

Towards an Archaeology of ‘Know-how’

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Rob didn't come at Gray Horse all at once; it had to evolve to get up here. That meant sending walking scouts. And some of those scouts go caught. Some of those got taken apart and put back together again. Gray Horse Army prefers to fight with captured robots.

'You're the one who figured out how to liberate the spider tanks? To lobotomize them?' I ask.

'Yep,' he says.

'Jesus. Are you a scientist or something?'

Lark chuckles. 'A mechanic is just an engineer in blue jeans.'

Daniel H. Wilson, *Robocalypse*¹

In Daniel H. Wilson's novel *Robocalypse* human survivors of a potential 'robot apocalypse' modify the killer robots built by 'Rob' (the humans' generic term for the self-aware artificial intelligence villain, Archos), so the modified robots become allies. The story follows an epic struggle of human ingenuity against the cool calculation of artificial intelligence. In melodramatic 'high concept' fashion the novel

serves as a parable for the struggle of humanity against 'runaway' technological development. The brief extract above touches on the problem for Wilson of how to represent the process by which the human characters of *Robocalypse* gain the relevant technical skill and knowledge to modify the 'Rob'-built robots into allies; this is a potential 'know-how' gap. For survivors to be able to modify the robots sent against them they would need a practical working knowledge of mechatronic engineering, artificial intelligence, computer science and so on.

In this article I endeavour to explore the relation between experience and 'know-how' as a 'tacit' form of knowledge, the role of enthusiasm in the production of 'know-how', and engage with the problem of the transmission of 'know-how'. Why is the transmission of 'know-how' a problem? If 'know-how' is a tacit form of knowledge, then there are difficulties imagining how it is transmitted through the media without becoming an 'explicit' form of knowledge. I shall turn my attention to the humble 'how to' article, as its primary purpose is the transmission of 'know-how'. My solution to this problem is to tease out the way 'know-how' is developed through experience and then to suggest that instead of transmitting 'know-how' itself, the 'how to' article presents the conditions of experience through which a reader or viewer can develop 'know-how'. I shall draw on relatively complicated conceptions of experience derived primarily from Gilles Deleuze's philosophy of transcendental empiricism.² There is an affinity between Deleuze's conceptualisation of the 'disjunctive synthesis' in the dramatisation of thought and the situational art of 'know-how'.³ Those unfamiliar with Deleuze's philosophy may find it perplexing, but I hope by drawing on relatively familiar examples such stylistic complexity will be less sharp.

Robocalypse is set in a near-future where robots are ubiquitous, so it is within reason, and the logic of the novel, that the huge number of consumer-market robots indicates that there must be an equally large number of 'robot mechanics' whose trade-based occupation is to repair and modify robots; perhaps this is Lark Iron Cloud's occupation? Wilson's background serves him well to address the problem of a potential 'know-how' gap. He graduated with a PhD from the Robotics Institute of Carnegie Mellon University in 2006 and presented a television show in 2008 called *It Works* where he explains how everyday socio-technologies (sneakers, guns, tattoos and so on) work. He is best known, however, for his series of books

dealing with *How to Survive a Robot Uprising* and *How to Build a Robot Army*.⁴ Wilson extrapolates from the present state of robotics research and presents a series of 'how to' aphorisms. The familiarity of Wilson's target audience with the 'how to' genre enables Wilson to use it as a discursive tool for framing the future potential of current robotics technologies. The 'how to' text is a form of popular journalism that seems to account for a large degree of material produced by the creative industries for subcultural, enthusiast or 'specialist' markets. Extending the contemporary composition of the creative industries into the diegetic world of *Robocalypse* presents another possible scenario where enthusiast 'know-how' could fill the 'know-how' gap. Similar to the way 1950s hot-rodders would share 'know-how' about automobile modifications through clubs and magazines, robotics enthusiasts of the near future would undoubtedly have a popular culture organised around understanding and modifying consumer robotics technologies that would then be pressed into service against the apocalyptic threat of their potential robot overlords.

Beyond the 'know-how' of a future robot apocalypse is the tricky proposition of situating a study of 'know-how' in a specific historical context. In the most general sense, 'know-how' has been the subject of philosophical investigation since ancient Greece, with a number of classical philosophies conceptualising different forms of knowledge, but beyond these focused perspectives complications arise because of at least the following three historical factors:

1. The emergence of modern education premised on the distinction between science and other knowledge producing practices. The 'purification' of knowledge into science is part of this shift.
2. The development of capitalist social relations and the emergence of organisational principles such as work, leisure and leisure-time activities such as hobbies and sport. There are further psycho-geographical issues here pertaining to shifts from agrarian economies and the emergence of modern cities.
3. Mass literacy and the development of the mass media, and later development of niche or 'specialist' media markets.

Each of these long duration shifts introduces historical discontinuities that means that the historical and geographical context of 'know-how' is very important. A

shorthand way to think about the historical context of 'know-how' is in terms of the relative distribution of necessity and contingency. In ancient Greece *tuchē* (chance) was often set against *technē* (close to contemporary 'know-how'), with humans understood as having the power to ward off chance through their expertise.⁵ Those that had the capacity for *technē*—the *technītes*—were distinguished from amateurs 'who although may on occasion produce impressive results, [are] (owing to his [or her] lack of fine-grained skill) more liable to make mistakes, and to be vulnerable to contingency'.⁶ The 'vulnerability to contingency' changes in character across the above three series of historical discontinuities. Taken from the perspective of contingency, political power is the capacity to stabilise contingent relations and control is performed through the distribution of contingency; what Galloway has discussed in terms of protocol as a 'technique for achieving voluntary regulation within a contingent environment'.⁷ It is not as if everyday life suddenly involved a greater degree of contingency for a larger number of people as compared to the past; rather, the quality of control has shifted from the distribution of agency to the relative capacity to ward off the deleterious effects of contingency and the associated entropic processes that burden all forms of life. The untested hypothesis I am drawing from the above set of assumptions is that individuals are increasingly burdened with the responsibility of developing individualistic expertise (as compared to collective or social forms), so as to increase their own capacity to act in contemporary neoliberal distributions of contingency.

The embodied forms of knowledge developed in the reader or viewer of 'how to' texts rely as much on the socio-technical objects being engaged with as much as the 'how to' text itself. In this context, my work is part of a much larger scholarly and philosophical debate regarding the tactile dimensions of discourse and its location in visual culture.⁸ On a diagrammatic level, the 'how to' text seems to reverse the historical 'separation of the senses' that Jonathan Crary isolates as a key quality of the emergence of the 'society of the spectacle':

[The] sense of touch had been an integral part of the classical theories of vision in the seventeenth and eighteenth centuries. The subsequent dissociation of touch from sight occurs within a pervasive 'separation of the senses' and industrial remapping of the body in the nineteenth century ... This autonomization of sight, occurring in many different domains, was

a historical condition for the rebuilding of an observer fitted for the tasks of 'spectacular' consumption.⁹

The tension between representations of 'the hands' (tactile) versus those of 'the eyes' (visual) is elucidated in Bruno Latour's investigation into the 'connective quality of written traces' and the way representation in scientific and engineering discourse developed from the perspectivism of 'descriptive geometry'.¹⁰ Latour isolates a similar historical division between the senses as Crary, but from a different perspective, focusing on the intervention of an abstract plane into technical perspectivism, so that vast machineries could be 'visualised' on paper by engineers and the like.¹¹

Another scholarly discipline that has a related set of interests with investigating the transmission of 'know-how' is technical communication. As Miles Kimball argues in his exploration of what he calls 'tactical technical communication', the field of technical communication has largely been preoccupied with an organisational or institutional context.¹² Kimball's use of 'tactics' is derived from his reading of Michel de Certeau's influential work *The Practice of Everyday Life* and de Certeau's observation of the historical separation of the craftperson's 'know-how' from the descriptive accounts found in formal technical documentation.¹³ In the introductory section of his article, Kimball suggests that most works of technical communication are written for an institutional context and aim to reproduce what de Certeau called 'strategies'. In this context, strategic technical communication aims to reproduce ideal narratives of the 'user-as-practioner', while tactical technical communication is produced from the experience of users using 'local narratives'.¹⁴ Kimball turns his attention to exploring 'tactical technical communication of user-producers' through 'enthusiast publications and their surrounding cultures':

Such publications are motivated not by institutional strategies, but by enthusiasm for the activity, technology, and embedded communal narrative of the subject matter. Researchers could examine any number of enthusiast subjects in this light.¹⁵

My concern is ultimately with the role of experience and enthusiasm in the production of 'know-how' and its subsequent transmission through media. Kimball focuses on the function of 'narratives' in framing the challenges that mobilise enthusiasts into action and then the character of these narratives operating on both

local and communal registers. I shall focus more on the affective dimension of experience in the development of 'know-how' and what part this plays in the transmission of 'know-how'. What I aim to demonstrate is that, simply put, 'know-how' is transmitted by exposing a subject to the conditions of experience through which 'know-how' is developed. This exposure does not happen 'in' the 'how to' text; rather, the text is used as a *primer of experience* necessary for the development of 'know-how'.

—THE 'HOW TO' TEXT AS PRIMER OF EXPERIENCE

The 'how to' text is an apprenticeship by proxy; a typical example leads readers through the procedural steps of engaging with what is most commonly a socio-technical system. The 'how to' article has a weird temporality as it captures future experiences by providing the conditions of past experience(s) that are nevertheless repeated (if the steps are actually followed) in different ways. What is represented is 'this' practice of engaging with 'that' technical system, but what circulates is the 'how' of the knowledge developed through the experience of doing 'this' to 'that'. I shall briefly engage with Jim Murphy's *Custom Car* as an example.¹⁶ Similar to Kimball's examples, Murphy's text is a slim book-length treatment of 'how to' build a modified car. It shares some of the explicit concerns of enthusiast magazines, but it sits just off to the side as it is a 'how to' text that incorporates how to use magazines and other 'how to' texts into the practical exercise of building a modified car. In terms of Kimball's concept of 'tactical technical communication', Murphy treats magazines and other similar publications as tools to assist enthusiasts in their endeavours. The six chapters of the book do not actually cover the technical 'nuts and bolts' of the project; rather, each chapter covers various socio-technical dimensions of 'know-how' including how to buy the 'right' car, how to plan the 'build', how to incorporate knowledge of technical documents into the practical aspects and how to reappraise the 'project' after it is ostensibly finished ('or is it?' Murphy enigmatically asks).¹⁷

The key passage of Murphy's text I want to examine is in the third chapter, 'Putting the Zip Back In', about carrying out modifications to the engine. Murphy writes:

The keys to assembling an engine are care and patience. Remember an engine is not unsolvable mystery; it's a bunch of parts that have been linked together one after the other. What's more, the people who build and repair engines aren't smarter than you; they've become skilled through putting engines together over and over.¹⁸

Murphy captures a sense of the multiple dimensions of 'know-how' in this passage. The practical act is premised on an affective disposition characterised by 'care' and 'patience'. The engine is a system of parts linked together in a way that is 'not an unsolvable mystery'; implicit here is both the recognition of the engine as a 'problem' and the assumption of functionality. Lastly, Murphy draws a relation between 'know-how' ('smart') and the development of 'skills' through the repetition of practices ('putting engines together over and over'). This brief passage functions as encouragement and is very different to the strategic narratives of technical manuals.¹⁹ Even in the more technical articles found in countless enthusiast magazines, there is a similar *affective tone* to what might be very technical discussions. The purpose of this brief passage in Murphy's book is not to relay technical information *per se*, but to prepare a subject for the experience through which he or she will develop 'know-how'. 'Know-how' develops in the body through experience and, after enough repetitions of a given practice, the subject of 'know-how' can be considered proficient enough at the given task to be described as an 'expert'. An appreciation of the way 'know-how' develops in experience is essential for properly appreciating the way 'how to' texts intervene in this process as primers of experience.

Bert Moorhouse's work on 'hot rod' enthusiasts indicates a way to discuss the complicated relation between engagement with socio-technical systems and relations of experience. He briefly touches on the shifting character of technology on a historical scale of practice for the entire hot rodding scene:

In recent years on-board electronics and electro-mechanical devices could be viewed objectively as commodities stripping away skill and, indeed, dealing the death blow to the mechanical basis of rodding. But this is not how they are presented to those who read the magazine. *They simply represent new challenges.*²⁰

The 'progress' of automotive technologies is understood by following an implicit 'evolutionary' model; it is not presented as a problem to 'fix', but as a *challenge* that *enthusiasts mobilise to engage with*.²¹ A 'challenge' defines more than the objective conditions of a problem. A 'challenge' has a curious ontology; similar to a 'problem' (in the non-Deleuzian, normative sense) it begs resolution ('meeting the challenge'), but it also has an explicit affective dimension ('rising to the challenge'). The concept of the 'challenge' is a useful way to think about a range of amateur or everyday practices that collectively involve some kind of practical and creative labour premised on an affective mobilisation. On the one hand, the conditions of experience for the development of 'know-how', such as a broken car, tonight's bourgeois dinner party or the contemporary rite of passage of buying your first home, have a concrete 'kicking-a-rock' and socially procedural reality. On the other hand, the experience exists only in relation to a 'problem' or 'challenge', which is fully real, but of a different incorporeal or virtual modality. I am using the term 'challenge' here partially because of Moorhouse's insight, but also for convenience.²²

The development of 'know-how' is part a process of iterative experience-based learning and part reflective practice of the selection of tactical elements from experience at the level of both consciousness and tacit embodiment. Moorhouse discusses 'know-how' in terms of the labour of hot rodding enthusiasts and its representation in *Hot Rod* magazine.²³ The affective dimension is clearly present in Moorhouse's analysis, to the extent that he discusses the labour of enthusiasts as something subjectively enjoyable and worthy of meaning. But again even this subjective dimension of affect is not the focus of his research, and his theoretical apparatus did not allow him to explore the dimensions of 'know-how' and enthusiasm that are of interest here. First, Moorhouse posits enthusiast labour as an ideological function of the 'work ethic' and a kind of moral valorisation of working-class leisure activities that, following Aristotle, is to implicate *technē* as part of *phronēsis* ('practical wisdom').²⁴

Second, Moorhouse's goal is to understand how particular meanings or 'ethics' become associated with particular 'works' and explores this problematic in hot rodding through the example of mechanical labour. The meanings of mechanical labour (of working on the mechanics of vehicles) are examined as 'presented' in specialist magazines and books of post-war US hot rodding.²⁵ He focuses on those

examples that emphasise ‘the importance of applying and testing knowledge in a practical, down to earth way’ to critique a conception of the modern ‘conspicuous consumption’ society, arguing that hot rodding was ‘more in tune with older virtues’.²⁶ Moorhouse is proffering a defence of working-class leisure-time labour and associated activities in the face of the ‘radical’ critique to ‘refer to ‘capital’ shaping ‘leisure’ and to dwell on ‘commodity provision’.²⁷ This ‘radical’ diagnosis of labour and exchange relations in terms of the dialectic between subsumption and antagonism is naive, but so is Moorhouse’s rearticulation of labour in terms of some alleged ‘work ethic’ as ‘presented’ in partisan enthusiast magazines. To use Foucault’s terminology, magazines are part of a popular *dispositif* of power relations that seeks to shape the scene in particular economic and social ways.

In his analysis Moorhouse isolates a tension between, on the one hand, the emphasis of the presentation in magazines ‘not simply on working metal but on theoretical understanding, scientific knowledge and designing skill,’ and, on the other hand, how theoretical knowledge was ‘not ... regarded as important in its own right; what mattered was its application’.²⁸ Moorhouse is noting a *circuitous* movement here from experience (‘down to earth’, ‘working metal’) to discourse (‘theoretical knowledge’) to experience (‘application’). I suggest that rather than a circuitous movement, the dynamic of abstraction and ‘in-action’ is best understood as an iterative process of the differential repetition of experience.

—‘KNOW-HOW’ AND THE TRANSVERSALITY OF EXPERIENCE

‘Know-how’ is not absolutely singular in a spatiotemporal sense. If I work on this car here today then depending on the character of my experience I am actualising virtual tendencies that were partially actualised possibly hundreds of times (and spaces) previously. A new ‘challenge’ or problem may actualise existing ‘know-how’ in new ways, thus the experience of the existing ‘know-how’ is repeated through its differences. The development of ‘know-how’ in the body is an *intensive* process and its sequence can be characterised by the series of ‘challenges’ the subject engages with; ‘to experience’ here is always at the same time ‘to experiment [*expérimenter*]’.²⁹ Key in Deleuze’s philosophy of transcendental empiricism is the process of disjunctive synthesis whereby the ‘problematic field ... conditions a differentiation [*différencier*] within the milieu in which it is incarnated’.³⁰ This is the

'milieu of the event'; what Brian Massumi calls the amodality of experience that is always 'in-relation'.³¹ According to Inna Semetsky, Deleuze argues these '[virtual] tendencies per se cannot be represented, they cannot be thought of in spatial terms—otherwise they turn into discrete multiplicities, betraying the notion of multiplicity as intensive and continuous'.³² I want to suggest that even though I agree with Semetsky that a spatial or even (linear) temporal appreciation of the 'virtual tendencies' apprehended by intuition is reductive, there is another way to gather congruent tendencies together that avoids thinking intensive multiplicity of problematics as discrete. This is to treat the virtual dimension as composed (or 'structured') according to serial problematics.³³

The differentially repeated experiences of 'know-how' are gathered around a *problematic contiguity*. That is, the differentially repeated events of experience, within which the subject of 'know-how' in-acts his or her capacities, forms a series that is *problematically* contiguous rather than spatially or temporally contiguous.³⁴ In philosophy, contiguity is a relation of proximity whereby elements of the relation are in contact with each other.³⁵ Spatial contiguity describes a situation whereby relations of proximity are determined by extensive distributions in space, such as distributions within a neighbourhood or city. Temporal contiguity describes a situation involving temporal relations of proximity, such as the notion of one's generation. These Aristotelian definitions of contiguity are attempts to account for the *extension* of elements in the world.³⁶ By shifting to a question of problematic contiguity I will address the *intensive* relations of *proximity* in the events of experience involving the development of 'know-how' across non-local spatio-temporalities that gather around a virtual and singular problematic. Put simply, two experiences are problematically contiguous when they are both involved in the development (as 'differential repetition') of 'know-how' and the 'how' develops across this serial problematic contiguity of experience. The problematic contiguity of integral events through which 'know-how' develops is part of the general 'migratory nonlocal linkage' of elements of experience operating on an amodal register.³⁷ Two experiences of a singular differentially repeated 'know-how' are *transversally* related, albeit differentially attuned to the specific conditions of experience in each repetition. 'Transversality' is the non-local, non-hierarchical proximity of a multiplicity of elements in relation.³⁸ I am using it here to think about

the complex movement within experience of elements from previously developed and future developing events of experience.

Establishing the problematic contiguity of experience is essential for, first, appreciating the way 'know-how' is developed through experience and, second, understanding the enabling role of 'how to' texts in this transversal movement. 'Developed' in this context does not mean only an initial intuitive apprehension of virtual tendencies, but includes the iterative and differentiating process of its repetition. Each experience is a differentiation of a previous (and, depending on the context, felt-tendency of a future) multiplicity of experiences. As soon as a given contingency of practice is anticipated, the process of the development of 'know-how' also becomes the procedure of its application. On the one hand, the 'accumulation' of experience is not a summative process, but a differential process. Experiences are repeated in different ways and the 'know-how' develops across a number of iterations through a 'disjunctive synthesis' of these differences.³⁹ Distinction between the relative quality of 'know-how' is not based on one person having 'more' experience than another; rather, they have a 'keener' (or 'duller') appreciation of a given state of affairs. On the other hand, it means that 'know-how' is never static; if it is being deployed, then it is always being *developed* by contemporary experiences integrated with the active and embodied memory of prior experiences.

Returning to the example of Murphy's 'how to' text on building a custom car, after the passage discussed earlier comes a brief step-by-step account of how to integrate the 'theoretical' knowledge of technical manuals and magazines with the practical act itself:

First, read the instructions in your books ['book' is also common enthusiast argot for 'magazine'] or the ones that came with the parts. Then read them again. Next, visualize the sequence of actions. You should read the instructions and visualize what will happen several times. When the procedures feel familiar, you're ready to begin the assembly for real. If you take your time and follow the directions precisely, you'll see an engine gradually take shape.⁴⁰

The visualisation Murphy describes is a practical act of the imagination, both in the 'mind' but also explicitly a *thinking through (of) the body* to become familiar with the movements required. Murphy may not have intended an ontological discussion of

such a practical act, but his use of 'for real' enables me to make an important point. The practical act and experience of the event 'to assemble' began before there was an engine to assemble and continued after Murphy apparently assembled the actual engine. The problematic contiguity of 'know-how' can be mapped across a number of transversally related temporal series. In Murphy's case these are signalled by the 1967 Ford Fairlane automobile, the 1969 *Muscle Parts* magazine, the other congruent temporal series of his technical editor's 'know-how', the multiple indeterminate temporal series of his various discussions at speed shops, enthusiast events and so on.

The *procedures* that Murphy describes are instantiated codifications of the *process* of thinking through the body; it is a superposition of prior and future experience to the degree that they come to 'feel familiar'. Massumi calls this 'forward projection of perception into latent action-choice' a process of 'possibilisation':

Each actual conjunction is a dynamic mixture of different orders materially combining the experience of the actually under way with possibilizing extensions beyond itself. The inextricability of the experiencing and the extension make perception an *analysis in action* and the perceived 'thing' a sensible concept ... The [object]-thing is all of the thought-perceptions in which it is implicated. Latent in the [object], as a thing 'in itself,' is its connectability with other things outside itself ... Perception, even before its thinking out, is a limited selection, an actualization of potential plug-ins.⁴¹

For Massumi, the production of explicit knowledge that can be codified in discourse as the subject of instrumental reason requires an operation of abstraction that 'thinks out' perception from an object.⁴² This is the work of science, as noted by Michael Polanyi (see discussion below), to apprehend objects and 'nature' as explicit knowledge. 'How to' texts are direct interventions into this process of possibilisation and the transversal movement of affect in experience at the level of perception and the modulation of affect that are both integrated into practical acts and the level at which such a practice happens.

—ENTHUSIASM AND 'BLACK-BOXED' SOCIO-TECHNICAL SYSTEMS

The affects of an enabling 'challenge' and the amodal affective dimension of experience come together in productive ways in Polanyi's work on the intrinsic role

of passion in the production of scientific knowledge.⁴³ Instead of a heuristic of doubt or a suspension of belief, Polanyi argues for a heuristic of passion premised on belief. Indeed, the way he introduced 'personal knowledge' and a philosophical conception of 'belief' into the production of scientific knowledge was not received well at the time of publication.⁴⁴ For Polanyi, 'intellectual passion' is an integral element in the process of scientific discovery and development of scientific knowledge. Polanyi's main point is that 'into every act of knowing there enters into a tacit and passionate contribution of the person knowing what is being known, and that this coefficient is no mere imperfection, but a necessary component of all knowledge'.⁴⁵ Affect is an essential element of 'know-how' as the subject of 'know-how' must be mobilised by active affects; what Polanyi called the 'passion coefficient' of knowledge above. According to Deleuze, passions furnish the epistemic associations of the mind with 'motives and dispositions to act, inclinations, and particular interests'.⁴⁶ In his discussion of explorers, Polanyi describes commitment to belief as an integral element of intellectual passion that is satisfied by discovery. The explorer enjoys a 'daring anticipation of reality'.⁴⁷ Polanyi suggests this creative dimension of scientific endeavour relies on a 'heuristic passion':

We have to cross the logical gap between a problem and its solution by relying on the unspecifiable impulse of our heuristic passion, and must undergo as we do so a change of our intellectual personality. Like all ventures in which we comprehensively dispose of ourselves, such an intentional change of our personality requires a passionate motive to accomplish it. Originality must be passionate.⁴⁸

Polanyi argues that the gratification of instinctual appetites (hunger, sex and fear) is a manner of verification. There is a parallel to intellectual passions in that 'all passions animating and shaping discovery imply a belief in the possibility of a knowledge of which these passions declare the value'.⁴⁹ That is, Polanyi suggests, a (not infallible) 'competence' of intellectual passions is to recognise truth. The satisfaction of intellectual passions is a kind of verification of discovery, as discovery 'terminates the problem from which it started' and 'leaves behind knowledge'.⁵⁰

The more general term I shall use to describe what Polanyi calls the 'passion coefficient' is *enthusiasm*. 'Enthusiasm' has been understood as a kind of quasi-

religious mode of subjectivity (or subjectivisation) and to the best of my understanding has not been explicitly discussed in the context of epistemology or related philosophies except in negative ways. Indeed, 'enthusiasm' has traditionally been understood as the enemy of rationality, evidenced in the way various philosophers of the Enlightenment era did battle to ward off 'enthusiasms' as a form of 'fanaticism' in the name of a higher rationality or ward off enthusiasm to make space for 'clearheaded thinking'.⁵¹ For example, the US-based grassroots direct action group the Tea Party is understood as collective political mobilisation born of a quasi-religious political enthusiasm.⁵²

Following Kant, enthusiasm is the 'idea of the good joined with an affect' leading to 'a state of mind that seems to be sublime', because enthusiasm is 'a stretching of the powers through ideas, which give the mind a momentum that acts far more powerfully and persistently than the impetus given by sensory representations'. Kant continues:

Only such a mentality is called noble—an expression subsequently also applied to things, e.g. buildings, costume, a literary style, a bodily posture, etc., if it arouses not so much astonishment (an affect in the representation of novelty that exceeds expectation) as admiration (as astonishment that does cease when novelty is lost), which happens when ideas in their presentation unintentionally and without artifice agree with aesthetic satisfaction.⁵³

I am approaching enthusiasm in a different way or, rather, treating Kant's insight into the aesthetic character of stretching the 'powers' not by ideas, but through the affective and problematic dimension of 'admiration' as an aesthetic disposition. This is closer to the way Erin Manning has used the concept of enthusiasm as a way to grasp how it is constituted as properly pre-individual in the field of expression; the enthusiastic is prior to the ontogenesis of an individual through expression:

It is not the human as pre-constituted who is enthusiastic. It is the field of expression itself that takes the shape of enthusiasm. Enthusiasm percolates at the very limits of sayability in the before of the subject or object as such. Enthusiasm as a movement-with that colours expressibility, giving a certain allure to the coming-to-expression.⁵⁴

Jean Francois Lyotard's interpretation of the Kantian enthusiasm also furnishes the concept with an integral role in the process of individuation; enthusiasm is an 'energetic sign, a tensor of *Wunsch*' that 'produces an *Affekt* "of the vigorous kind"'.⁵⁵ For Lyotard, enthusiasm signals the most 'improbable passage', that of an 'impasse' that is both a becoming and an overcoming.⁵⁶ What I have been describing as a 'challenge' is similarly both an impasse that enthusiasts overcome and the experiential passage of enthusiasm through which 'know-how' is produced.

The mobilisation of an enthusiast is an expression of a passion. Passion in this context does not mean a giddy excitement. More often than not it is a co-assembly of active affects that increase the enthusiast's capacity to act. There is a more complex point to be made here regarding the process of collective individuation and the properly impersonal character of these affects. The experience of enthusiasm is often the subjective experience of impersonal affects that an enthusiast shares with others. The opposite of enthusiasm is when a passive affective relation is assumed, such as in charismatic power relations. In the context of socio-technical systems, Jacques Ellul captures a sense of the passivity of non-enthusiast relations in his discussion of the co-adaptation of humanity through the incorporation of 'technique'. The expression of technique, Ellul argues, is the 'iron ring with which technique surrounds and localizes' the passionate sources of 'vital energy which might be summarized as sexuality, spirituality, and capacity for feeling'.⁵⁷ In the end, all 'attempts at culture, freedom, and creative endeavour have become mere entries in technique's filing cabinet'.⁵⁸ Ellul's assumption is that users of technology will necessarily allow themselves to become constituted as subjects characterised by a *passive* relation to technology. Ellul's pessimism needs to be challenged; humans do passionately engage with technologies, technical systems and various other designed objects, environments and practices. The passionate being of being human is now expressed and even induced through socio-technical systems.

Some direction is provided by Polanyi when he shifts from thinking about science to engaging with practical problems and compares the practice of the scientist to the 'technician' or 'technologist'. The scientist, in Polanyi's analysis, is concerned with the 'natural order', while the 'technician' or 'technologist', although working within a similar *framework of discovery*, has a far more *focused* heuristic passion:

He follows the intimations, not of a natural order, but of a possibility for making things work in a new way for an acceptable purpose, and cheaply enough to show a profit. In feeling his way towards new problems, in collecting clues and pondering perspectives, the technologist must keep in mind a whole panorama of advantages and disadvantages which the scientist ignores. He must be keenly susceptible to people's wants and able to assess the price at which they would be prepared to satisfy them. A passionate interest in such momentary constellations is foreign to the scientist, whose eye is fixed on the inner law of nature.⁵⁹

The constellation of interests organised around the focused heuristic passion of the technician is in part determined by the set of material advantages afforded by a technology; what Polanyi calls the rules 'taught to us by technology', the 'operational principle' of a given technology.⁶⁰ Subjects of 'know-how' have a tactical relation to these 'rules-as-operational-principles' designed into technological objects and reproduced through the stabilisation of socio-technical networks.⁶¹

Following Polanyi, the singular points of the system are isolated, so that an appreciation of the system develops as the 'particulars are noticed in different ways ... [first] we are aware of the particulars focally, in the second, that we notice them subsidiarily in terms of their participation in a whole'.⁶² The successful production of 'know-how' in the first instance is not measured by the production of (scientific) knowledge or even necessarily an understanding (although these may be part of the process), but *whether or not a given practice results in a technical system functioning*. Functionality is the enabling limit of the development of 'know-how'. While Polanyi is drawing on Gestalt psychology in his use of the term 'whole', I am suggesting an alternative understanding. Polanyi argued that 'inductive problem is an intimation of coherence among hitherto uncomprehended particulars and the problem is genuine to the extent to which this intimation is true'.⁶³ I am suggesting in the case of 'know-how' the coherence of a problem is determined by the functionality of the given socio-technical system. An *enthusiast* may pursue understanding beyond the function-limit of 'know-how', but this is not necessary for 'know-how' itself. Functionality is a limit for the development of 'know-how', but does not coincide with a 'form' of the socio-technical system with which the subject of 'know-how' engages. Rather, the subject of 'know-how' apprehends the singularities of the socio-

technical system (or perhaps even actualises them, which is the case for the artisanal plastic arts).

One way to approach the 'stabilisation' of these operational principles is in terms of the actor-network theory (ANT) concept of 'black-boxing'. The term 'black box' as it is used in this context is borrowed from technical fields where it refers to literally a 'black box' drawn around a complex component or part of a circuit diagram. Through 'black-boxing', one is allowed to disregard complexities of circuit, machinery or code assigned to the dynamics within the box.⁶⁴ 'A black box contains that which no longer needs to be considered, those things whose contents have become a matter of indifference.'⁶⁵ ANT uses the concept to refer to networks of action and distribution of agency that lead to technologies and facts becoming 'stabilised'. Madeleine Akirich suggests that stabilised technologies are those where the 'innovator' (as distinct to the 'user') is 'no longer present, and study of the ordinary user is not very useful because he or she has already taken on board prescriptions implied in interaction with the machine'.⁶⁶ To return to the example of Murphy and his custom car, he captures a sense of the 'black boxing' of technology when he notes that the car's engine is 'not an unsolvable mystery'.⁶⁷ For some consumers automotive technologies are 'black boxed' socio-technologies; yet, in the earliest automobile era vehicles were often sold with a set of tools and the expectation that consumers would carry out their own maintenance. Marc Frauenfelder notes that in the case of the Model T the burden of self-maintenance was not an 'unreasonable assumption on the part of the Ford Motor Company, because a large percentage of the people who bought Model Ts had experience maintaining farm machinery'.⁶⁸ In his history of auto mechanics, Kevin Borg similarly notes that the experience of farmers with agricultural machinery meant they had a 'willingness to go into a machine and "figure it out"'.⁶⁹ As I alluded to in the introduction, the historical specificity of 'know-how' means that an enthusiast working on a Model T now has a different kind of 'know-how' compared to the 1920s farmer working on the 'same' vehicle, because the socio-technology of the Model T is 'stabilised' in different ways.

'Know-how' is a practical epistemological tool for opening 'black-boxed' socio-technical systems through the overcoming of 'challenges'. The 'user' becomes an 'innovator', but one that does not have the same degree of technical mastery over

the design of the technical object, nor the same socio-political agency to stabilise socio-technical networks within which objects are (re)produced (as enthusiasts of obsolescent consumer technologies, such as the Model T, will attest). Unlike formal scientific or even professional engineering knowledges (although some, if not most, engineers, like those Latour describes, would reject this characterisation), subjects of 'know-how' have an ad hoc appreciation of technical systems. There is a common experience of enthusiasts the moment they come to appreciate what they consider are the general coordinates of a problem and face the prospect of attempting to fix or work on something they have not yet had to work on previously. This is a daunting experience and the moment when the 'black box' is truly 'opened'. On the one hand, engagement for the subject of 'know-how' proceeds by way of an assumed holism, where 'function' is necessarily an inference of the Gestalt performativity of parts. This is insufficient to account for 'know-how' being a practical knowledge, however, where the subject's dispositional co-assembly of affects is either affirmative (enthusiasm), diminutive (exhaustion, 'beat') or both at once (by degrees) and enjoin with the non-human affects of socio-technical systems (the 'stubbornness' of stuck window, the 'slickness' of a gear shift mechanism, the 'efficiency' of 'German engineering' or the 'finish' of a set of cutlery). In most enthusiast discourses, these non-human affects are described using technical terminology in a specific ironic or subcultural way. An appreciation of functionality is immanent to the appreciation of the system and the quality of 'know-how' that shapes the subject's engagement. Over successive iterations of situation the degree of appreciation of the system increases until a given subject has a 'working knowledge'.

—CONCLUSION: TURNING ENTHUSIASM INTO A RESOURCE

I have worked to demonstrate two facets of 'know-how' that need to be taken into account for a study of 'how to' texts. First, the experiential dimension of 'know-how' needs to be taken into account to appreciate the way 'know-how' itself is not transmitted. Rather, the conditions of experience are presented so they can be reproduced by the reader or viewer of 'how to' texts who can then develop 'know-how' through their own bodies. Second, the 'how to' text serves as a primer of experience for the development of 'know-how' in an affective sense. I have focused

primarily on the way contemporary consumer technologies are 'black boxed' and indicated that one of the functions of the 'how to' text is prepare readers or viewers for 'opening' black-boxed socio-technologies. There are many other ways that contemporary consumers are mobilised into action and this means thinking about 'how to' texts beyond the confines of the specialist or enthusiast media.

The weird ontological character of a 'challenge' means that anyone—an enthusiastic novice through to an 'old hand'—can mobilise to engage with the same problematic represented by the challenge, albeit actualised in sometimes very different ways and varying degrees of 'success'. The creative industries turn this mobilising force of enthusiasm into a resource by valorising some challenges over others as worthy of mobilisation and organising cultural events that serve as conduits of experience for the satisfaction of 'know-how'. Joseph Pine and James Gilmore turned the experiential dimension of the service economy into a general commercial program in their best-selling book *The Experience Economy*.⁷⁰ They gloss the ways businesses can exploit the labour of consumers by developing a model of commoditising feedback premised on the on-going 'mass customisation' of commodities by consumers.⁷¹ What they are actually describing is the extraction of surplus value from the creative labour of consumers.

It is surprising that Pine and Gilmore do not dwell on the importance of the media in modulating the affective dimensions of experience so as to not only be congruent with the enthusiasms of readers or viewers, but to also be congruent with the commercial imperatives of business. The anticipatory cycle of 'hype' for new products has become a well-known feature of many contemporary industries, in particular the computer and information technology sectors. Steven Jones dedicated a chapter of his book *The Meaning of Video Games* to exploring the phenomena in 'Anticipating *Spore*' and notes the importance of such anticipatory practices for gaming fans.⁷² More important to the commercial interests of the contemporary experience economy is the use of 'custom media' to help shape consumer experience. Turning enthusiasm into a resource is a powerful tool for companies operating in this 'experience economy', but it requires a careful balance between the circulation of active and passive affects of enthusiasm. The successful harnessing of enthusiasm means that, at a minimum, participants in the culture are willing to pay

for an experience they in part create through attendance, and in more elaborate examples actually produce the objects or practices that other participants consume.

The collective-individualising character of the contemporary experience economy has a problematic relationship to the necessities of the current political situation, where individual people, groups and nations are being challenged to respond to likely global ecological catastrophe. In the introduction I suggested that developing individualistic expertise in enthusiastic and often amateur forms of 'know-how' as compared to collective or social forms of everyday knowledge was one way to characterise the current composition of neoliberal power relations. How is it possible then to respond to collective problems when the mode of affirmative affective mobilisation is individualising by design? Wilson's *Robocalypse* is also interesting when compared to another recent post-apocalyptic science-fiction novel with a similar narrative structure, Max Brooks' *World War Z*.⁷³ *Robocalypse* and *World War Z* have different economies of knowledge in the ways 'know-how' is developed to respond to their respective apocalyptic threats (robots and zombies). *Robocalypse* is organised around valorising individualistic modes of engagement in the struggle against the apocalyptic robot threat. I've already mentioned Lark Iron Cloud, but there is another narrative thread organised around a Japanese robotics engineer, Takeo Nomura, who adores his robotic android partner, Mikiko. Nomura divides the robots in those that have 'good minds' and those that have (Archos-controlled) 'bad minds'. Mikiko has a 'bad mind' and through Nomura's efforts to 'cleanse' her (it?) of Archos' control he learns how to cleanse the industrial robots at his factory workplace. The layering of masculine control (over technology, over gendered technology, over women) is a topic worth exploring elsewhere, but here I want to emphasise the way Nomura's endeavours are framed as an individualistic struggle. *World War Z* documents a different kind of knowledge development (or 'innovation') whereby the surviving government authorities work (or, in some cases, fail) together so as to develop standardised ways of combatting zombies (standardised weapons, standardised military strategies and so on) in response to the apocalyptic zombie threat. *Robocalypse* follows in a great tradition of personifying innovative development, where even the 'villain' Archos is personified as a singular intelligence, while the personal dimension of *World War Z* is largely subsumed by the response required against the collective threat of mindless

zombies. Brook's novel is a follow up text from his 2003 *Zombie Survival Guide*.⁷⁴ Like Wilson's 'how to' texts about the robot apocalypse, Brooks covers zombie survival in amazing detail. An important difference is that Brooks advocates for *collective action* at every level from individual survival to military strategies for eventually overcoming the zombie threat. This is summed up in the single command: 'You should never go off alone.'⁷⁵ The pre-personal collective dimension of enthusiasm, involving the transversal movement of affect across and through bodies, is subjectively experienced as it 'develops' in the body, but I am indicating something else here regarding the relationship between contingency and necessity with my brief example of *Robocalypse* and *World War Z*. Collective action is necessary in the face of global ecological catastrophe, but are most people simply incapable of appreciating the collective dimension of the challenge? Everyday life in the experience economy is, in part, structured to enable consumers to passively enjoy their own enthusiasms, so the problem isn't mobilising enthusiasm in a greater cohort of the population. The problem is how to turn this enthusiasm into a different kind of resource.

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—NOTES

¹ Daniel H. Wilson, *Robocalypse*, Vintage, New York, 2011, p. 267.

² Gilles Deleuze, *Empiricism and Subjectivity: An Essay on Hume's Theory of Human Nature*, trans. C.V. Boundas, Columbia University Press, New York, 1991. Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton, Columbia University Press, New York, 1994, p. 180. Gilles Deleuze and Felix Guattari, *What is Philosophy?* trans. Gary Burchill and Hugh Tomlinson, Verso, London, p. 48.

³ Gregory J. Seigworth, 'Cultural Studies and Gilles Deleuze' in *New Cultural Studies: Adventures in Theory*, ed. Gary Hall and Clare Birchall, Edinburgh University Press, Edinburgh, 2006; Nathan Widder, *Political Theory after Deleuze*, Continuum, London, 2012, pp. 35–52; James Williams, *The Transversal Thought Of Gilles Deleuze: Encounters and Influences*, Clinamen Press, Manchester, 2005, pp. 15–34.

- ⁴ Daniel H. Wilson, *How To Survive A Robot Uprising*, Penguin Group, London, 2005; Daniel H. Wilson, *How to Build a Robot Army: Tips on Defending Planet Earth Against Alien Invaders, Ninjas, and Zombies*, Bloomsbury USA, New York, 2007.
- ⁵ Tom Angier, *Technē in Aristotle's Ethics: Crafting the Moral Life*, Continuum, London, 2010, pp. 37–8.
- ⁶ Angier, p. 4.
- ⁷ Alexander Galloway, *Protocol: How Control Exists After Decentralization*, MIT Press, Cambridge, Mass, p. 7.
- ⁸ Emilia Djonov and Theo Van Leeuwen, 'The Semiotics of Texture: From Tactile to Visual', *Visual Communication*, vol. 10, no. 4, 2011, pp. 541–64.
- ⁹ Jonathan Crary, *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century*, Cambridge, MIT Press, 1992, p. 19.
- ¹⁰ Bruno Latour, 'Drawing Things Together' in *Representation in Scientific Practice*, ed. Michael Lynch and Steve Woolgar, MIT Press, Cambridge, MA, 1990, p. 54.
- ¹¹ Although I do not have the space to explore it fully here, thinking about the relation between 'how to' texts and associated practices requires an appreciation of the 'tacticalities' of discourse in a similar fashion to the way Deleuze describes Foucault's concern with the 'visibilities' and 'sayabilities' of discourse. Gilles Deleuze, *Foucault*, Athlone, London, 1988, p. 47.
- ¹² Miles Kimball, 'Cars, Culture, and Tactical Technical Communication', *Technical Communication Quarterly*, vol. 15, no. 1, 2006, pp. 68–71.
- ¹³ Michel de Certeau, *The Practice of Everyday Life*, trans. Steve Rendall, University of California Press, Berkeley, 1984, pp. 69–70. Kimball, p. 73.
- ¹⁴ Kimball, pp. 70–2.
- ¹⁵ *Ibid.*, p. 74.
- ¹⁶ Jim Murphy, *Custom Car: A Nuts-and-Bolts Guide to Creating One*, Clarion Books, New York, 1989.
- ¹⁷ *Ibid.*, p. 86.
- ¹⁸ *Ibid.*, p. 32.
- ¹⁹ Matthew B Crawford, *Shop Class as Soulcraft: An Inquiry into the Value of Work*, Penguin Press, New York, 2009, pp. 176–9.
- ²⁰ Herbert Moorhouse, *Driving Ambitions: An Analysis of the American Hot Rod Enthusiasm*, Manchester University Press, New York, 1991, p. 161 (*italics added*).
- ²¹ Jennifer Daryl Slack and J. Macgregor Wise, *Culture + Technology: A Primer*, Peter Lang, New York, 2005, pp. 9–25.
- ²² A parallel that shall not be explored here is between Heidegger's discussion of 'work' and what I am calling a 'challenge' is the much celebrated and critically analysed passage where Heidegger suggests that:

What is peculiar to what is initially at hand is that it withdraws, so to speak, in its character of handiness in order to be really handy. What everyday association is initially busy with is

not tools themselves, but the work. What is to be produced in each case is what is primarily taken care of and is thus also what is at hand. The work bears the totality of references in which useful things are encountered.

The virtual dimension of a challenge can be actualised in any number of ways and across intensive and extensive degrees and scales. The problematic character of a challenge can subsist in discourse and indeed in socio-technologies themselves, but is also embodied through dispositional capacities of subjects of 'know-how'. Martin Heidegger, *Being and Time*, trans. J. Stambaugh, State University of New York Press, New York, 1996, p. 65.

²³ Moorhouse, p. 157.

²⁴ Aristotle, *The Nicomachean Ethics*, trans. D. Ross and L. Brown, Oxford University Press, Oxford, 2009, p. 1140a.

²⁵ Moorhouse, pp. 151–3.

²⁶ *Ibid.*, pp. 155, 157.

²⁷ *Ibid.*, p. 159.

²⁸ *Ibid.*, p. 154.

²⁹ Gilles Deleuze, *Negotiations*, trans. Martin Joughin, Columbia University Press, New York 1995, pp. 106, 197, endnote 13.

³⁰ Deleuze, *Difference and Repetition*, p. 207.

³¹ Brian Massumi, *Semblance and Event: Activist Philosophy and the Occurrent Arts*, MIT Press, Cambridge, Mass, 2011, pp. 109–15.

³² Inna Semetsky, 'The Role of Intuition in Thinking and Learning: Deleuze and the Pragmatic Legacy', *Educational Philosophy and Theory*, vol. 36, no. 4, 2004, p. 440.

³³ Gilles Deleuze, 'How Do We Recognise Structuralism?' in *Desert Islands: And Other Texts 1953–1974*, ed. David Lapoujade, Semiotext(e), London, 2004, pp. 178–84.

³⁴ Gilles Deleuze, *The Logic of Sense*, trans. Mark Laster and Charles Stivale, Columbia University Press, New York, 1990, p. 55.

³⁵ Max Eastman, 'To Reconsider the Association of Ideas', *The Journal of Philosophy, Psychology and Scientific Methods*, vol. 7, no. 6, 1910, pp. 155–8.

³⁶ Michael J. White, *The Continuous and the Discrete: Ancient Physical Theories from a Contemporary Perspective*, Oxford University Press, Oxford, 1992, pp. 26–9.

³⁷ Massumi, *Semblance and Event*, pp. 108–9.

³⁸ Charles J. Stivale, *The Two-Fold Thought of Deleuze and Guattari: Intersections and Animations*, Guilford Press, New York, 1998, pp. 18–19. Felix Guattari, *Molecular Revolution: Psychiatry and Politics*, Peregrine Books, New York, 1984, pp. 11–23.

³⁹ Widder, pp. 23–4.

⁴⁰ Murphy, p. 32.

- ⁴¹ Brian Massumi, *Parables for the Virtual: Movement, Affect, Sensation*, Duke University Press, London, 2002, pp. 91–2, 92–3.
- ⁴² *Ibid.*, p. 94.
- ⁴³ Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy*, Routledge, London, 1998 [1958].
- ⁴⁴ Mary Jo Nye, *Michael Polanyi and His Generation: Origins of the Social Construction of Science*, University of Chicago Press, Chicago, 2011.
- ⁴⁵ Polanyi, *Personal Knowledge*, p. 329.
- ⁴⁶ Deleuze, *Empiricism and Subjectivity*, p. 129.
- ⁴⁷ Polanyi, *Personal Knowledge*, p. 327.
- ⁴⁸ *Ibid.*, p. 151.
- ⁴⁹ *Ibid.*, p. 183. There is a strange parallel here, which I do not have the space to explore, with Alfred North Whitehead's philosophical concept of 'appetition' in thinking about intellectual striving as a process of the cosmos differentiating itself.
- ⁵⁰ Polanyi, *Personal Knowledge*, p. 183.
- ⁵¹ John Passmore, 'Fanaticism, Toleration and Philosophy', *Journal of Political Philosophy*, vol. 11, no. 2, 2003, pp. 211–22; Jon Elster, *Explaining Social Behavior: More Nuts and Bolts for the Social Sciences*, Cambridge University Press, Cambridge, 2007, p. 436.
- ⁵² Solange M. Guenoun, 'Parody and Politics of Incarnation: Jacques Rancière's Aesthetics of Politics and Michel Journiac's Body Art', *Parallax*, vol. 17, no. 2, 2011, pp. 8–20.
- ⁵³ Immanuel Kant, *Critique of the Power of Judgement*, trans. Paul Guyer and Eric Matthews, Cambridge University Press, New York, 2000, p. 154.
- ⁵⁴ Erin Manning, 'The Shape of Enthusiasm', *Parallax*, vol. 17, no. 2, 2011, p. 85.
- ⁵⁵ Jean Francois Lyotard, *The Differend*, trans. Georges Van Den Abbeele, University of Minnesota Press, Minneapolis, 1988, p. 167.
- ⁵⁶ Lyotard, *The Differend*, p.166.
- ⁵⁷ Jacques Ellul, *The Technological Society*, Vintage Books, New York, 1964, p. 415.
- ⁵⁸ Ellul, p. 418.
- ⁵⁹ Polanyi, *Personal Knowledge*, p. 188.
- ⁶⁰ *Ibid.*, p. 186.
- ⁶¹ Kimball, pp. 70–1.
- ⁶² Michael Polanyi, 'Knowing and Being', *Mind*, vol. 70, no. 280, 1961, p. 462.
- ⁶³ Polanyi, 'Knowing and Being', p. 465.
- ⁶⁴ Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society*, Harvard University Press, Cambridge, 1987, p. 2. Isabelle Stengers, *The Invention of Modern Science*, University of Minnesota Press, Minneapolis, 2000, p. 103.

- ⁶⁵ Michel Callon and Bruno Latour, 'Unscrewing the Big Leviathan: How Actors Macro-Structure Reality and How Sociologists Help Them to Do So' in *Advances in Social Theory and Methodology: Towards an Integration of Micro and Macro-Sociology*, ed. Karin Knorr-Cetina and Aaron V. Cicouvel, Routledge, London, 1981, p. 285.
- ⁶⁶ Madeleine Akrich, 'The De-Description of Technical Objects', in *Shaping Technology/ Building Society: Studies in Sociotechnical Change*, ed. Wiebe E. Bijker and John Law, MIT Press, Cambridge, Mass, 1992, p. 211.
- ⁶⁷ Murphy, p. 32.
- ⁶⁸ Mark Frauenfelder, *Made by Hand: Searching for Meaning in a Throwaway World*, Portfolio, New York, 2010, p. 25.
- ⁶⁹ Kevin L. Borg, *Auto Mechanics: Technology and Expertise in Twentieth-Century America*, Johns Hopkins University Press, Baltimore, 2007, p. 34.
- ⁷⁰ Joseph Pine and James Gilmore, *The Experience Economy, Updated Edition*, Harvard Business School Press, Boston, 2011.
- ⁷¹ Pine and Gilmore, p. 111.
- ⁷² Steven E. Jones, *The Meaning of Video Games: Gaming and Textual Studies*, Routledge, New York, 2008, pp. 150–4.
- ⁷³ Max Brooks, *World War Z: An Oral History of the Zombie War*, Three Rivers Press, New York, 2006.
- ⁷⁴ Max Brooks, *The Zombie Survival Guide: Complete Protection from the Living Dead*, Three Rivers Press, New York, 2003
- ⁷⁵ Brooks, *Zombie Survival Guide*, pp. 125–9.