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How well does ANT equip designers for socio-material speculations?

Alex Wilkie

Introduction

In conversation with Claire Parnet, Gilles Deleuze (2002: 2) evokes the image of the becoming of the orchid and the wasp as a ‘double capture’ whereby, and momentarily, each becomes a function of the other’s doings. In considering actor-network theory and design practice, this image is appealing as it can be understood to stage two ways by which their practices can be seen to converge. In the first, each discipline captures something from the other. For practitioners of actor-network theory, design becomes another empirical domain to describe. For designers, ANT becomes another explanatory resource with which to capture the social and warrant the arrival of the new. Another way of relating, recalling Isabelle Stengers’ ‘reciprocal capture’, a variant of double capture, opens up the possibility of the emergence of shared practices of empirical socio-material speculation where adding designed propositions to collectives brings into being new prospects and capacities to act. In what follows, and after a brief discussion of the possibility of ANT and design as a constructivist proposition, I outline how ANT can be understood to support design practitioners. I then draw on the case of an interdisciplinary project, involving designers and STS practitioners, to discuss how a workshop for exploring the use of smart energy monitors – and resourcing the design and deployment of an interactive research device amongst UK-based energy communities – involved practices I characterise as *retroscription* and *procomposition*. With these notions I aim to confront the conundrum of how to unite the legacy of ANT, as an ostensibly descriptive and agnostic commitment towards the collectives it traces, with the prospective attitude of designing as that of adding to, and, in so doing, modifying the collectives it renders. This, I argue, involves a shift towards engaging the speculative compossibility of a collective where the question of what an issue, concern or care is capable of elaborates on the question of what it is composed of.

Reciprocal capture & speculative questions

For Stengers (2010: 36), “we can speak of reciprocal capture whenever a *dual* process of identity construction is produced: regardless of the manner, and usually in ways that are completely different, identities that coinvent one another each integrate a reference to the other for their own benefit.” In her diagnosis of modern science, it provides a way of understanding the upshots of complex and dynamic relations between located scientific/research (knowledge) practices, in what she dubs an ‘ecology of practices’ (ibid. 32) where the interdependent combination of the political and the scientific produces new modes of existence and evaluation. In the context of science, reciprocal capture describes how novel (scientific) practices (and entities) arise out of the becoming together, rather than coming together, of other practices and

how such practices present themselves to one another.¹ The term practice is noteworthy, here, as it underscores the inherent immanence of research, knowledge and its (human and more-than-human) participants. Perhaps of more importance is Stengers' insistence on the specificity – or constraints – of practices, where, rather than assuming an equivalence between science and technology (e.g. technoscience), but not discounting their interrelation, the question, or challenge, is to distinguish the particular types of creation they make possible and their fragile modes of existence. Thus, the subatomic neutrino particle has a dual existence as an entity inhabiting the reality of quantum physics and as an active member of scientific experiments. It is produced by and the producer of practices; simultaneously objective and constructed.

Reciprocal capture therefore invites the rethinking of the confrontation of ANT, in its various invocations, and design – or any social science and artistic discipline for that matter – not where the problems, constraints and products of the respective practices remain somewhat indifferent and untroubled by their encounter (the wasp and the orchid return to carrying out their business) – but as special kind of double capture vectorising the creation of new practices that are, themselves, capable of creating novel entities, assemblages, practices and speculative possibilities. Stengers provides a caution, however, in that the adaptation of the term to non-scientific practices, such as ANT and design, requires thinking through the specificity of these knowledge practices. We must actively “relate knowledge production to the question it tries to answer” (2008: 92) and this includes the constructs and risks of particular practices – how, for instance, concepts, research techniques and instruments elicit and shape epistemic things. The becoming together of particular practices will necessarily create their unique obligations and constraints, their own modes of creation and existence.

Clearly, practitioners of design and ANT are posing questions different to those of experimental physicists. If the interrelated notions of reciprocal capture and the ecology of practices operate as tools to think with practitioners without losing the specificity of their practices, then these tools demand that we carefully consider the becoming-together of ANT and design and the questions this enables. This, in part, echoes Marilyn Strathern's (1992: 10) adage “it matters what ideas one uses to think other ideas (with)”, which might, in this context, be rephrased as “it matters what matters we use to think other matters with...”. In the fusing of ANT and design it matters what concepts, devices and techniques we use to think and make with and what assumptions they carry into research. In this becoming, ANT unequivocally loses any kind of pretension to neutrality towards the compositions that it dramatizes. This necessarily involves moving from the view from nowhere (Haraway 1988: 581) to a situated and reflexively implicated mode of knowledge practice where designs and research instruments add to and shape the collectives under study. Here, for example, we might consider how the optics of visualizing online controversies and datasets (e.g. Venturini et al. 2017), in part a combination of interface and information design and ANT, co-constructs its very object of study through charts that typically reify spatio-temporal networks and bounded actors ‘out there’.

This insistence on the specificity and interplay of research practices therefore invites constructivist and speculative questions of the conjoining of ANT and design – about the kinds of knowledge practices it engenders, the devices it crafts, their becomings, compossibilities and how they are answerable to researchers, practitioners and community members etc. This, then, involves approaching each research problem with the following questions: what it is composed of? And what is this composition capable of? In other words, what is the compossibility immanent to the question at hand?²

Asymmetries of Practice

It never ceases to mystify colleagues whenever, in answer to being asked my profession, I cagily admit to being both a “designer” and “social scientist” – “STS scholar” being especially esoteric. “Strange combination!” is the usual response, suggesting an inexplicable mixture of practices and knowledge. The more I examine the two disciplines, however, the more they seemingly go hand in glove. The complex of sub-disciplines and genres that comprise design have a long and elaborate history of engagement with the social sciences and vice-versa. It is impossible to do justice to these entanglements and vectors here, suffice it to say multiple shared genealogies exist. Some, admittedly partial, examples, however, help to point towards the various co-becomings of two contemporaneous disciplines. In some cases, the two are ostensibly indistinguishable, such as the foundational graphic isotypes of Otto Neurath (for overviews see: Cartwright et al. 2008, Neurath and Cohen 2012) or various variants of ‘participatory’ design (Ehn 2017), including its more recent engagement with ANT (Binder et al. 2011). The related fields of Human-Computer Interaction (HCI) Design and Computer-Supported Cooperative Work (CSCW) have both emerged, in part, by way of encounters with ethnography (Button 2000) and ethnomethodology (Suchman 2006) as well as intricate cross-overs and co-developments with approaches associated with STS scholars (Star 1995, Cooper and Bowers 1995, Suchman 1999, Jensen 2001). The above also testifies to how the social sciences are routinely mobilised in industrial and commercial design practices (Wilkie 2010) as well as academic settings.

At base, then, this brief summary serves to overturn the view that traffic between ANT and design is exceptional: it is anything but. In this potted light, it is just another confrontation that dramatizes difference questions, issues and problems, or, to paraphrase Barry et al. (2008), it stages another transformation in the epistemic and ontological imagination of design, where sociocultural research effects a change in how sociality is conceived and acted upon/within and vice-versa. Furthermore, what is readily apparent from the above is the rhizomatic relations between social science and design, and the ecology of practices that this invariably includes. This, then, points to complex (a)symmetrical – or non-metrical – relations between the diverse multiplicity of practices of the two domains as a dynamic heterogeneous patterning that bears immanent equivalence and difference. It also suggests that the interrelations between design

and ANT undergo continual ordering and re-ordering as new practices are folded into prior commitments.

Within this ongoing multiplicity of practices, there are various instances where ANT has been implicitly and explicitly taken up by designers for purposes of design pedagogy (Wilkie et al. 2018), to write accounts of design practice and designs (Wilkie 2010, Calvillo González 2014, Jaques Forthcoming), to re-imagine and re-compose participatory design practices and user-involvement, in, for example, healthcare (Storni 2015), to develop experimental research devices (e.g. Wilkie et al. 2015) as well as efforts to infuse design into the milieu of policy innovation (Kimbell 2015). DensityDesign, a research laboratory based in the Design Department of Design at the Politecnico di Milan, is both indicative of the organizational embedding of interdisciplinary engagements between design and ANT as well as a particular coalescence of interests between sociological research into big data, controversy mapping and communication design (Valsecchi et al.). As part of the MACOSPOL (Mapping Controversies on Science for Politics) project, led by Bruno Latour, DensityDesign was also involved in the development of digital ‘tools’ for tracing public engagement with science and technology. The preoccupation of STS researchers with the design of digital tools for controversy analysis can, arguably, be traced back to the ‘Web Geographies’ project, a collaboration between Science Dynamics at the University of Amsterdam and members of the Computer Related Design Department at the Royal College of Art, London, which developed into govcom.org (Rogers 2000).

The multiplicity of practices that comes to light given the above could be neatly explained (away) as having immanent epistemological, methodological and ontological valency. Thus, and for instance, forms of user-centred and participatory design enlarge their respective collectives to include both human and more-than-human participants and reconsider the kinds of situated ontological politics (Berg 1998) they collude in and enact. New techniques, or methods, for identifying actors and rendering collectives and the composition of issues and controversies are devised by, for instance, activist and policy agencies alike. Lastly, it proposes a redistribution of epistemic practices amongst those involved or implicated (Clarke 1998) in processes involving design, such as designer-scientist-laboratory engagements, DIY hackathons, activist workshops (see Sánchez Criado, this volume) or probe workshops. One take on this (Latour 2008) figures the designer as a “cautious Prometheus” whose artfulness, craft and skills are pressganged into the (STS) task of rendering political ecologies (ibid. 13). Implicit to this, however, is the premise that such practices primarily involve retrospective optics – scrutinizing the present and/or past rather than animating the possible. More explicit is the subsuming of design to the obligations and requirements of STS – in such practices designers equip ANT scholars with renewed technological and visual capacities, devices and techniques. Furthermore, it palpably risks reviving the optical illusion of the neutrality of ANT as the visualization from nowhere where its practices remain withdrawn from view. Rather than appease the realist preoccupation of ANT in which agnostic diagnosis is the principle

commitment, design practices demand a shift to not only envisioning collectives and their composition or embellishing the specific modes of existence of objects but exploring the possibilities of collectives, their composition and the modes of existence of novel entities. This is precisely the risk or the exigencies of design practice i.e. the potential to move from an actualist to a speculative constructivism (Wilkie et al. 2017). At base, this means adding propositions to a collective, such as that made by Scandinavian participatory designers in 1982 who inserted an innocuous cardboard box, with “DESK TOP LASER PRINTER” handwritten on its side, into the workplace of newspaper typographers and journalists in order to reimagine the proofing machine and thus, their cooperative working practices (Ehn and Kyng 1991), or the deployment of an interactive radio-like device amongst local communities endeavouring to face down climate change by way of energy-demand reduction. In both, the insertion into, and this addition to, a collective explores its concrete possibilities to change and develop new practices.

In what follows I elaborate on this additive version of engagement carried out in relation to local community efforts to effect energy-demand reduction in the UK. In this approach, design demands that ANT becomes a procompositional practice. In doing so, I explore how script theory and script analysis, emblematic of the retrospective compositional analysis (of technology), metamorphoses in its encounter with design practices. Script theory is particularly germane here, not least since at its inception it concerned how “technical objects and people are brought into being in a process of reciprocal definition” (Akrich 1992: 222). More significantly, script theory has passed through various encounters with design, from its inception in relation to the analysis of the design and use of electricity generating and metering technologies in West Africa, to its reformulation – by way of an encounter between Dutch and Norwegian feminist debates and ‘constructivism’ – in the identification of ‘genderscripts’ (Oudshoorn 1996) that operate in, for example, digital design (Rommes et al. 1999) and product design practices (van Oost 2003). More recently, script analysis has been modified for design pedagogy and design research (Wilkie et al. 2018) and software design (Allhutter 2012) where the identification and analysis of compositions form the starting point.

Procomposing Smart Energy Monitors

The ‘Re-scripting Energy’ workshop took place in 2011 at Goldsmiths, University of London, as part of the early design research phases of the ‘Sustainability Invention and Energy-demand Reduction: Co-Designing Communities and Practice (ECDC for short) project, one of seven projects funded under the Research Councils United Kingdom (RCUK) Energy Programme. The scope of the ECDC project was to explore individuals’ and local communities’ understandings and effective use of energy-demand reduction technologies and regulation. In so doing, the project would inform UK government efforts to meet energy and environmental policy targets for reducing carbon emissions and tackling climate change. The attention placed on local energy communities – a principal requirement of the RCUK funding – complemented

and diversified existing government policy objectives for addressing energy demand reduction by ‘nudging’ individual consumption (e.g. smart monitors) and macro-economic (e.g. cap and trade emissions trading) intervention. As a small part of these emerging practices and technologies for managing energy and ameliorating climate change, the three-year ECDC project brought together design researchers and STS scholars in order to engage with a number of local energy communities, based in England, and, in doing so, to investigate, raise issues, and speculatively experiment with the nature of social and technical community practices.

Over the three-year course of the project various kinds of engagement with the issue of community energy demand reduction were conducted including participant observation with community members, probe workshops (an energy community variant of cultural probes Gaver et al. 1999), social media ‘bots’ (Wilkie et al. 2015) and exhibitions. Much of this effort directly informed the centrepiece of the project, namely the conception, development and three-month deployment of thirty-six Energy Babble research devices (Gaver et al. 2015). The ‘Re-scripting’ energy workshop took place during the early stages of the project and its purpose was to examine the interplay between the ‘frameworks of action’ and competencies inscribed into existing ‘smart metering’ technology and the practicalities of their installation as well as the potential for some kind of designed intervention into the smart monitor’s script. All of this was conducted in the form of group-based analysis and visualisation by team members as well as invited design and STS practitioners. The choice of smart meters here was certainly not arbitrary given the UK government’s huge financial investment and political commitment to the promises of a well-defined techno-behavioural fix with feedback solutions that make energy consumption visible – and supposedly calculable – to the individual end-user.³ There was also growing evidence that, in practice, smart monitors were failing to live up to expectations, whether as a result of the complex domestic settings they were installed in (Hargreaves et al. 2010) or the efficacy of the energy consumer figured as an economic-behavioural actor, troubled, in part, by the ‘boomerang effect’ (Schultz et al. 2007) where, for example, energy-saving technologies, such as low-energy bulbs, are left on for longer rather than being switched-off thus nullifying economic and environmental benefits.

Participants installed (or at least tried to install) and used a smart monitor for a period of time (typically one-two weeks) prior to the workshop. Three different monitors were used, representing two distinct consumer-based approaches to monitoring and feedback available in the UK at the time: one approach exemplifying indirect and impressionistic monitoring through ambient lighting and the other indicative of approaches favouring utilitarian and quantitative numerical read-outs. Participants then brought their energy monitor – and experience of using it – to the workshop. Initially, participants were asked, in groups, to identify and visually diagram the *program of action* inscribed into the monitor. During the second part of the workshop they used the diagram to identify entry-points for intervening in and proposing re-designs of the monitors, hence the title of the workshop – *re-scripting*.

For my purposes in this chapter, then, the workshop serves as a – somewhat crude – model of how social scientific practices of retrospective analysis can be combined with the prospective practices of design and its obligation to proposition formulation. In the following, I discuss two practices, which I tentatively call *retroscription* and *procomposition*, that, on the one hand involve an active participation in lived reality of using a smart energy monitor and transferring this experience, by way of visualisation, into a diagram of use in which the efficacy of the appliance is laid bare. Crucial here, is that the diagram differs from the aims of the traditional STS scholar to produce a (somewhat closed) written analysis (Akrich and Latour 1995: 259). Instead, what is produced is a visual analysis primed for *procomposition*: which is, at base, a lure for the re-arrangement of the composition and acts of invention where elements are modified, re-aligned, added or removed, thus effecting a relational change in the patterning and capacities of the collective.

Retroscription

During the workshop, Liliana, a designer on the project, narrated an account of her failed attempts to install and use an Alertme Starter Kit in the rented accommodation she was living in at the time in North London. The story of Liliana's encounter with the electricity meter is quite ordinary, and yet it is precisely the unremarkable nature of having to find a key to a locked door in a communal area, circumvent warning signs, identify the meter belonging to her flat amongst others, consulting manuals left by her landlord, and then finally, and blindly, attaching the transmitter to a cable hidden from view by a duct. Back in her flat, Liliana found that the signal from the transmitter was too weak and thus invisible to the display device.

Whilst Liliana narrated her experience, other participants in the workshop worked together to produce a visual diagram of the Alertme's script elicited by Liliana's account as well as including aspects of their own experiences to the mix – often aligned with Liliana's experience. In addition, the monitor, its packaging and manuals were examined for indications of its putative energy-monitoring and saving script. The visualisation rendered three versions of the monitor. First, wherein the script 'worked' under somewhat restricted conditions, producing a discrete energy-user as a calculative individual concerned with minor variations in cost saving and dependent on online connectivity. Second, where the monitoring set-up (transmitter & display) minimally worked in displaying data sourced from the meter which remained somewhat unintelligible due to the lack of accurate live kWh unit supplier costs or any sense of connection to the UK national grid. Third, where the kit failed to work due to irresolvable conflicts between the script and the situated reality of its point, or site, of application.

In *retroscribing* the active participation with Alertme smart energy monitor, the workshop participants are doing more than merely tracing an issue or network. Here, *retroscription* connotes an active involvement with, or dramatization of, a device, its script and therefore enactments of – in this case – the politics of energy consumption. Second, the processes of transfer and transcription that *retroscription* involves aims not to remove or downplay the

techniques and technologies of capture, such as visualization, that enable the rendering of experience but rather seek to reflexively include these in the process. Lastly, the prefix ‘trans’ – involved in transcribing retroscriptions – denotes the potential for thoroughly changing the script in combination with its elements: the possibility of transversing, transcending and misaligning the script as *part* of the process of analysis.

Procomposition

If retroscription involved rendering past situated and collective experiences of using an energy monitor into a visualisation, then procomposition included mobilising the experiences of monitoring-in-use and of demand-related appliances as part of the design and deployment of the Energy Babble (see figure 1 and Gaver et al. 2015) speculative research device. The Energy Babble, a radio-like interactive research device that ‘spoke’ audible energy and climate related content drawn from the internet, social media, and community member voice messages, deliberately aped generic aspects of smart energy monitor scripts in form and function.



Figure 1: The Energy Babble.

As figures 1–3 show, the Energy Babble is relatively small appliance that is designed to be placed into a domestic or workspace and connected to the Internet either by Wi-Fi or Ethernet. Once connected, the Energy Babble emits an algorithmically constructed stream of energy-related information sourced from the Internet including scrapes from Twitter feeds, results from searching Twitter, samples from URLs mentioned in tweets, reports of (any)things being

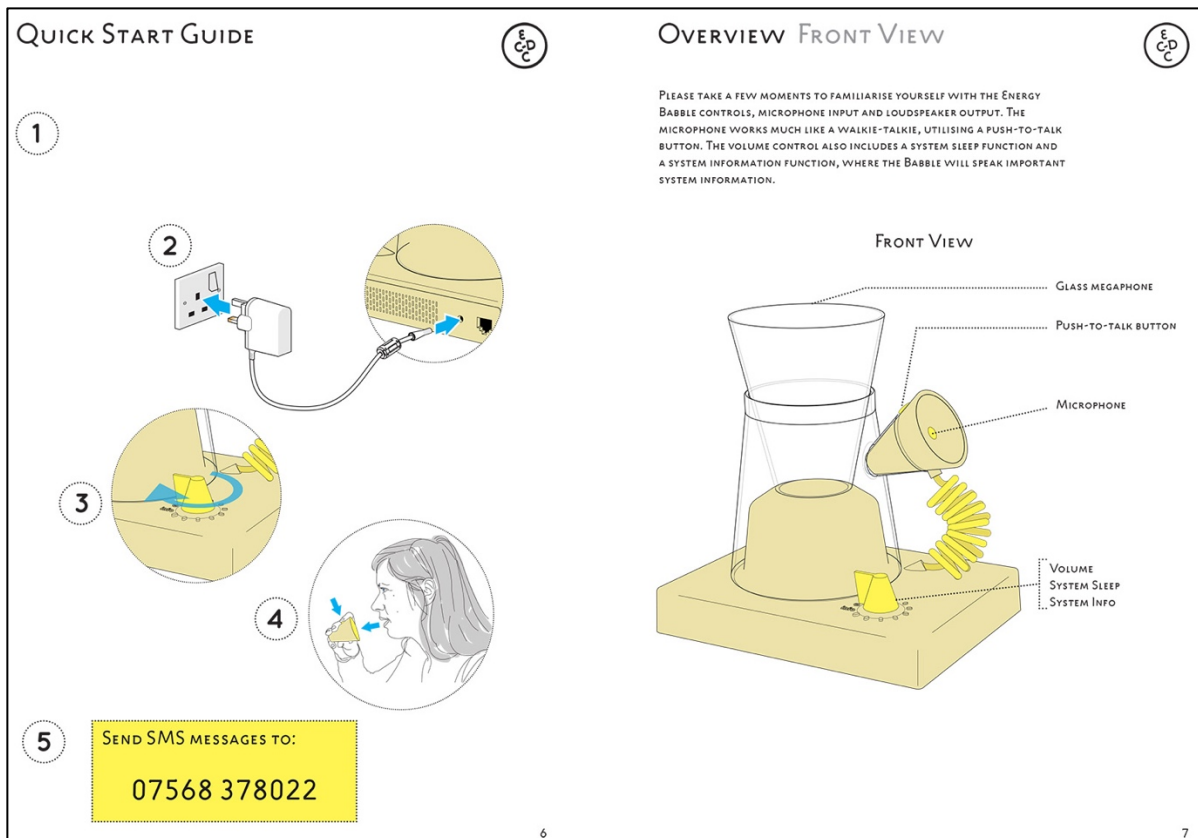


Figure 3: Pages from the Energy Babble manual showing the quick start guide for the device.

The process of designing the Energy Babble also suggests that procomposition work – a point where design and STS converge – is complex, circuitous and involves combinations of skilled practices. As the figures indicate, this involves, at base, the intricate interplay between and coordination of interaction design, industrial design, graphic communication, photography and sound design. The interplay in this case also suggests that, although practical design action may be embodied, it also routinely cuts across or transverses the collective involved in designing where skills and craft are shared and outcomes co-produced.

Locating procomposition *only* in such activities not only betrays a relation between orthodox design practices (three-dimensional, graphic etc.) and procomposition but also points to a multiplicity of novel design techniques and approaches are enacted during this engagement. Realizing the final Energy Babble device involved many encounters, experiments, proposals, and trials involving both humans and non-humans. Probe Workshops (Michael et al. Forthcoming) were held with members of energy communities to investigate the meaning and configurations of community, elicit members' expectations of climate-change and environmental futures and explore affective or aesthetic aspects of energy use; automated algorithmic software robots (Bots) were designed and deployed on Twitter to detect and identify energy-related practices and actors (Wilkie et al. 2015).

Conclusion

To return to the conversation between Deleuze and Parnet (and Stengers) and the interrelated notions of double and reciprocal capture; the question of equipping designers is transfigured into the possibility of design becoming-with ANT. As sketched out above, this entails the rendering, or retroscription, of political collectives, in this case UK energy communities, AND the addition of new speculative propositions – procompositing these collectives in the form of an interactive material-semiotic research device to excite and prehend the possibilities of new energy-demand reduction practices and make such things matter. The upshot of the reciprocal capture of design and ANT rests neither with matters of fact nor description: it animates compossibility in the making of speculative propositions as lures for procompositing new political collectives.

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Endnotes

¹ See (Fraser 2010: 75) for clarification of ‘becoming together’.

² On the nature of possibles, it was Gottfried Wilhelm Leibniz (cited in Messina and Rutherford 2009: 962) who asserted that not all possibles are compossible and that compossibility entails the possibility of actual existence in a common world. In other words, there are situated and contingent restrictions on speculative relations. See (Deleuze 2004: 100-101) on the relation between the compossible and impossible.

³ See (Darby 2006, Decc 2009) for the rationale, reasoning and UK government policy on the rollout of smart-metering technology.

References

- Akrich, M. 1992. The de-description of technical objects. In: Bijker, W. and Law, J. eds. *Shaping Technology/Building Society: Studies in Sociotechnical Change*. Cambridge, MA: MIT Press, 205-224.
- Akrich, M. and Latour, B. 1995. A Summary of a Convenient Vocabulary for the Semiotics of Human and Nonhuman Assemblies. In: Bijker, W., E. and Law, J. eds. *Shaping technology/building society : studies in sociotechnical change*. Cambridge, Mass. ; London: MIT Press, 341p 323cmpbk.
- Allhutter, D. 2012. Mind Scripting A Method for Deconstructive Design. *Science, Technology & Human Values*, 37(6), 684-707.
- Armstrong, L., Bailey, J., Julier, G. and Kimbell, L. 2014. Social Design Futures: HEI Research and the AHRC.
- Barry, A., Born, G. and Weszkalnys, G. 2008. Logics of interdisciplinarity. *Economy and Society*, 37(1), 20-49.
- Berg, M. 1998. The Politics of Technology: On Bringing Social Theory into Technological Design. *Science, Technology, & Human Values*, 23(4), 456-490.
- Binder, T., Ehn, P., De Michelis, G., Jacucci, G. and Linde, G. 2011. *Design Things*. Cambridge, MA; London: MIT Press.
- Button, G. 2000. The ethnographic tradition and design. *Design Studies*, 21(4), 319-332.
- Calvillo González, N. 2014. *Sensing Aeropolis. Urban air monitoring devices in Madrid, 2006-2010*. Arquitectura.
- Cartwright, N., Cat, J., Fleck, L. and Uebel, T. E. 2008. *Otto Neurath: Philosophy between science and politics*. Cambridge University Press.
- Clarke, A. 1998. *Disciplining reproduction: modernity, American life sciences, and "the problems of sex"*. Berkeley ; London: University of California Press.
- Cooper, G. and Bowers, J. 1995. Representing the User: notes on the disciplinary rhetoric of human-computer interaction In: Thomas, P. J. ed. *The Social and Interactional Dimensions of Human-computer Interfaces*. Cambridge: Cambridge University Press, 48-66.
- Darby, S. 2006. *The effectiveness of feedback on energy consumption: A review for DEFRA of the literature on metering, billing and direct displays*. Environmental Change Institute: University of Oxford.
- Dec 2009. *Smarter grids: the opportunity*. Department of Energy and Climate Change.
- Deleuze, G. 2004. *Desert islands: And other texts, 1953--1974*. Los Angeles, CA; New York, NY: Semiotext(e).
- Deleuze, G. and Parnet, C. 2002. *Dialogues II*. London: Continuum.
- Ehn, P. 2017. Learning Participatory Design as I found it (1970–2015). In: Disalvo, B., et al. eds. *Participatory Design for learning: Perspectives from practice and research*. Abingdon, Oxon; New York, NY: Routledge, 7-21.
- Ehn, P. and Kyng, M. 1991. Cardboard Computers: Mocking it Up or Hands on the Future. In: Greenbaum, J. M. and Kyng, M. eds. *Design at work: cooperative design of computer systems*. Hillsdale, N.J.: L. Erlbaum Associates, 169-195.
- Fraser, M. 2010. Facts, ethics and event. In: Jense, C. B. and Rödje, K. eds. *Deleuzian Intersections: Science, Technology and Anthropology*. New York, NY; Oxford: Berghahn Books, 57-82.
- Gaver, W., Dunne, T. and Pacenti, E. 1999. Cultural Probes. *Interactions*.
- Gaver, W., Michael, M., Kerridge, T., Wilkie, A., Boucher, A., Ovalle, L. and Plummer-Fernandez, M. 2015. *Energy Babble: Mixing Environmentally-Oriented Internet Content to Engage Community Groups*. 1115-1124.

- Ginsberg, A. D., Calvert, J., Schyfter, P., Elfick, A. and Endy, D. 2014. *Synthetic aesthetics: investigating synthetic biology's designs on nature*. Cambridge, MA; London: MIT Press.
- Haraway, D. J. 1988. Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist studies*, 575-599.
- Hargreaves, T., Nye, M. and Burgess, J. 2010. Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors. *Energy Policy*, 38(10), 6111-6119.
- Jaques, A. Forthcoming. Knowing-Mies as Rendered Society. In: Marres, N., Guggenheim, M. and Wilkie, A. eds. *Inventing the Social*. Manchester: Mattering Press.
- Jensen, C. B. 2001. CSCW design reconceptualised through science studies. *AI & Society*.
- Kerridge, T. 2015. *Designing Debate: The Entanglement of Speculative Design and Upstream Engagement*. (PhD). Goldsmiths, University of London.
- Kimbell, L. 2009a. *Beyond design thinking: Design-as-practice and designs-in-practice*. CRESC Conference, Manchester, 1-15.
- Kimbell, L. 2009b. The turn to service design. *Design and creativity: Policy, management and practice*, 157-173.
- Kimbell, L. 2015. Applying design approaches to policy making: discovering policy lab.
- Latour, B. 2008. *A cautious prometheus? A few steps toward a philosophy of design (with special attention to Peter Sloterdijk)*. University College Falmouth, UK, 3-6 September, 2-10.
- Messina, J. and Rutherford, D. 2009. Leibniz on compossibility. *Philosophy Compass*, 4(6), 962-977.
- Michael, M., Wilkie, A. and Ovalle, L. Forthcoming. Aesthetics and affect: Engaging energy communities. *Science as Culture*.
- Neurath, M. and Cohen, R. S. 2012. *Empiricism and sociology*. Springer Science & Business Media.
- Oudshoorn, N. 1996. Genderscripts in technology. Fate or challenge. *Inaugural Speech*.
- Rogers, R. 2000. *Preferred placement: knowledge politics on the Web*. Maastricht: Jan Van Eyck Akademie.
- Rommès, E., van Oost, E. and Oudshoorn, N. 1999. Gender and the Design of a Digital City. *Information Technology, Communication and Society*, 2(4), 476-495.
- Sanchez Criado, T., Rodríguez Giralt, I. and Mencaroni, A. 2016. Care in the (critical) making. Open prototyping, or the radicalisation of independent-living politics.
- Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J. and Griskevicius, V. 2007. The Constructive, Destructive, and Reconstructive Power of Social Norms. *Psychological Science*, 18(5), 429-434.
- Star, S. L. 1995. *The cultures of computing*. Blackwell Publishers, Inc.
- Stengers, I. 2008. A constructivist reading of process and reality. *Theory, Culture & Society*, 25(4), 91-110.
- Stengers, I. 2010. *Cosmopolitics I*. Minneapolis, MN.: University of Minnesota Press.
- Storni, C. 2015. Notes on ANT for designers: ontological, methodological and epistemological turn in collaborative design. *CoDesign*, 11(3-4), 166-178.
- Strathern, M. 1992. *Reproducing the future: Essays on anthropology, kinship and the new reproductive technologies*. Manchester: Manchester University Press.
- Suchman, L., A. 1999. Working Relations of Technology Production and Use. In: MacKenzie, D. A. and Wajcman, J. eds. *The social shaping of technology*. 2nd ed. ed. Milton Keynes, [Eng.] ; Philadelphia, Pa.: Open University Press.
- Suchman, L. A. 2006. *Human-Machine Reconfigurations: Plans and Situated Actions 2nd Edition*. Cambridge: Cambridge University Press.

- Tironi, M. and Hermansen, P. 2018. Cosmopolitical encounters: Prototyping at the National Zoo in Santiago, Chile. *Journal of Cultural Economy*, 1-18.
- Valsecchi, F., Ciuccarelli, P., Ricci, D. and Caviglia, G. The DensityDesign lab. *ShangHai*, 180.
- van Oost, E. 2003. Materialized Gender: How Shavers Configure Users' Femininity and Masculinity. *In: Oudshoorn, N. and Pinch, T. J. eds. How users matter : the co-construction of users and technologies*. Cambridge, MA: MIT Press, 67-80.
- Venturini, T., Jacomy, M., Meunier, A. and Latour, B. 2017. An unexpected journey: A few lessons from sciences Po médialab's experience. *Big Data & Society*, 4(2), 1-11.
- Wilkie, A. 2010. *User assemblages in design: an ethnographic study*. (PhD). Goldsmiths, University of London.
- Wilkie, A., Farías, I. and Sanchez-Criado, T. 2018. For a speculative aesthetics of description: Interview with Alex Wilkie. *Diseña*, 12, 70-87.
- Wilkie, A., Michael, M. and Plummer-Fernandez, M. 2015. Speculative method and Twitter: Bots, energy and three conceptual characters. *The Sociological Review*, 63(1), 79–101.
- Wilkie, A., Rosengarten, M. and Savransky, M. 2017. Speculative techniques. *In: Wilkie, A., Savransky, M. and Rosengarten, M. eds. Speculative research: The lure of possible futures*. Abingdon, Oxon; New York, NY: Routledge, 111–113.