Partito socialista italiano grafica [Italian Socialist Party graphic] by Ettore Vitale (1973). Retrieved from <http://www.csmovimenti.org/it/festa-grande-daprile/>



Figure 57

Tejo Remy, '*Ladenkast*' or *Chest of Drawers* by Tejo Remy (1991). Retrieved from <http://www.detnk.com/node/3489>



Figure 58
Hella Jongerius, *Soft Urn* (1994) (Jongeriuslab, 2014).



Figure 59
Hella Jongerius, *Soft Urn* (1994). Retrieved from <http://www.mydesignlife.tv/images/rotator/soft-urn.jpg>



Figure 6o

Hella Jongerius, *B-set (stacked plates)* by (1997). Retrieved from <http://www.jongeriuslab.com/work/b-set>



Figure 61–62

Hella Jongerius, *Nymphenburg Sketches – Animal Bowls* by (2004). Retrieved from <http://www.jongeriuslab.com/work/nymphenburg-sketches-animal-bowls>



Figures 63-65

Dunne and Raby, *Blood/Meat Energy Future* from "Is This Your Future" (2004). Retrieved from <http://www.dunneandraby.co.uk/content/projects/512/0>



Figure 66

Anatomy of a *Thonet No. 14* chair at the MAC in Vienna. Retrieved from <http://iveseenthat.tumblr.com/post/58943012822/anatomy-of-a-thonet-chair-at-the-mac-in-vienna>

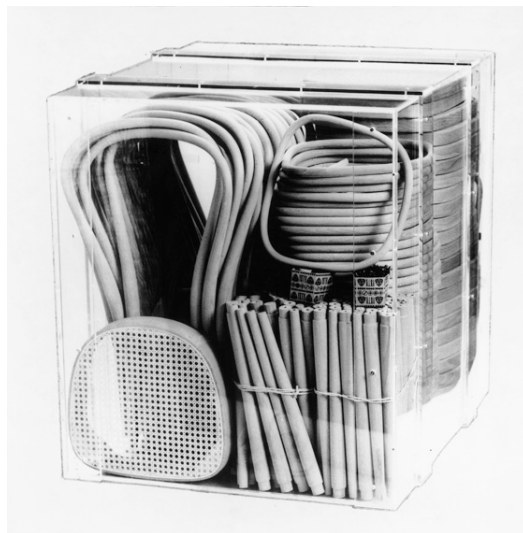
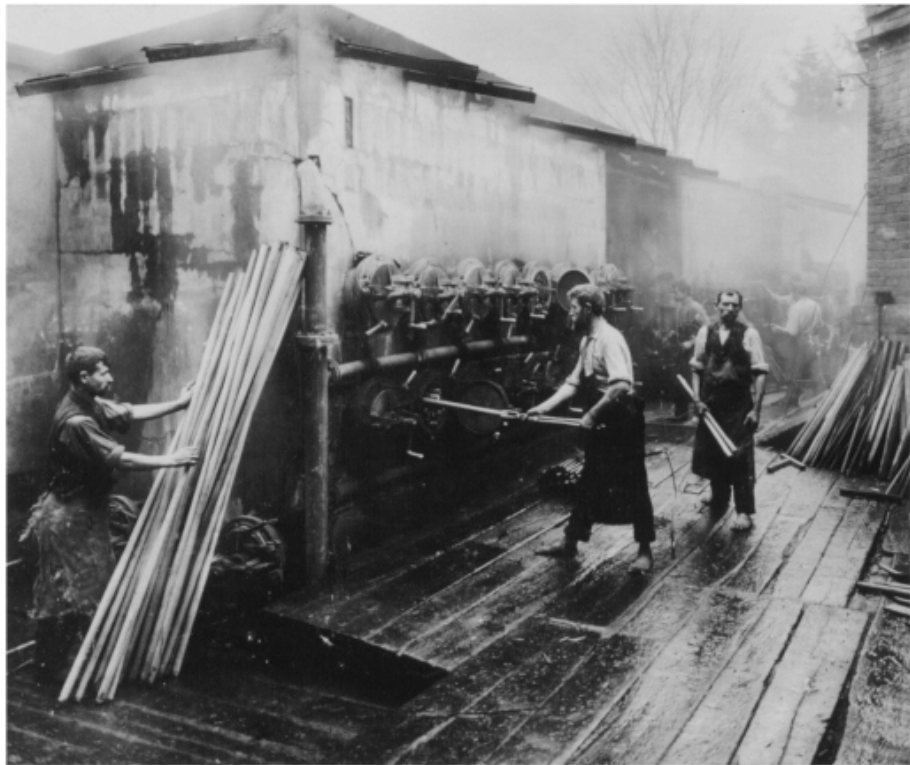


Figure 67

Michael Thonet, *No. 14* chair (demonstration of the chair packed for shipping) , Thonet (1859) (Vegesack, 1997).



Figures 68–69
Thonet factory in Bistritz c. 1920 (Vegesack, 1996: 70).



Figure 70

Martino Gamper *Conran Collection* (2008) modified Thonet chairs. Retrieved from <http://www.designboom.com/design/conran-inspirations-by-martino-gamper/>

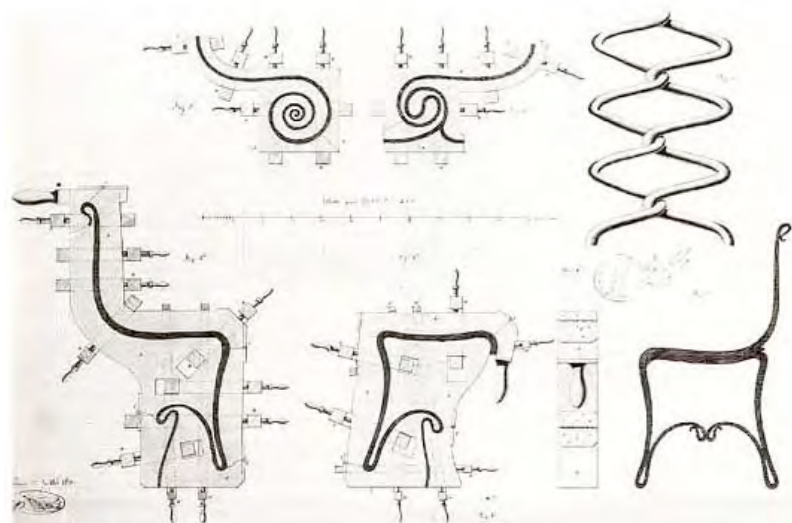


Figure 71

Technical drawing from one of Thonet's patent applications (n.d.). Retrieved from <http://objectguerilla.com/blog/2014/5/12/michael-thonet-gamper/>



Figure 72

214k chair (2009). Adapted by the Thonet company in 2009 (credited to Michael Thonet). Retrieved from <http://www.showhome.nl/nieuwsitem/design-in-de-knoop/>



Figure 73

Steam bent wood sample, Thonet Catalogue (2014). Photo: Mirko Krizanovic. Retrieved from <http://en.thonet.de/>



Figure 74
M/M Paris, *Thoumieux Chair* (2011) (King, 2013: 427).



Figure 75
Pablo Reinoso, *TH 24, Série Thoneteando*, (2007). Photo Credit: Estudio Cavallero. Retrieved from <http://www.pabloreinoso.com/en/Art-9-thoneteando.html>



Figure 76

French Thonet chair labels advising the occasional re-tightening of screws. Retrieved from <http://www.aubonusage.com/signaturesetiquette/index-en.html>



Figure 77

Clyde Beatty (c. 1930s) from Harvard Library, President and Fellows of Harvard College.



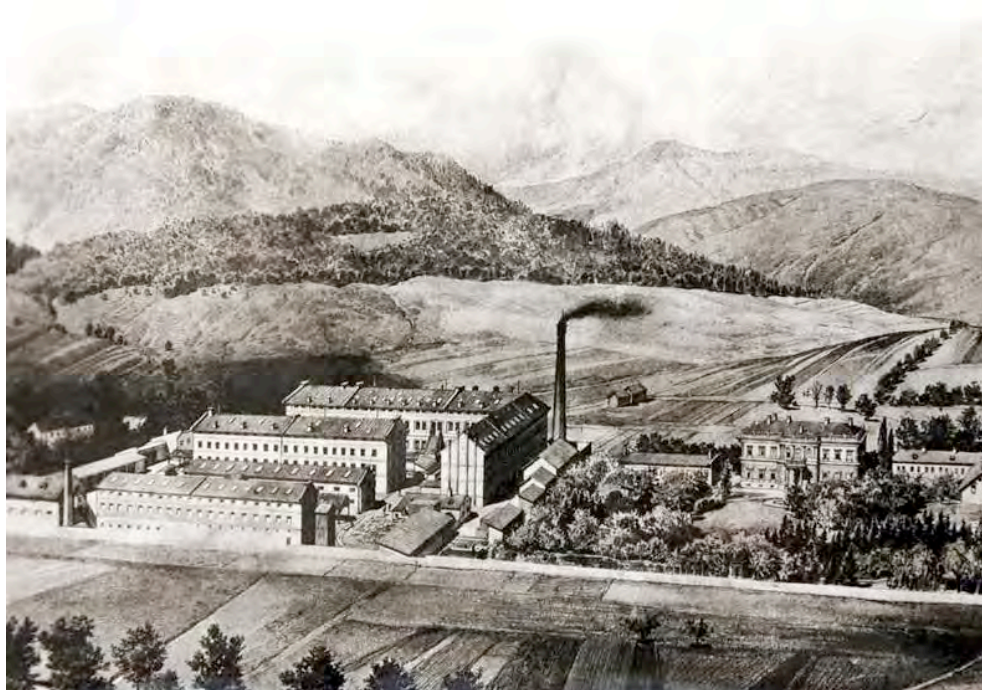
Figures 78-79

Pat English (1940). Photos by John Phillips for Time Life Pictures. Retrieved from <http://www.gettyimages.co.uk/>



Figure 8o

Clyde Beatty and Pat English (1940), photo by John Phillips for Time Life Pictures. Retrieved from <http://www.gettyimages.co.uk/>



Figures 81–82

Thonet Factory at Bistritz. Top: 1890, bottom: 1911 (Vegesack et al., 1996).



Figures 83–84

Formafantasma, *Craftica* (2012). Photos by Luisa Zanzani. Retrieved from <http://www.formafantasma.com/craftica>



Figures 85–88

Formafantasma, *Craftica* (2012). Photos by Luisa Zanzani. Retrieved from <http://www.formafantasma.com/craftica>



Figure 89

Guy Keulemans, *Marble and Steel Room Divider* (2013), with simulated domestic installation into floorboards. Photograph by Dean McCartney. Art direction by Guy Keulemans and Dean McCartney.

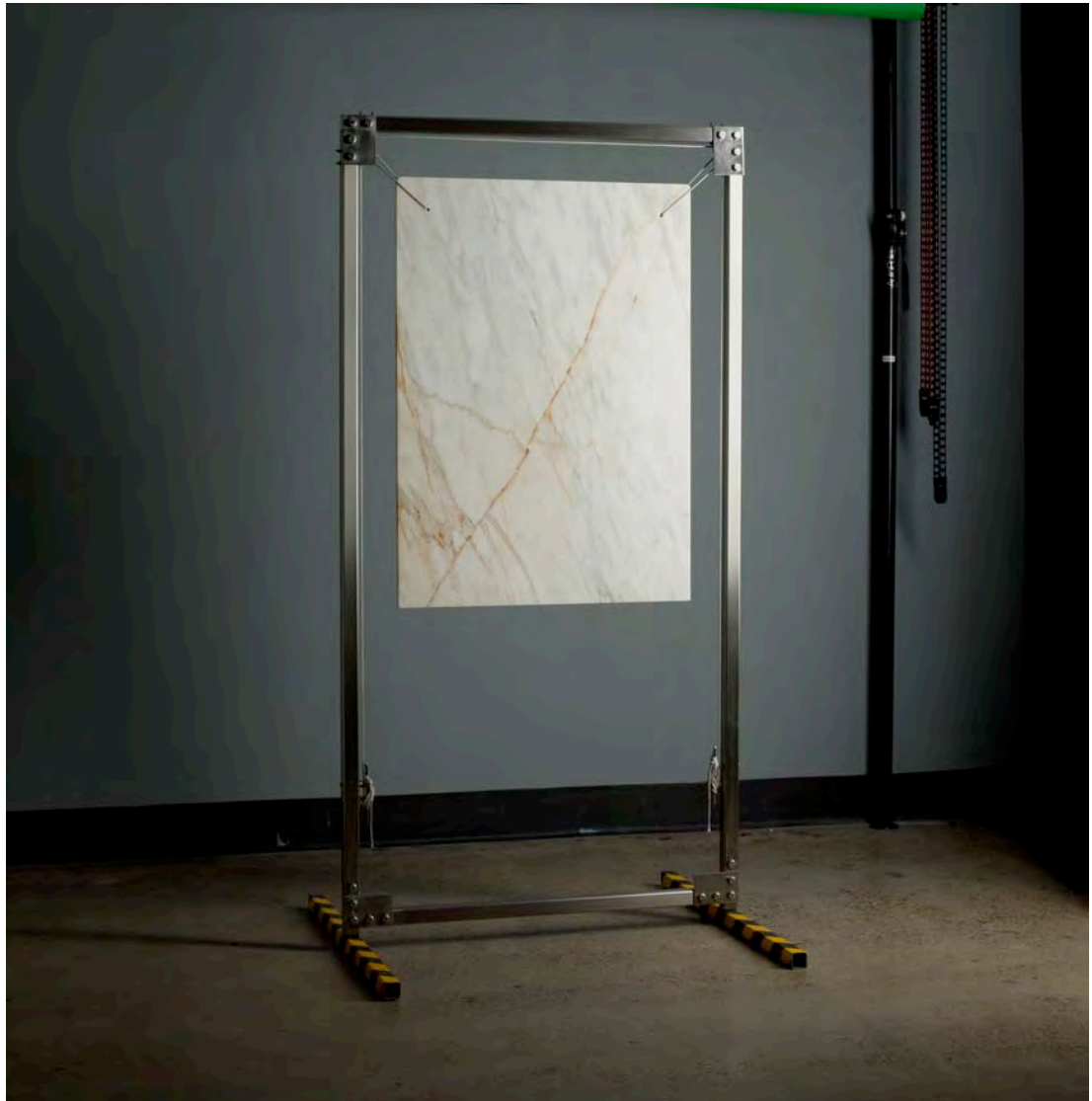
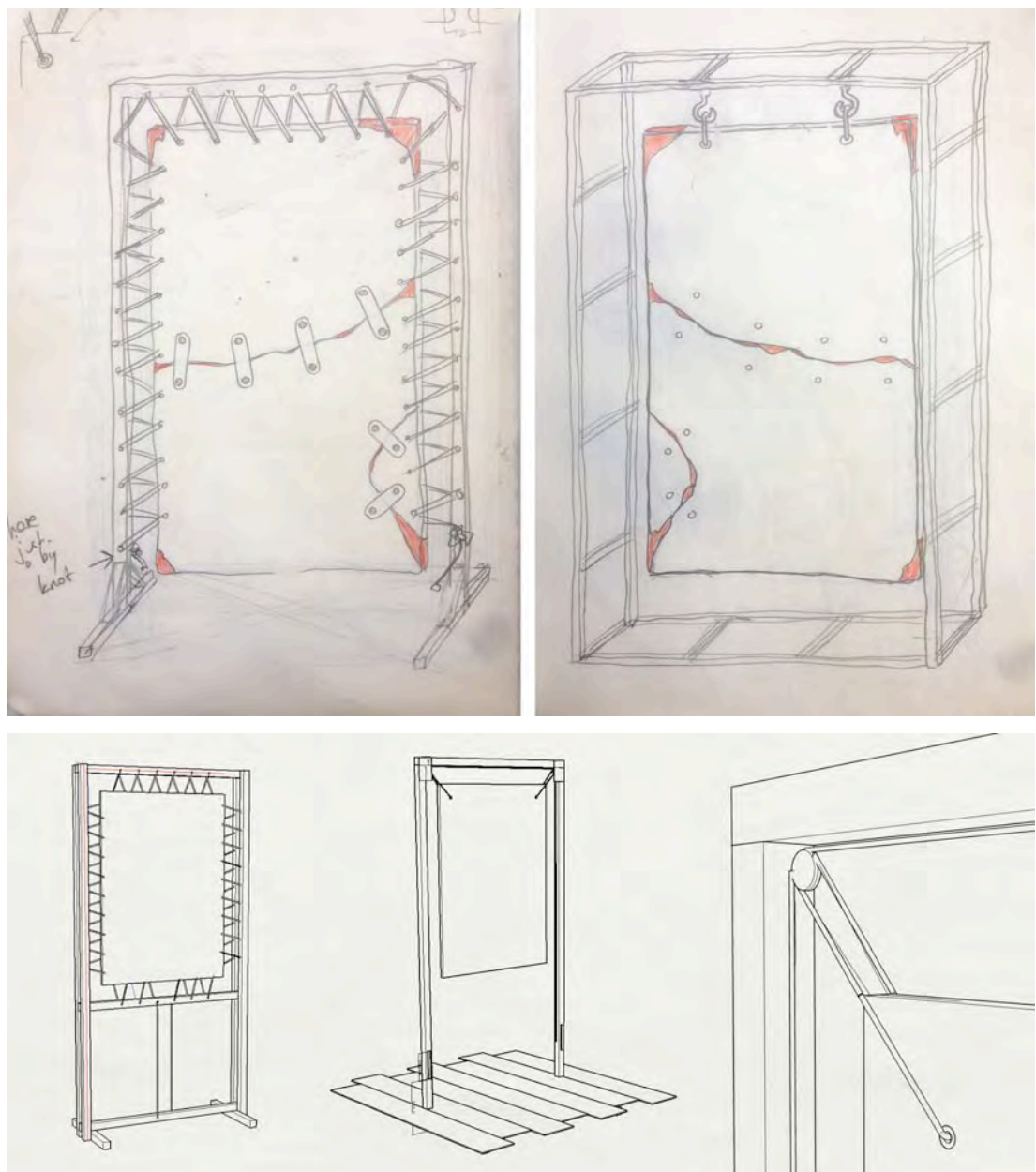


Figure 90

Guy Keulemans, *Marble and Steel Room Divider* (2013), with hazard striped feet for exhibition presentation. Photograph by Dean McCartney. Art direction by Guy Keulemans and Dean McCartney.



Figures 91–93

Guy Keulemans, development drawings for *Marble and Steel Room Divider* (2013).



Figure 94

Tea bowl by unknown Raku-ware workshop, c.19th century, Dosai, Edo period. Raku-type clay with Black Raku glaze; gold lacquer repairs. Courtesy of the Freer+Sackler Galleries, Freer Gallery of Art.



Figure 95

Unknown, *Tea bowl (chawan)*, c. 16th century. Korean Karatsu-ware, repaired with a Japanese pattern using *kintsugi* lacquer technique (Herbert F. Johnson Museum of Art and Museum Für Lackkunst, 2008).



Figure 96

“The owner of a ceramic shop checks his damaged wares following the massive 8.9-magnitude earthquake in Tokyo.” 11 March 2011. Source: AAP. Retrieved from <http://www.sbs.com.au/news/article/1498702/Earthquake-largest-ever-to-hit-Japan>



Figure 97

Twitpic user: @jefferrson, *A crack in the earth in Japan, 14 March 2011* (2011). Retrieved from <http://twitpic.com/48e39x>



Figure 98

“Cracks are seen on the snow-covered ground in woodlands near the earthquake and tsunami-devastated town of Sendai, March 12, 2011.” Photo by Reuters/Jo Yong-Hak (2011).



Figure 99

“A father and son walk alongside sidewalk cracks--the aftermath of a 6.5-magnitude earthquake at Yaizu port in Japan.” 11 August 2009. Photo by Itsuo Inouye/AP (2009).



Figures 100–101

Guy Keulemans, *Archaeologic 2* (2011). Production by Guy Keulemans and Henry Wilson. Photos and art direction by Guy Keulemans.



Figure 102

“Phosphorescent paint pigment (lume) applied on a Citizen Promaster Eco-Drive BJ8050-08E Diver's 300 m (tool watch suitable for mixed breathing gas diving) to make it readable in low light conditions, 26 April” (2008). Author: Francis Flinch. Retrieved from http://commons.wikimedia.org/wiki/File:Luminescent_paint_pigment_applied_on_a_diver%E2%80%99s_watch_to_make_it_readable_in_low_light_conditions..jpg

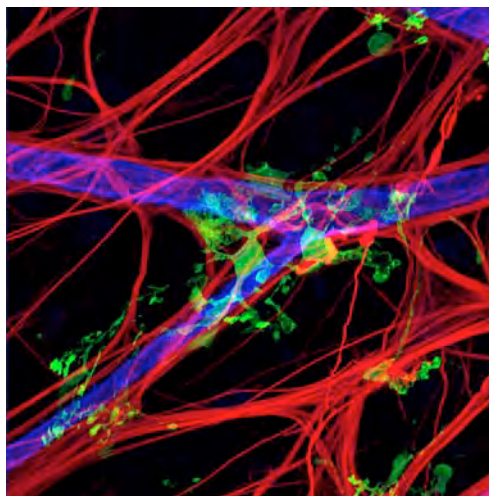


Figure 103

“A wholemount human retina triple labelled with fluorescent antibodies that stain blood vessels (blue), astrocytes (red) and microglia (green). Specimen imaged on a Zeiss 710 Confocal Microscope and is merged from 46 optical Z sections.” September 28, (2012) Source: Flickr user D. Scott McLeod.



Figure 104

“Out of the blue: Melbourne forensic biologist Steven Fowler and a trail of blood made visible with the use of the reagent luminol. This demonstration was done using pig's blood.” Photo: Craig Sillitoe, *The Age*, 9 July (2006).

UNDARK Radium Luminous Material



"I want that on mine"

When you wake up at night and look at a clock that glows with UNDARK on the dial you needn't fumble for the matches or turn on the light to see it. It's the same when you want a flashlight in the dark, and that's when you do want it. If it has little glowing UNDARK markings you see it easily.

UNDARK makes a watch or a compass as useful in the dark as it is in the light.

On gasoline gauges it explains its own service of safety. On electric switch buttons, pull-chain pendants, locks, door-knobs, it is a great convenience, a modern necessity.

UNDARK doesn't get dark in the dark

You can get a hundred percent more usefulness from things illuminated with UNDARK.

It contains real radium and will glow for years.

We are miners and refiners of radium-bearing ore, the pioneer manufacturers of radium luminous material in this country and the largest in the world.

Our service of instruction and inspection encourages the application of UNDARK by manufacturers in their own plants.

If you are interested in seeing how UNDARK can be applied, we will send you a TRY-OUT set for \$3.00. In writing, state class of work for which you want to use it. We can also give you the names of manufacturers who use UNDARK on the particular articles in which you are interested.

UNDARK is used on numerous articles, of which the following are the most important

Watches	Safe Combinations
Clocks	Gasoline Gauges
Flashlights	Speedometers
Pull-Chain Pendants	Steam and Pressure Gauges
Push-Button Switches	Revolver Sights
Flip Switches	Telephone Mouthpiece
Door Bells	Fire Extinguishers
Tile House Numbers	Mine Signs
Ship's Compasses	Women's Felt Slippers
Sportsmen's Compasses	Theatre Seat Numbers
Fish Bait	Hospital Call Bells
Locks	Poison Indicators

Names of the makers of these furnished upon request

RADIUM LUMINOUS MATERIAL CORPORATION

58 Pine Street, New York City

Factories: Orange, N. J.

Mines: Colorado and Utah

Trade Mark Name UNDARK Reg. Applied For



Figure 105

Advertisement for Undark radium paint, *The Literary Digest*, November (1920). Retrieved from <http://www.roger-russell.com/radioactive/radioactive.htm>

CONTENTS:

2 Kinds of Urushi Lacquer Tubes (20g), 2 Kinds of Brushes, Tonoko Powder, Alternative Gold Powder(10g), Pearl Gold Powder(10 g), Plastic Spatula , Rubber Gloves (M), Plate, Pure Cotton, Turpentine(100cc), Sandpaper, English Manual

*Includes 2 different powders: Alternative Gold and Natural Pearl Powder.
Since both golds are different, you can choose which color to use!*

NOTE: We regret that the TURPENTINE OIL included in our Kintsugi Repair Kit is now prohibited from export from Japan therefore we cannot ship abroad. The good news is that it is usually available at your local art supply/hardware store.



NOW FUKI-URUSHI INSTRUCTION & "FUKI-URUSHI PAPER" ARE ALSO INCLUDED!

Figure 106

Screenshot of a web advertisement for a Do-It-Yourself *kintsugi* kit ready for export from Japan (2014), Mejiro Co., Ltd. Screenshot taken 28 July 2014 from: <http://www.mejiro-japan.com/en/product/kintsugi-repair-kit-low-allergenic-urushi>

May 30, 1939.

S. L. KELLY

2,160,023

TOOL FOR HANDLING CONGEALED MATERIALS

Original Filed May 23, 1935

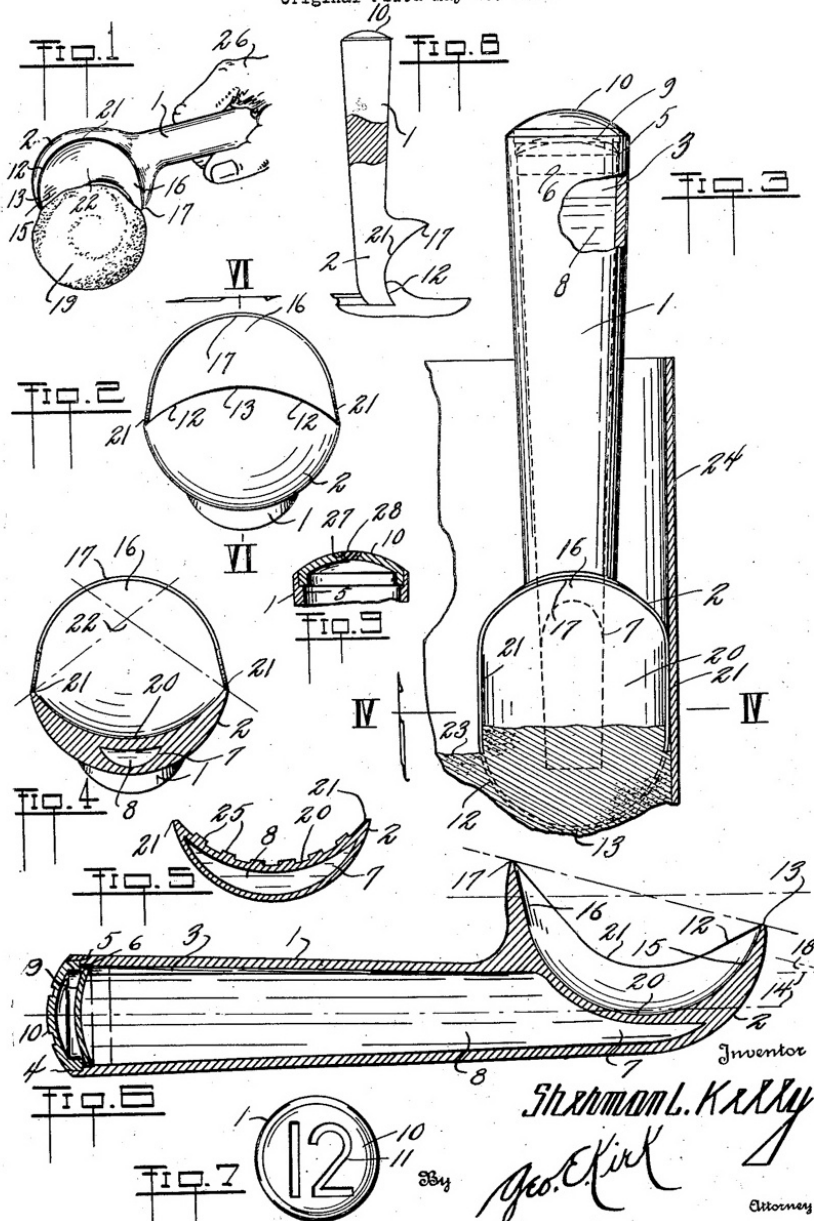


Figure 107

Sherman L. Kelly's patent drawings of the ice cream scoop (1935). US Patent Office.



Figure 108

Zeroll icecream scoop (2014) sold by Williams Sonoma. Retrieved from <http://www.williams-sonoma.com.au/zeroll-ice-cream-scoop>



Figure 109

A collection of Zeroll scoops, and Zeroll-type scoops from other manufacturers, dating from various times. Photography by Guy Keulemans (2012). For more information please see <http://guykeulemans.com/2012/09/ice-cream-scoops.html>



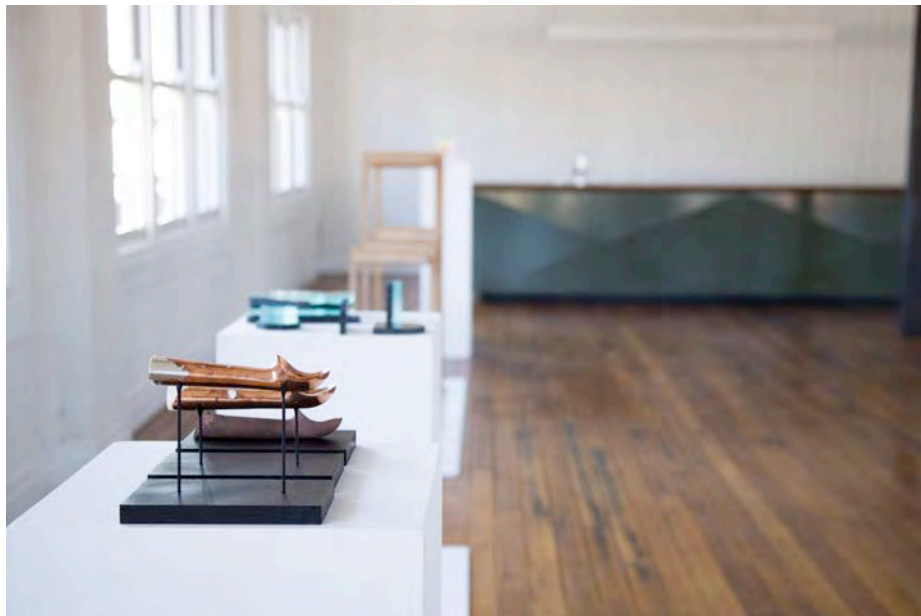
Figure 110

Guy Keulemans, raw casts of the *Copper Ice Cream Scoops* prior to repair.



Figure 111

Guy Keulemans, *Copper Ice Cream Scoops* (2012) during repair production: removal from a second mould after filling and coating with epoxy resin.



Figures 114–115

Guy Keulemans, *Copper Ice Cream Scoops* (2012) exhibited at Object Future, Melbourne, curated by Dale Hardiman & Suzannah Henty, June & July, 2014



Figure 116

“Open-pit copper mine outside Bisbee, AZ. Scale, tremendous. Environmental impact, off the chart.” Mike St. Jean (2012). 5 March 5 2012, Bisbee, Arizona, US. Retrieved from <https://secure.flickr.com/photos/stjeanm/6986243895/>



Figure 117

“A vulcaniser monitors our daily “anode pour”, where molten copper is cast into 750 kilogram copper anode blocks.” (n.d.) Photo: Mount Isa Mines. Retrieved from <http://www.mountisamines.com.au/EN/Media/Pages/Gallery.aspx>



Figure 118

"Molten copper is poured at the KGHM copper and precious metals smelter processing plant in Glogow." 10 May (2013). REUTERS/Peter Andrews. Retrieved from <http://www.theglobeandmail.com/report-on-business/international-business/european-business/molten-metal-pouring-bars-of-silver-at-polands-glogow-smelter/article11946869/>



Figure 119

Guy Keulemans, *Copper Ice Cream Scoops (retouched)* (2012). Photography by Dean McCartney, art direction by Guy Keulemans and Dean McCartney. Photographic retouching by a Clipping Path Asia Co. Thailand.

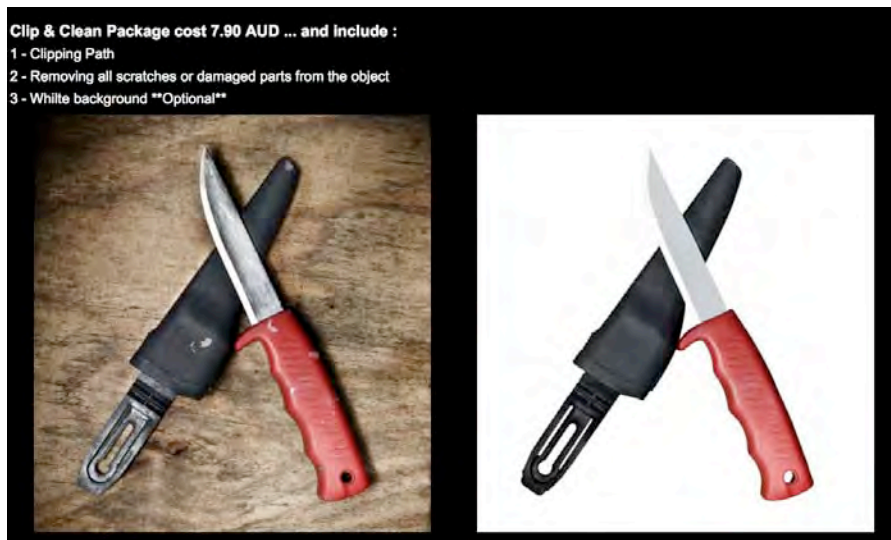


Figure 120

Image extracted from promotional material for Clipping Path Asia Co. Thailand (2012). Retrieved from <http://www.clipping-path-asia.com/>