

(In)tangible Arguments about Play, Creativity, and the Political Economy of 3D Printing: The Free Universal Construction Kit

Lone Koefoed Hansen* and Jan Løhmann Stephensen**

**Department of Digital Design and Information Studies, Aarhus University, Denmark, koefoed@cavi.au.dk*

***Department of Art History, Aesthetics and Culture, and Museology, aejls@dac.au.dk*

Abstract: With the increasing economic accessibility of 3D printers, the lessons learned and the logics cultivated on digital Web 2.0 now seem applicable to the world of material things. Released in early 2012 by the artist groups F.A.T. and Sy-lab, the Free Universal Construction Kit is a set of 3D drawings that enable everyone with access to a 3D printer to make connectors between intellectual property restricted toys like LEGO, Tinkertoys, and Fischertechnik. However, when describing this project as "reverse engineering as a civic activity", it becomes obvious that the Kit's greater agenda is not just to enable cross-over playing, but rather, to problematize and perhaps ultimately open up closed formats through critical appropriation. But how does that, for instance, conform with the fact that the connectors are parasitically attached to these toys, whose logic it is simultaneously defying? And which (implicit) notions of creativity and play are at stake in this project, and to what extent do they fit the more general philosophical underpinnings of this project?

Keywords: 3D printing, Intellectual Property Rights, Political Economy, Art, Critical Design, Appropriation, Creativity, Play

Acknowledgements: This research has been supported by Aarhus University's interdisciplinary research centre for Participatory Information Technology, PIT, and AU IDEAS Pilot Center The Democratic Public Sphere. Thanks to the anonymous peer reviewers for valuable feedback and insightful comments.

"The crux of prefigurative politics imposed substantial tasks, the central one being to create and sustain within the live practice of the movement, relationships and political forms that 'prefigured' and embodied the desired society" (Breines 1980, 421)

1. Introduction: The Free Universal Construction Kit, construction toys galore

Free Art and Technology, also called the F.A.T. Lab, is a group of artists, tinkerers, researchers, and hackers whose sarcastic yet functional projects comment on digital practices and phenomena in the broadest sense. Among other things, the F.A.T. Lab artists have produced cunning browser plug-ins for changing the content on web pages displayed in your browser, printable cardboard Google Glasses, fake media award shows, and happenings on Facebook.

Made in collaboration between Sy-Lab and F.A.T. Lab member Golan Levin, the Free Universal Construction Kit (figure 1) offers 3D printable adaptors to ten different proprietary toy systems, so that they can be combined in multiple variations. Distributed as 3D print files and not as actual tangible objects, the kit is available for free download via various online sources either as a collection or as individual connectors.

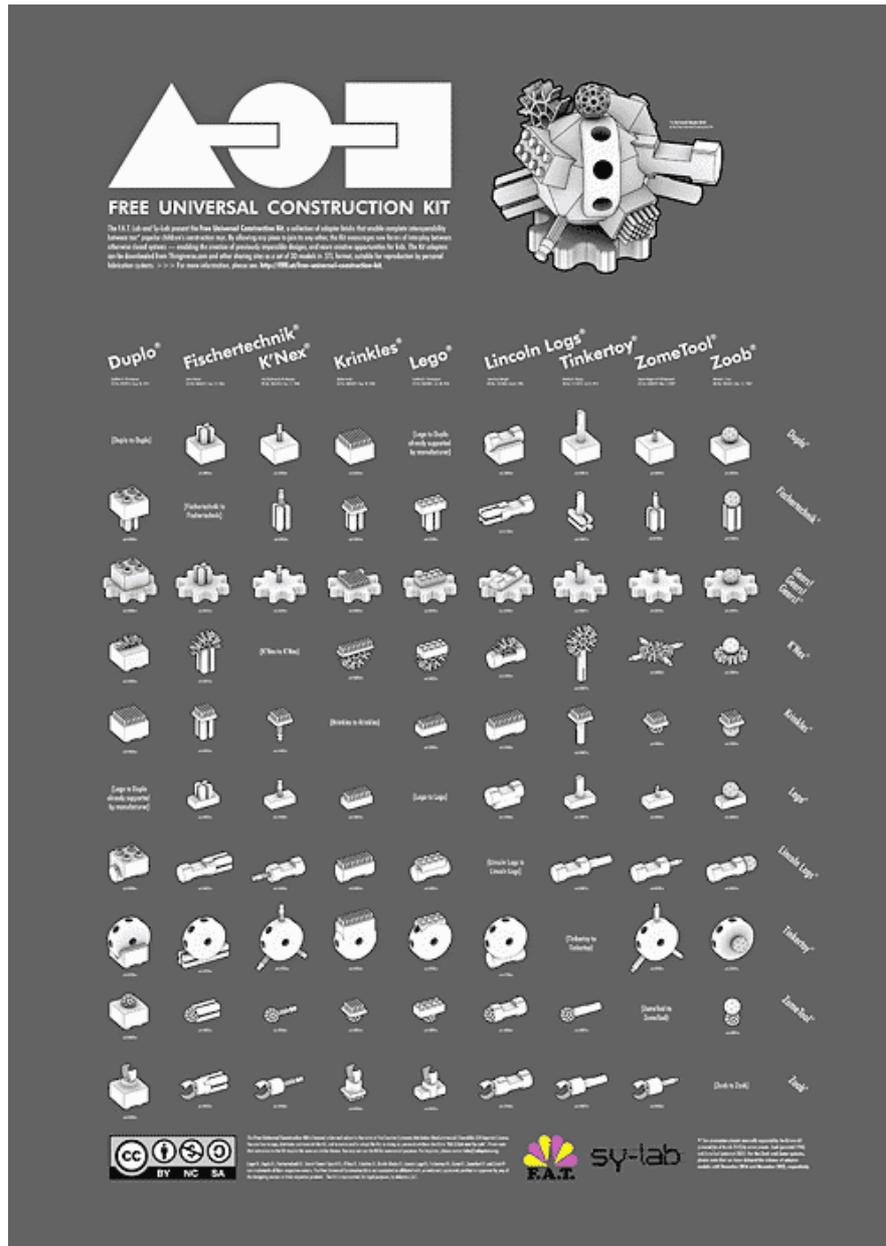


Figure 1: The Free Universal Construction Kit adapter matrix

The Free Universal Construction Kit comprises 80 two-way connectors and one so-called universal adapter—a “globe” connecting them all (figure 2)—that allow for connecting building parts from 10 different construction toy systems like LEGO, Tinkertoys and Fischer Technik.



Figure 2: The Universal Adapter Brick

On a utilitarian level, the Kit is quite simple: a set of toy objects made so that children can play by combining the various toys they already have. From the Kit's perspective, this more open way of playing and using toys is analogous with quality; as such, playing with toys in unintended ways that transgress the restrictions imposed by the functional architecture of the toy systems themselves is understood as liberating. Thus, it is essential for the project that the remix adaptors mediate between construction toy systems that are supposedly highly flexible themselves.

The fundamental principle and joy of construction toys is that every individual system allows for very flexible combinations within their own system. One of the thrills of for instance LEGO is that you can combine any brick with any other brick and thus build almost anything from the myriad of bricks available. But with very few exceptions (e.g. different subsystems of LEGO) it is impossible to combine bricks or objects from one system with another.

These barriers to “cross-brand interoperability” are what the Free Universal Construction Kit sets out to change, aiming to “stitch together” different kinds of toys, to become the suture in the remix or, as the website puts it, “a ‘meta-mashup system’ ideally provisioned for the creation of transgressive architecture and chimeric readymades.” (F.A.T 2012). In this way, the Kit uses what could be termed the “disruptive” technologies of 3D soft- and hardware (cf. below) to unleash the potentials for thinking out of the box by combining the systems and use each for what it does best, instead of compromising within each individual system.

2. Aim of the Paper

The question is, however, if this is the full story? In the following, we argue that there might be more to it than this. As with the other projects that the F.A.T. artists are part of, this project strikes a balance between that which is functional and that which is both satirical and critical. It is this balance that we will use as the guiding light in our discussion.

We will discuss how—by using the tactics of critical and speculative design—the Free Universal Construction Kit is not only a set of fun adaptors that enrich the activity of play, but is also using the notions of play, creativity and the highly hyped technology of 3D printing to pose a critique towards contemporary digital culture and its political economy. The structure of the paper is as follows: After presenting the project as well as its conceptual background in greater detail, we discuss how the kit can be understood as a particular type of cultural critique as we dig deeper into details concerning 3D printing, distribution channels, IP legislation, design practices, and (implied) notions of creativity and play. All these components form

the complex, yet basic critique that is manifested in the Free Universal Construction Kit. A critique, which highlights that even in the world of toys, a playful attitude to cultural production is seemingly only allowed on some levels, namely, those that do *not* include the infringements of IP.

3. 3D Printing, How it Works and Some of its Effects

A homemade revolver, a duck with an artificial leg, a human skull implant, a blue or pink gift-box containing a print of your baby's ultrasound scan, or a situationist chief ideologist Guy Debord doll in a colour of your own choice. Every day brings new and curious examples to the surface, and the (disruptive) potentials of 3D printing seem endless. Combined with the rising numbers of FabLabs and MakerSpaces around the world, the many ways in which 3D printing currently features in the press tell a story of a technology on the rise.

While many examples are indeed mind-blowing, 3D printing's specific use value currently seems less important than what it represents rhetorically speaking: discussed in ways that bear resemblance to the rhetorics of a gold rush, 3D printing promises unlimited possibilities for those who seek it—there seems to be no end to the useful benefits and in the rhetorics of the media we are only just now seeing the beginning of what will soon be possible. The enthusiasm with respect to 3D printing happens both on a small scale (the limits of what can be printed), and on large-scale national educational ambitions on preparing the younger generation for the future of economic production (for instance the FabLabs4America project). In this rhetoric, 3D printing is changing (substantial parts of) the world as we know it. The current focus on the disruptive potentials of 3D technologies fuels the attention towards the Free Universal Construction Kit, and it is a current example of how clever use of contemporary hyped technologies leads to massive attention and often critical acclaim both in the popular press and within the worlds of art and critical theory. Similarly, the conception, making and existence of the Kit is also in tune with the current attention towards 3D technologies—the Kit is part of this hype just as much as it is a response to it.

Returning to the physical reality of 3D printing itself, the practical aspects are as important as they are easily explained: Objects are printed in plastic, wood, paper, or other substances that come in a granular form and become solid with either chemicals, water or heat. 3D prints are distributed as files that can be fed into the printer and the files describe only the surface geometry. Obviously, this then leads to customization by the person printing it, who will adjust parameters of structure, colour, material, etc., although this adjustment can be more or less important and intentional.

In industry, the 3D printing technology has been important for a long time for customizing equipment, for prototyping, or for making hands-on models of micro-scale structures. The current hype relates to the increased domestic or small-scale use, as also Anderson argues in his book *Makers* (2012). Similarly, the reasons for making FabLabs is that individuals will benefit greatly from access to and familiarity with 3D printers, for instance for making spare repair parts, but also as a part of what will be expected in the future.¹ While 3D printers were incredibly expensive and only available for professional customers a few years ago, this changed with the affordable MakerBot specifically marketed for small-scale settings, including homes.² The MakerBot meant a giant leap in accessibility, and soon other brands fol-

¹ The convenience/necessity of being familiar with the process and technology of 3D printing is often being presented as a kind of individual, educational “future proofing”, which—much like broader discourses on the necessity of adapting technological change on a societal scale—“confers the ability to ride the waves of creative destruction” (Knights et al. 2002, 108–110). In other words: a discourse which itself quite clearly contributes to the construction of a shared set of social expectations about the future of technology and business (that it claims to merely portray), often by simultaneously evoking the bleak alternative of “falling behind” (ibid.).

² Although it could be argued that too much attention perhaps has been given to just the MakerBot, which obviously draws on—or perhaps even recuperates—all the previous work on alternative 3D printers done by various hobbyist/maker-communities, it is the MakerBot that has come to stand out as the game changing machine (see also our comments on the so-called RepRap below).

lowed with more affordable models than the professional ones. Following the rapid price drop of small 3D printers, new business models emerge, when also print shops feature 3D printers and consumer-to-consumer website services connect printers and the public (for instance at the website <http://www.makexyz.com>).

4. A Method of Multiple Analyses

In the main body of this paper, we will analyse the Kit from four different perspectives. The purpose is to show how, on the one hand, the Kit is obviously made for children since it connects children's toys, while, on the other hand, it must be equally obvious that this perspective does not suffice; the Kit is multi-stable and needs several independent perspectives in order to be analysed properly. Thus, we begin by understanding the Kit from a children's toys perspective and as this falls apart, we introduce the other perspectives. This first perspective is important, though, in order to understand why the three other perspectives are necessary, when the Kit materialises from the analysis as a complex, culturally situated design project that is in itself contradictory and perhaps also holds its own critique, deconstructing itself the more you—or we—look at it. While some of what we write in the following will possibly have been conceived by the artists/designers themselves, some of it will also be speculative on our behalf, or even critical towards what we read and hear the designers say, write, and do. The purpose is, however, not to diminish the design. Rather, we wish to unfold its cultural and political potentials for a critique that is both constructive and fun.

5. Toys and Play

Children feature prominently in the promotional videos for the Kit. However, even if “cross-brand interoperability” sounds intriguing to most adults (at least those prone to critical theory), this isn't necessarily what children themselves want. In the following analytical perspective, we wish to discuss for whom this project is beneficial (or fun) by taking the Kit's claims at face value: that this project is made so that children can play differently and perhaps also better/freer.

In various ways, construction toys as such seem to embody a particular form of play; they are bearers of a particular conception of how adults understand the “function” of play and toys—and subsequently perhaps also of how they understand children. In *Mythologies* (1957) Roland Barthes for instance famously noted, that when we start paying close attention to mundane things like (in his case, French) toys, we find that they,

are essentially a microcosm of the adult world; they are all reduced copies of human objects, as if in the eyes of the public the child was, all told, nothing but a smaller man, a homunculus to whom must be supplied objects of his own size. [...] French toys always mean something, and this something is always entirely socialized, constituted by the myths or the techniques of modern adult life: the Army, Broadcasting, the Post Office, Medicine (miniature instrument cases, operating theatres for dolls), School, Hair-Styling (driers for permanent-waving), the Air Force (Parachutists), Transport (trains, Citroens, Vedettes, Vespas, petrol-stations), Science (Martian toys). (1991, 53)

The point of this mimetic reproduction of the adult world and its functionality in children's scale is, according to Barthes, the ideological naturalization of everything the adult “does not find unusual: war, bureaucracy, ugliness, Martians, etc.” (ibid.) Things, which Barthes obviously thinks we should consider strange.

There is, however, another category of toys, namely: building blocks, which allow children to invent forms themselves. The crucial difference is that these toys seem to imply a completely different normative anthropology, that is, a completely different implicit understanding of what adults and children are, how they fit into the world, and not least: what and how they should or could be:

The merest set of blocks, provided it is not too refined, implies a very different learning of the world: then, the child does not in any way create meaningful objects, it matters little to

him whether they have an adult name; the actions he performs are not those of a user but those of a demiurge. He creates forms which walk, which roll, he creates life, not property: objects now act by themselves, they are no longer an inert and complicated material in the palm of his hand. But such toys are rather rare: French toys are usually based on imitation, they are meant to produce children who are users, not creators. (ibid., 54)

Barthes primarily discusses, what the straightforward, intended functionality of the toys means and what kind of activity they invite; or if we were to put it in Actor Network Theory-terms: how they are “scripted” (Akrich 1992). In contrast, as we will delve further into later, FAT-Lab is primarily interested in the even more subtle mechanisms of the world of toys and its politics of things, especially its political economy (models of ownership, legal issues, circuits of distribution, etc.).

Those differences aside, the passages in which Barthes in positive terms discusses the building blocks as “dynamic forms” that “appeal to the spirit of do-it-yourself” (ibid., 53) have obvious similarities with the way construction toys, play and children are being talked about in relation to the Kit, where phrasings like “everything should be connectable” and “the fewer limits the better” seep through the descriptions of the project. The connectors are clearly inscribed as liberating for the child playing with them, aligning the Kit with a substantial educational aspect: by including these connectors in play, the child will be liberated in his/her thinking. The Kit and its paratexts—that is, all the explanatory texts, videos, etc. that frame the objects (Genette 1972), in this case especially on FAT-Lab’s home page (F.A.T. 2012)—are inscribed in the belief that there is more to a toy than fun in both a practical and a social sense; toys also aid physical and mental development as well as convey ideological and cultural norms. Along comes the Kit and challenges the world of toys as we know it by providing us with a more democratic alternative than a world where even the “free-play” construction toy systems restrict play by only being compatible within their own system.

Barthes and FAT-Lab thus both seem to share the basic assumption that certain kinds of freedoms and restrictions to play also mean certain kinds of social “training” (or perhaps even *Bildung*). However, as intuitively correct that might sound, things are more complicated. In his book *Toys as Culture*, renowned toy and play researcher Brian Sutton-Smith argues that contrary to popular belief—introduced by John Locke in the 17th Century and still highly discernible in the discourse of parents as well as in popular press, marketing material, and even academic literature—research has not been able to document that play objects really are vehicles for “telling” children how to interpret the world and make lasting ideological or developmental imprints in this way. Sutton-Smith states that generally, some toys are understood as “better” than others and that many of these toys promote active, educational play like Lego and other blocks (1986, 125). However, even if some believe that “a child’s play may be the source of its future creativity, its future innovation and its future unique role in the world [...] there is no need to confuse imagination or creativity with play. They may well be correlated, but they have quite distinct functions in human adaptation.” (ibid., 227) According to Sutton-Smith, the idea that playing with (particular) toys play a crucial role in the development of a child “lies more in our own cultural desires, than in any well-established collection of scholarly information” (ibid., 124).

Refuting the “progress rhetorics” of play that states that play is the cause of positive developmental outcomes (1997, 36ff), Sutton-Smith repeatedly shows how also objects that we would think had a relatively fixed meaning can actually be played with in myriad ways and explains—much in line with how Barthes describes how only the scarce “good toys” can be played with—that his studies show that to children “the toys are only a means to some larger imaginative representation [...] the toys are reduced to agencies of their own activity” (ibid., 192ff). Furthermore, children’s play tends to build on previous play and everyday activities, to follow its own rules and it tends to be structured according to more or less fixed patterns. The act of playing is very often repetitive and conformist, reproducing and sharing stable sets of routines, artifacts, values, and concerns (Corsaro 2011) and does not equal a creative act as such (cf. the above quote from Sutton-Smith 1997, 227).

Sutton-Smith finds all children's play (potentially) creative and explorative,³ but it also seems to happen within certain (self- or peer-inflicted) frames, even if it often also interprets and (re-)negotiates those frames. This is the case with "ordinary" play as well as play with construction toys. In this perspective, it is not at all certain that children will find the intercompatibility between toy systems all that interesting, as this will 'break with the rules' as well as mess with the cultural narratives about when children would want to play with which toys, as we will address later. However, there is no doubt that rhetorically—even if they often come in kits designed to allow for particular things to be built—playing with construction toys also means to be explicitly encouraged to build objects and worlds that the designers had not envisioned.⁴ Of course, children often do build imaginative objects of construction toys. But as both Sutton-Smith and Corsaro argue, they also do this with toy objects that are not made in the construction toy tradition that for instance Barthes found so compelling. Furthermore, this does not mean that children will find it extraordinarily attractive to be able to combine different systems; the limits of each toy system can, so to speak, also be seen as part of the rules of the game.

6. Toys for Different Ages (Kids vs. Adult Tinkerers)

While children's play is the object of the Kit's presentation material, it seems to cover only part of the story. The Kit makes better sense if not thought of as a project only directed at children's ways of playing but also—possibly even predominantly—directed at the adults who respond to the "liberating" potential of these toys. The connectors would seem to be at least as interesting for the adult tinkerer as for the child at play, and also adults play with construction toys. Construction toys in particular have a close link to the ways in which the curious nerd or tinkerer approach the world. To the tinkerer, construction toys are brilliant because they carry with them immanent notions of play and creativity that make them appeal not only to children, but also very much to the adult with a "playful mind".

Many of the toys that are "serviced" by the Kit are also used in projects made by adults. Examples of adults using these toy systems to construct advanced machines are many, for instance K'nex (e.g. The Binary Calculator⁵ and The K'nuter: K'NEX Computer⁶), numerous Fischertechnik Marble Sorters,⁷ a Tinkertoy Computer,⁸ and a LEGO Turing Machine.⁹

Given the fact that Lincoln Logs and Duplo bricks (LEGO for toddlers) are also included in the series next to much more complex toys, it does, of course, still make sense on some levels, when the Kit's paratext claims that "the Free Universal Construction Kit makes possible new forms of 'forward compatibility', extending the value of these systems across the life of a child" (F.A.T. 2012). According to this line of thought, the adaptors and the "cross-brand interoperability" they offer simply annul the obsolescence of the specific toys—be it planned, accidental or possibly "natural" to growing up¹⁰—turning their inherent "diachronic incom-

³ In this juxtaposition, Sutton-Smith obviously uses the term 'creative' in a certain, restricted sense, namely as so-called "heroic creativity", which does not encompass the different current meanings of the word (cf. herein below on these different notions).

⁴ This is also the "morale" of LEGO's blockbuster *LEGO the Movie* (2014), in which the protagonist Emmet Brickowski (mistakenly thought to be "the Special") joins forces with other 'free builders' in the—tongue-in-cheek-eudipal, it turns out—battle against the tyranny of building by instructions enforced by President/Lord Business and his dreaded tube of glue, who wants to inhibit free creativity and fix things the way they were originally planned.

⁵ <http://www.youtube.com/watch?v=Tf6K7lktvGE>.

⁶ <http://www.youtube.com/watch?v=rdT1YT9AOPA>.

⁷ http://www.youtube.com/watch?v=4RFQ_wel_I.

⁸ http://www.retrothing.com/2006/12/the_tinkertoy_c.html.

⁹ <http://legoofdoom.blogspot.com/>.

¹⁰ The issue of children out-growing their toys is, of course, an old one. In his study from the late 19th Century of the "Amusements of Worcester School Children", author T.R. Croswell quoted a girl aged 13, who said that "My favorite toys are dolls, but I do not use them very much because I am getting too old for them", and much in the same vein a boy aged 11 stated that "The reason I like to play with these toys, [is that] these are toys for bigger children and the others are for babies and other small

measurability” into some kind of relatively unproblematic “synchronic” co-existence. Thus, as children grow up, it will be possible for them to include the toys they already have in the new toys suitable for their age.

This means that there is a certain ambiguity at play. On the one hand, the Kit is a project that renders itself available for an analysis as a project helping children to play better (that is, freer). But on the other hand, it clearly endorses a more adult perspective, which not least involves a tinkerer/geek perception of play as creative cross-platform production; hence also the accompanying discourse highly imbued with the notion of *transgression* as a preferable phenomenon, which is propagated in a rather “adult” tone:

the Kit encourages totally new forms of intercourse between otherwise closed systems—enabling radically hybrid constructive play, the creation of previously impossible designs, and ultimately, more creative opportunities for kids (F.A.T. 2012).

Both the argument and the rhetorics of this passage does point to the Kit as a project very much directed at adults. Forward (or backward) compatibility is really only interesting or desirable, if you have already reached an age where you no longer need different toys as a marker of how old you are (cf. for instance the transition from DUPLO to real LEGO as a “rite of passage”).

Yet, even among the grown-up toy users in the co-creative communities of fan culture, like for instance the so-called “AFOL” (Adult Fans Of LEGO), that organise event series like “Brickfair”, it is not everyone who is keen on this kind of transgression of toy boundaries at all:

For trademark reasons, we call ourselves ‘BrickFair.’ But be clear, this is a *LEGO* festival! Within the adult LEGO community certain leeway is collectively agreed upon regarding other modelling mediums, such as string or rubber bands, engraved LEGO brand bricks, and even custom AFOL-created bricks designed specifically to resemble LEGO. However, Mega Bloks, K’Nex, Lincoln Logs, Playmobil, and the like, are *not welcome*. (Brickfair 2014)

But as the critical argument would probably go, maybe these AFOL have just been too well trained as mono-system consumers. Why else would they accept solutions that derive from outside the toy systems sphere (like rubber bands), but not ones from competing brands?

So, to sum up, the Kit is not only functionally relevant. This is not just a set of connectors that will actually make a difference in (children’s) play. Something else is at stake, and by only taking the Kit’s statements at face value, we will miss most of its critical power. Because—as we will argue in more detail below—by using the Kit as a (vehicle of) critical, perhaps even political, “statements” or “arguments”, the constructors come to mean something very different than what their immediate materiality suggests, thus deeply transforming the kind of interaction they hand out invitations to. Because if play in general could be meaningfully understood as an activity that is primarily characterised by being “alienated to goals, production, and other basic labor-intensive chores” (Rochat 2013, 105)—or in other terms: play as quint-essentially different from the world and logics of instrumental reason and labour—then the Kit (given that we were to perceive it as a mere plaything) would actually somehow re-align the world of play with those very activities, and that kind of mind-set, to which it is supposedly Other. Or in Barthes’ terminology: even construction bricks—at least these particular ones—have now come to “mean something”, and this something has very much to do with “modern adult life” (op. cit.). They have become political symbols or tokens, and this in quite an adult way.¹¹

children.” (Crowell 1899, 353) Nonetheless, it seems obvious that making age-specific toys—just like making toys that easily break—has become a much more intentional strategy among toy producers than previously.

¹¹ In fact, by operating in the domain of toys, play and childhood, the Kit has the potential to become even more politically charged; much like the performance in 1967 by King Mob, the British section of

These are some of the paradoxes we would run into, if we were only to treat the Kit as a project related to the realms of toys and play alone. Thus, in the following parts of this paper, we will delve into three different, but interconnected perspectives looking into how the Kit seems to use its status as a design object to engage in a critical or conceptual as well as political discussion concerning political economy, creativity, IP and patents, especially in relation to 3D printing. The purpose of the following analysis through three different perspectives is to shed light on how the Kit (also) appears to be a kind of material argument in a general critique of the ways that Western societies are organized with respect to these matters. The project seems to oscillate between being objects of useful design and of critical art. Through being useful for play—regardless of by children or adults—the connectors also pose a critique of the very framework, structure or conditions of play in particular and of culture as such. One purpose of this article is to engage further with this discussion in several ways, and we will continue this exploration below.

7. The Political Economy of 3D printing: Two Trajectories

In *Makers: The New Industrial Revolution* (2012) Chris Anderson argues that the advent of the MakerBot has changed not only 3D printing, but will even change how we understand much greater issues like our own agency to things and objects, production and economy, etc. There's a new kid in town called 3D printing, and it fuels a new industrial revolution that will change the complicated and sometimes quite laborious, capital-based manufacturing into a process of DIY entrepreneurial creativity which holds much fewer obstacles on the way from invention to entrepreneurship, is the gist of Anderson's claim. Although explicitly referring to Karl Marx's call for control over the means of production as a way of overcoming capitalism (Anderson 2012, 26), Anderson still understands this development as an addendum to what he himself previously has labelled "the long tail", which describes how the Internet is creating new markets for niche products well within the confines of existing capitalism (Anderson 2006). So, like any other object, home-printed 3D objects will in Anderson's view certainly still be part of the capitalist circuits of economic exchange, no matter how special it may be in other respects.

Conversely, others have suggested that perhaps 3D printing will on a more profound level "disrupt established patterns of mass-production, mass-consumption and global distribution networks", as Söderberg and Daoud (2012, 66) sum up the politico-economic tenets of other parts of the 3D printing community, thus perhaps ultimately freeing atoms (physical goods) to the same extent that bits and information (arguably!) have been freed at fringes of the digital economy. This more radical view on the disruptive potentials of 3D printing is especially related to the so-called RepRap—an abbreviation of (self-)replicating rapid prototyper. This forerunner to MakerBot was an open hardware project—like MakerBot also used to be—aimed at developing a really cheap printer; but not just one that could print a lot of other (mostly) useful stuff, but one that even would be capable of printing its own key components (including its own circuit-boards), which you could then assemble into a new working RepRap yourself. Obviously, this has—or at least: can easily be thought to have—quite revolutionary consequences on a number of levels, especially regarding issues like ownership and/or access to the means of production. We put this in Marxist terms; and we did this not by coincidence, since interpreting the socio-political potentials in terms of this kind of rhetoric is quite common among the members of the RepRap hardware hacker community and its commentators. According to this line of thought, the successful invention of a fully self-replicating 3D printer would mean that access to the means of production would be radically liberated and/or democratized, which places the RepRap as some kind of revolutionary machine vis-à-vis proprietary capitalism. A fact—or an interpretation of facts—which has

the (anti-)art movement Situationist International, who entered the Selfridge's store in London dressed up as Santa Clause, taking down random toys from the shelves and giving them away as 'presents' to children. A political performance, which peaked when the Police was forced to arrest Santa and take back the presents from the children. This performance was repeated by the Danish happening group Solvognen in 1974 and again in 2006.

spurred some figures within the RepRap-community to even sharpen the conflict with the intellectual rights regime, by setting up the so-called “Product Bay” (ibid.)—an object/atoms-oriented parallel to well known “The Pirate Bay”.

Although less high strung than the most revolution-inclined RepRap’ers, Chris Anderson also insists that 3D printing and the so-called Maker-culture is part of nothing short of a new industrial revolution. Although skipping the claim that 3D print will cause the disruption of the current hegemonic model of political economy *tout court*, the effects are still profound. Not only does this Maker-revolution, according to Anderson, transform the processes of innovation, production and diffusion; it also fundamentally changes the roles of those involved in the whole process—and their relation to each other. New forms of consumers will, for instance, emerge. Describing an afternoon with his daughters who wanted to add furniture from the game *The Sims* to their dollhouse, Anderson tells how they

went to Thingiverse, an online repository of 3D designs that people have uploaded. And there it was, just like *The Sims*. Every furniture type we would want, [...we] resized them with a click to perfectly fit our dollhouse scale, and clicked on “build”. Twenty minutes later we had our furniture. (2012, 62)

Stressing how consumers, producers and designers are merged into a new form of consumer, Anderson argues that databases like Thingiverse will become as important to the “object industries” as online sharing systems (legal as well as illegal) have been to the music industry: “We may never buy dollhouse furniture ever again. If you’re a toy company, this story should give you chills”, Anderson concludes (ibid.). In other words: the DIY (Do It Yourself), BIIT (Be In It Together) (Ackerman 2013) or DIWO (Do It With Others) ethic and culture of *both* the Maker-movement *and* the RepRap-community seem to be in perfect tune with other contemporary conceptualizations of the new, transformed or blurred relationship between production on one side, and on the other: consumption/use. Thus—with varying inclination and radicality, of course—they both represent aspects of those new processes of “prosuming”, “prosumption” or “produsage” (Toffler 1980, Ritzer and Jurgenson 2010, Bruns 2008, etc.), which has also been labelled “co-creation” (Pralhad and Ramaswamy 2002) and “social/commons-based peer production” (Benkler 2006) in one end of the ideological register (where Anderson is also placed); and in the other: a kind of praxis which could be conceptualized on par with the “knowledge communism” of Gorz (2010) or the “virtuosity of the multitude” and “the social factory” of Hardt and Negri (2004), Virno (2004), and likeminded theoreticians.

Both positions, however, seem to overstate their point. The socio-political importance of the RepRap can perhaps primarily be seen as a symbolic intervention, a hint of another world that might be possible. In practice it seems very unlikely that it—even in the future—will have any greater subversive effect on capitalism. Given this, one might argue that it is Anderson’s vision that seems the most realistic of the two: 3D printing will certainly produce new kinds of business models, and it will certainly challenge old models—and to the regret of some, if not many, it will not constitute any fundamental challenge to capitalism. The problem with *his* vision, however, is rather the magnitude of this change. In a sense it all comes down to how a quantitative change can bring about a qualitative shift of paradigms, in this case “a new industrial revolution” *per se*. Because his fundamental argument is quantitative: all the lessons learned in the world of bits, which—despite the hyped rhetoric of the hegemony of post-industrial immaterial economy—only is a rather small part of the overall economy (cf. Huws 2003, Wright 2005, Maxwell and Miller 2012, Gabrys 2011), will only have a revolutionary impact, when the rest of the economy, that is, the world of production/manufacturing in the world of atoms and physical goods, is fundamentally affected. Only then will it surmount to a qualitative change, that is, the new industrial paradigm of the Maker Culture. But this argument actually supposes that consumer printers like the MakerBot will impact all (or most) of manufacturing. It will certainly impact a lot of areas, but how many, one might ask? Hence, an alternative and more appropriate frame of understanding the socio-economic and political importance of 3D printing could perhaps be something like P2P Foundation’s notion

of a “collaborative peer-to-peer economy” (Bauwens et al. 2012), which places practices like these more at the fringes of standard economic/capitalist exchange: as a system that simultaneously works within and alongside contemporary capitalist market economy, and which can go either way historically speaking (Kinsley 2012).

8. The Right to Print

Regardless of the actual feasibility of the heralded “3D print revolution”, it is a fact that the phenomenon of 3D printing is surrounded by a lot of revolutionary discourse which simultaneously criticizes the “old world” of closed business models and its various proprietary rights, and demands change, often with the argument that the old model is unfair, destructive, and basically against human nature. Perhaps not all that surprisingly, The Free Universal Construction Kit uses a similar rhetoric to criticize the proprietary rights within the world of toys:

Our kids are already doing it! And when we were growing up, ourselves, we did it too—or we tried to, anyway. Connecting our toys together. Because: what if we want to make a construction which is half-Tinkertoys, half-K’Nex? Why shouldn’t we be able to? (F.A.T. 2012)

Thus, making, distributing, and playing with toys across various brands is described as an almost fundamental right—perhaps even something essentially human; or something that is intimately tied with Man’s “species-character”, as the young Karl Marx put it (1967 [1844], 294)¹²—which has been stifled by the economic interests and logics of capitalism. A point, however, that, as already indicated, pertains not only to the world of toys and play, but even works as a metaphor for the world of things and bits, including economy and production at large. The Kit is, in the words of its producers, “simply one ‘toy’ illustration of a coming grass-roots revolution, in which everyday people can—with desktop tools—overcome arbitrary restrictions in mass-manufactured physical culture” (F.A.T. 2012).

Yet, if we were to approach this line of argument critically, wouldn’t we then wonder if the Kit here does not join the rest of the Maker community in embracing “a kind of naively apolitical, techno-economic, capitalist utopia that thrives on individualistic values”, as Sadowski and Manson put it recently (2014), instead of its alternative? Although definitely making a point in insisting on the fact that the present proprietary logics of capitalism, especially the walled gardens of IP (intellectual property; cf. below), is problematic, it actually seems like the people behind the Kit (also) make the argument that once that cluster of problems has been successfully overcome, we will have attained a new kind of freedom. Hence, just like in the discourse of most of the Maker Culture, other questions of “privilege and access, of systemic structural biases based on class, race and gender” (ibid.) simply seem to slip under the radar.

9. Distribution and Legal Stuff (IP)

In combination, the distribution channels for the Kit cover and describe how bits and bytes through a myriad of technologies can multiply and change hands in an online environment optimized for distributing and sharing. In the case of the Kit, the connector files can be downloaded (1) from Thingiverse, (2) from F.A.T. lab’s website, and (3) on Pirate Bay. Interestingly, these different platforms also constitute quite different discursive environments with differing takes on what it means to share:

(1) Based in the web 2.0 paradigm, Thingiverse is a typical DIY community website similar to those in e.g. programming (sourceforge.com) and knitting (ravelry.com). With their fully community-driven content, these sites gain their importance because users share experienc-

¹² Cf. also Marx’s description of Man’s alienation from his productive/creative powers which could be exercised in so-called “free human production”, if capitalism had not smothered it (Marx 1967, 277–301).

es with particular files and projects. The individual files can be downloaded from description pages similar to every other project uploaded to the virtual community website.

(2) The FAT website is a web 1.0 distribution channel. A file is made available for download on a private server, and other people download it. This is also where the primary paratextual framing of the project occurs: here we find not only the files that can be fed into the printer, but also the promotional videos, the images, the poster, and the long description of the purpose of the Kit. This is clearly the “home” of the Kit.

(3) Heavily debated, blocked in many countries, and highly political, Pirate Bay is the primary symbol of illegal file sharing and subversive political activism in digital culture (Kaarto and Fleischer 2005, Burkart 2014). By choosing to use Pirate Bay, the Free Universal Construction Kit thus also—although perhaps partly misled by the Pirate Bay’s morally charged “pirate rhetoric”? (cf. Johns 2009)—reflects an anti-capitalist and anti-proprietary attitude where resistance is primarily a matter of “freeing” material from the hands of capitalist corporations. Hence perhaps the Kit’s acronym F.U.C.K., which more than alludes to the fact that this project is imbued with meanings that go beyond that of making it possible for children to expand their toy collections?

Hence, facing the fact that this project borders on infringements, and directly addressing “those eager to enforce these rights” (F.A.T. 2012), FAT-Lab invokes a multiple defence strategy in the accompanying description explicitly appealing on several levels: on a normative level (“please think of the children”); on a semi-threatening level (humoristically referring to the so-called “Streisand effect”, according to which prohibitions often increase the unwanted interest and desirability); and finally on a legal level (by referring to *fair use*). Especially the latter is of interest here.

Pointing to similar discussions of IP like copyright, patents, trademarks and distribution rights in other domains, the Kit is rhetorically placed in a currently heated discussion: “the implementation of cross-brand interoperability can be nearly impossible, given the tangled restrictions of patents, design rights, and trademarks involved in doing so” (F.A.T. 2012) Given that the project rests on many ways of doing internet-enabled distribution, statements like this evoke a host of other discussions that are not solely restricted to toys. In several ways, it seems to mimic the legal arguments typically made in this area, for instance when using the very pathos laden phrase “please think of the children”. Often, IP advocates rely equally heavily on pathos, for instance when The Global IP Center set up by the US Chamber of Commerce argues for the importance of IP by referring to “human progress” stating that IP “drives social and cultural progress. Just think about it—what if scientists never developed a malaria vaccination?” (The Global IP Center). Since intellectual rights like patents are generally believed to—or justified with reference to their ability to—provide incentives to individuals by offering them recognition for their creativity and material reward for their (marketable) inventions, a world with no patent system, or one in which people would not obey its rules, would—or so the argument (or the threat) often goes—not only be a world where there would be fewer inventions; it would also be a world in which people would die (for instance of malaria, which millions do, but that’s another story). Thus, as we will also discuss in more detail later, through designing these toys and by explicitly referring to children and children’s play, the Kit also becomes a physical manifestation of pathos in a discussion that in many ways is already filled with pathos disguised as logical arguments.

However, there is another twist. Even though the Kit refers to “fair use” in the paratext, fair use only applies to (American) copyright, not patent, trademark or design (O’Rourke 2000, Bradshaw et al. 2010). Since F.A.T. lab must know this—especially given the massive legal advice they received before the release of the project (Sims 2012)—their defence fundamentally rests on the assumption that patent holders (hopefully) will perceive the connector kit as a rather innocent artistic expression, not as a set of functional objects—even if they are also functional.

10. Different Notions of Creativity as Paradoxical Critique(s)

As one of the Kit's creators, Sy-Lab artist Shawn Sims, has indicated in a presentation speech at the 2012 Ars Electronica (Sims 2012), the project is an example of how Ars Technica writer Peter Hanna envisions the profoundly transformative and perhaps even disruptive possibilities of 3D printing in general, namely that "the proliferation of 3D printers eventually promises to democratize *creation*" (Hanna 2011). This specific choice of words does, however, point to a certain ambiguity, or perhaps even a moment of unresolved thinking, in the philosophical underpinnings of the Kit. Intentional or not, using these exact words points towards quite different conceptions of creativity. On the one hand, creativity as an act of creation; in the sense of semi-divine world-making *ex nihilo*. And on the other, creativity as an activity that is much more distributed and diverse, in which multiple actors—or to be more precise: multiple "actants", since participatory agency is not solely restricted to humans (cf. Latour 1996, Harman 2007)—distributed throughout time and space contribute in various forms and materialities to the act of making something.

Of course, generally speaking, this project primarily mirrors the latter notion, which corresponds with the general trends within contemporary theories of creativity. According to this trend, a shift has taken place towards an increasingly dominant understanding of creativity as continual processes of transformation, flux, flows, and meshworking—"the way in which materials of all sorts, with various and variable properties [...] mix and meld with one another in the generation of things" (Ingold 2010, 2)—rather than as something that has to do with final products and finite states of matter (artworks, objects, products, etc.) produced by singular individuals (inventors, artist-geniuses, etc.). And notably also a shift, that inevitably seems to bring our most up-to-date (or least Romantic) notion of creativity into conflict with the underlying assumptions of IP and the way it is being legally enforced. Hence, a crucial component in the Kit's critique of proprietary capitalism and the walled gardens—or as they refer to them: "closed systems/platforms/ecosystems"—of play, which these specific toy systems (are made out to) represent, is a set of mostly implicit notions of what also creativity ought to be, and what stands in the way of that.

Hence, one level of that critique, specifically related to the issue of IP discussed above, is closely bound to the historically close ties between, on the one hand, the Romantically inherited notion of 'heroic creativity' (Bilton 2010) and authorship; and on the other, the regime of copyright, patents, design, etc. (Woodmansee 1984, Boyle 1996). Although it has been a recurring critique that the coupling is too one-sided (Foucault 1991, Kaplan 1967, Woodmansee 1992, Jaszi 1992), the IP regime is obviously modelled on the idea that creativity is a punctual process that ends with an idea, a finite product or an expression. Fuelling the argument that a monetary incentive is in order, this conception of creativity stipulates that an idea originates from and thus belongs to—either in a legal or a more authorial sense – one single person (Mason 2003). Had that particular person and his/her act of creation not been there, the argument goes, that particular idea or product would not have come about.¹³

On a number of levels, this notion of heroic creativity is in stark opposition to the one FAT-Lab seems to propagate and the Kit materializes. Namely: the idea that creativity rather is a perpetual process of cultural participation, in which many contribute through continuous re-mixing, quotation, and inspiration across time, place, and media/materiality; and thus also: that authorial authority is a fiction—perhaps even an ideological one, or least one that has severe repercussions for our personal, productive freedom (Lessig 2004 and 2008, Stallman 2010). In this sense, the Kit should be seen as an extension, perhaps even a product, of the historical enterprise of (re-)opening the "circuits of authorship" (Roberts 2007) that has influenced the fields of art and technology throughout most of 20th Century. The Kit is in other words, cf. Roland Barthes, an exertion of the logic of openness of the "text" against the fixed hierarchical authority of "literature" (Barthes 1977, Peters 2007); or simply an example of how the "logic of new media" fundamentally seems at odds with, and can be pitted against,

¹³ In practice, this "legal subject" can, as is quite often the case, also be a group of people or a company; the fundamental model and the assumptions concerning the inventive/creative act remain unchanged.

the “logic of the art world” (Manovich 2003, 14), which, of course, is almost 1:1 synonymous with the underlying logic of IP. In fact, we could even view the Kit as a more general objection to and protest against the dominant “innovation-centric” approach to culture and technology (Edgerton 2008), and the way this approach has been objectified in legislation, institutions, and communicative infrastructures of our political economy, including how these logics profoundly pervade countless spheres of our lives, also those of childhood and play.

Thus, FAT-lab’s critique of the walled gardens of toy systems seems to imply a number of quite specific conceptions of what creativity (of for instance play) is in more general terms. As already discussed above, these toys are quite a special selection of toys that fit into the discourses on tinkerers, tweekers, and soft- and hardware hackers. In this sense, they represent the imagined necessities of play for a hardware hacker looking back at his or her own childhood; they represent what he/she would have wished for back then, possibly more than they represent what children in the midst of their childhood would associate with important toys and toy functions/operationality. This for instance becomes obvious in the short movie “Lessons on Interoperability” on FAT-lab’s website, in which a boy aged about four vents a frustration with the lack of interoperability of construction toy systems. A frustration that seems much less his own, than that of the person who is behind the camera interviewing him through a number of quite leading questions.

As already mentioned above, what is implied in this canonical constellation of geek toys is a quite specific and rather advanced conception of play with strong emphasis on the “productive” and “experimental” aspects of playing, which could be summed up under the notion of “construction”. Given this is a correct assessment, the practical and not least legal obstacles represented by these walled gardens of play seem like issues that would be more pressing to hardware hackers (and politically oriented artists) than to most kids—at least those we know of. This does, of course, once again point to what kind of project this is one that primarily seems to deal with art and protest, rather than the development and production of functional toys for kids.

Yet, the inherent emphasis on the kind of play associated with construction toy simultaneously—and in all likelihood less intentionally—mirrors a prevalent trend of the last couple of decades, in which the notion of “creativity” has increasingly been tied closely to that of “innovation” and hence also economic productivity (cf. Howkins 2001, Gauntlett and Stjerne Thomsen 2013, Hesmondalgh and Pratt 2005, Lovink and Rossiter 2007). A creative economy that is largely based on the coupling of IP and the heroic notion of creativity, and which gives almost absolute dominance to the idea that one (legal) individual comes up with a fixed idea or product of which he then holds full authority.¹⁴ For anyone who, like the Kit, claims to be taking on crucial aspects of capitalism, it is worth noting the historical paradox that permeates this conception of a creative economy/capitalism on the rise, which is performatively “being talked into being” (Fairclough 2000) through a host of government policy papers, academic publications, management and business literature, etc. (Thrift 2006, Nepper Larsen 2014, Stephensen *in press*). Namely, the fact that this conception of the creative economy quite often in its self-explanatory, self-justificatory and self-constitutive discourse draws on the 1960’s “New Left”/“Humanist Marxist” critical account of the maladies of alienating capitalist labour. A critical account, which in current discourses often functions as a woeful counter-image to the present state of ‘creative de-alienation’ of the creative economy; which in turn very often is explained by the historical intervention of new digital technologies and/or organisational models (Boltanski and Chiapello 2005, Bifo 2009, Stephensen *in press*). Hence, just like argued above in relation to the ‘rugged individualism’ implicitly running through the Maker Culture’s take on political economy, there seems to be a certain blindness at play here, which the Kit (unwarily) comes to adopt; the idea that simply by transgressing the material boundaries of the stuff that restrict us (in this case symbolised by the interface-obstructions of the toy systems), we will become more free and more creative; and further-

¹⁴ This is a historical account, in which the figure of ‘the geek’ has come to play the role of the new heroic economic figure (Florida 2002, 209–10).

more, that this diffusion of creativity into the everyday fabrics of all of our lives unambiguously is a good thing.

As pointed out by numerous commentators in the last decade, what counts as ‘creative’ is, however, far from objective. Or as Ulrich Bröckling puts it, “what is creative is the new that prevails” (2006, 571), by which he implies that what is regarded as creative is, in fact, highly conditional, relational, contingent, and political; and most importantly: that it is beyond the creative individual’s control if it prevails or not. Yet despite this fact, the rhetorical bond between creativity and productivity has become increasingly intimate and personalised (Ericsson 2001, Prichard 2002, McRobbie 2004, Ross 2009, Hesmondhalgh and Baker 2011), and being creative has become a normative imperative imposed on the individual (Bröckling 2006). Thus, instead of understanding failure (or success) of one’s creative endeavours as a (partial) result of the logics and workings of the economic system at large, there is a tendency that failure instead becomes internalised within the individual, who (is lead to) believe that “he or she is not sufficiently creative and ingenious” (Sadowski and Manson 2014). Furthermore, to this apparent misconception we can add that obstacles to the realisation of the creativity of the individual are often understood as something that can be socio-technologically overcome (for instance by the emergence of truly open Maker-practices as the most utopia-prone parts of the 3D community seems to suggest). All in all, these darker aspects of the current creativity discourse seem to be in stark opposition to the Kit’s more general take on political philosophy and economy.

Apropos paradoxes, it could be argued that the Kit holds a quite classic-modernist view of play and creativity, which in some respects also clashes with its critique of proprietary capitalism, or at least with the conceptions of play, creativity, and so on that the Kit embodies. By insisting on the essentiality of absolute creative freedom—in the sense of “freedom-from-restraints”—the Kit taps into the idea of creativity as something inherently transgressive, which has been quite predominant in 20th Century thinking on art. Most obvious, of course, is the way that the Kit manifests the necessity of transgressing what we might term the media boundaries (in this case, though, of different toy systems).

Thus, in the midst of this celebration of creative transgression some confusion also arises between what has been labelled “Big-C creativity” and much mundane forms of “little-c” (or “mini-c”) creativity (Kaufman and Beghetto 2009); the latter of which in many ways seems the more appropriate term to apply in this specific context, especially when talking about the play, creativity, and learning experiences of children (even taking into account that the scope of the Kit, as argued above, is not limited to children). In line with this argument, the Kit’s insistence on “no restraints-creativity”—pitted against the hampering effects of IP walls, in the paratext repeatedly framed as some kind of malevolent curtailment—thus seems at odds with one of the things we actually do know about creativity, namely: that it sometimes, perhaps even often, thrives through restrictions; hence also the term “creative constraints”. Or, with reference to buzz lingo: “in order to ‘think outside the box’, you might have to go inside it first” (Lehmann 2011, 150); to which, however, should also be added, that good creativity does not necessarily involve breaking out of the box at all.

But even if radical transgression was the solution to the creative, cultural, economic, and political predicaments caused by the system of intellectual property rights, one might finally also ponder whether the interfaces/connectors they suggest to overcome this problem are outside the box at all? Even if they are clearly tinkerer/geek-toys, it seems reasonable to ask if the Kit is a genuine tinkerer-solution? Albeit somewhat monstrous, the connectors still look and function more like “official connectors”—that is, how one would imagine that they could look like, had the toy companies decided to provide that service themselves. Maybe this is just how tinkerer solutions will be in the 3D printing era, but another possibility is that the finish is more like a “real product” and less of a genuine hardware hack where all kinds of toys are connected through materials like play dough or duck tape.

11. Art or Design?

As argued, the Kit should not be taken at face value only; it obviously also contains a strong political critique. Why is this articulated in objects and not in more conventional forms of a political manifesto or a protest group? One reason for this is that it is through being (potential) objects that these connectors acquire argumentative strength; they are out there, tangible, in everyday life itself. This is the core aspect of an artistic strategy that could be termed the creative/democratic challenge of the “politics of things” (Verbeek 2012);¹⁵ or, as we will prefer to conceptualise it here: Critical Design. Crucial for both is this aspect of ‘thinginess’ as well as the status as an object of art (albeit perhaps at its fringes).

The inscription of the Kit into the spheres of art happens on several levels. One of them is institutional (Danto 1964, Dickie 1997) and by submitting it to the Ars Electronica Festival in the Hybrid Art category, the designers have explicitly evoked this level. Likewise, the explicit references to “fair use” certainly also hints towards the artistic nature of the project. Finally, the Kit’s artistic agenda can be seen in its use of some of the same strategies that art does. Delving into this artistic perspective opens up for interpreting the Kit as an explicit and specific artistic intervention into digital culture, we argue, and below we will show how the Kit can be seen as belonging to the critical design discourse where criticality comes as a consequence of using strategies from both art and design.

Injecting the Kit into the world of art and its logics does, of course, fundamentally change the way it is framed and thus also how it can be “read”. Rather than just being judged or valorised as a functional object, the Kit’s inclusion in an art exhibition and of the way it is positioned rhetorically in the paratext also makes it a ‘statement’, at least potentially. Thus, despite the fact that it morphologically speaking is quite different from most art, the Kit still draws on a centuries’ old notion of art as a particular and autonomous institution within society (cf. Kant 1787, Schiller 1794). In particular, that conception was amplified with the notion that so often took precedence during the 20th Century: that art should be understood as fostering critical or political reflection. At times to such an extent that the specific work of art need actually not express anything critical and/or political *per se* (e.g. Adorno 1997, Marcuse 1978), as our experience of art is attuned to expect that kind of inherent statements in art-like objects, simply because they are “Art”.

In this case, the intended message—and especially the intention of delivering a message—from the privileged position of art is quite univocal. Yet, what is important here is really not whether the Kit is ‘art’ or not. Instead, we argue that the Kit uses the strategies of art as well as the strategies of design to position itself as an object on a mission to change something. In this way, the Kit inscribes itself into the emerging practice of ‘critical design’ and in the following we will discuss the analytical consequences of (placing it in) this category.

12. The Kit as Critical Design?

Coined by British designers Anthony Dunne and Fiona Raby in the mid-90s, the term “critical design” describes design that has a critical agenda, or that makes the viewer/user rethink the role of design. In their recent book *Speculative Everything* (2013), Dunne and Raby present their work in this field, arguing that critical design is also speculative design; asking “what if” questions, concerned with alternatives to the current or future state of the world. In its original form, critical design is industrial design with a clear function while also using tactics from the arts to criticise contemporary culture. It can be described as an amalgamation of design and art, but some proponents argue that in order to be labelled “critical”, design neither needs to be artistic nor to be explicitly critical towards something, as long as it opens up for new ways of “thinking design” (Bardzell and Bardzell 2013). Others argue that maybe critical design is not design at all, but ‘just’ a particular form of art. In current literature and design practice,

¹⁵ The Kit resembles the art projects described by Latour-inspired philosopher of technology Peter-Paul Verbeek in his essay entitled “On Art and the Democratization of Things”, which all in quite different, yet still similarly ways “[make] it possible for us to be aware of the hidden politics of things and to experiment with that” (2012, 27).

what we refer to here as critical design would also be covered by one of the many similar terms like “speculative design” (cf. Dunne and Raby 2013), “explorative design” (Fallman and Stolterman 2010), “adversarial design” (DiSalvo 2012), “design fictions” (Sterling 2013) and “reflective design” (Sengers et al. 2005). All of these terms refer to design perspectives and design activities that are deliberately aiming to be more than merely utilitarian and/or pretty, as the objects also seek a speculative, counter-factual, political or even provocative agenda.

In his seminal book *Hertzian Tales* (1999), Dunne discusses a wide range of designs, among these Dr Kevorkian's “Suicide Machine” (1989), a piece of furniture with which you can commit suicide. Dunne uses this case to describe how design can also be critical, drawing on the way art functions, even if the object is not thought of as art by the designer him/herself: “[The machine's] ambiguous status between prototype and product [...] suggests a role for design objects as discourse where functionality can be used to criticize the limits that products impose on our actions.” (Dunne 1999, 43) A direct connection between the design objects and ‘the real world’ is important, Dunne argues, and objects must be designed, framed and understood as functional or purposeful even when they are strange: “The physical presence of the artifacts encourages additional interplay between reality and fiction, between what is and what might be [...] The designer becomes an applied conceptual artist” (ibid., 100). Still, coming from the standpoint that art is removed from the everyday—thus not paying much attention to the avant-garde's (intended) rupture of the autonomous institution of art (cf. Bürger 1984)—Dunne insists that critical design is not art, even if it might be using artistic strategies, as it must be “closer to the everyday, that's where its power to disturb comes from” (2007, 10).

Following Dunne, but not adhering to the “not art”-argument, one could make the point that the meaning of critical design objects is found in their being “not just art”, which is Fuller's way of describing those “art methodologies [that] can pop up unexpectedly, not even recognising themselves as art” (Fuller 2008), thus becoming what in the cultural media studies has also been named “evil media”. Arguing that it is important to look beyond the face value of any object, but also that some objects lend themselves better to further and close readings due to the discussions embedded in their design, Fuller states that “evil is a good name for the strategies of the object, for what things do in themselves without bothering to pass through the subjective demand for meaning” (Fuller 2007). This line of thought is taken up by Bardzell et. al (2015), arguing that research through design (RtD) would benefit from being better at unpacking the discussions that a given design makes possible; and further, that especially critical design stresses that design is never neutral or apolitical.

While it can certainly be debated whether or not art is removed from or rather part of the everyday, we would rather just note that it is important to recognise that when design is critical, it blurs the boundaries between fiction and reality, between conceptual and real and between art and design. When design is critical, it uses the very utilitarian purpose of design—“design ‘works’”, as Flusser (1995) states—to ask highly abstract, critical questions concerning contemporary (design) culture. For instance, when in the project “120 days of *buntu”, Vasiliev and Savicic create a series of fully functional, but in different ways hard to use versions of the operating system Ubuntu, for instance “mondrianbuntu” and “dadabuntu”, they mimic the functions of “normal” operating systems, thus forcing the viewer to ponder how also “normal” operating systems work, both as utilitarian user interfaces and as cultural expressions and cultural creators.

In this respect, we argue that it is because it is *also*, but not *exclusively*, of a practical nature that the Kit is able to pose the critical questions it does. The questions that the Kit opens up for are many and rather complex, and they get their actuality and applicability through design—by being (potential) actual objects with an actual function. “Potentiality” is a keyword here, because while it is an actual design addressing a particular and identifiable problem, it is also of a quite speculative nature, which concerns a range of broader issues that concern most of us, even if few of us are aware of it. In fact, in order to raise a discussion, the Kit does not even have to manifest itself in a physical print although it is fundamentally thought of as a physical project. It makes a point simply by being potentially manifest, a kind of “speculative materiality”; much in line with how for instance software is also being perceived

as some kind of materiality within theories of so-called “(new) radical empiricism” and ‘new materialism’ (Mackenzie 2010, Stephensen 2015). If looked at this way, it is, of course, the practical function that receives attention in the tech press. But at art and technology festivals it is also the critical ideas installed in these (potentially manifest) objects that receives attention. Yet, in neither of the two contexts does the Kit actually have to be physically printed in order to work.

Something quite similar goes for the legal aspects of the Kit. As we have discussed earlier, if we try to make sense of FAT-Lab’s extensive reference to the copyright law, this reference is from a legal perspective really to no use at all. But from a political perspective it becomes an important part of the project’s ‘statement’. If the toy companies decided to put their legal departments to work, it should not be hard to object to the project. Instead, one might argue that the legal IP aspects are invoked also as a way of referring to the practice of hacking or as a way to counter-balance dominant ideas about how digital culture should work without actually doing anything illegal.

By delving into the legal aspects in detail, the paratext manages to address how the Kit disrupts current (toy) practices, but in a literally fun—and perhaps also child-friendly—way, where we as viewers are not entirely sure how to understand it. Furthermore, while we are trying to make up our minds, we find it hard to keep the smile off our face. As Dunne also argues, humour is an important ‘tool’ for critical design to evoke engagement: “The viewer should experience a dilemma, is it serious or not? Real or not? For this kind of design to be successful the viewers need to make up their own mind” (2007, 10). By being ambiguous as either possible solutions to a problem or improbable ones evoking laughter (or both at the same time), these design objects get their critical power from their ability to make viewers struggle with making the “correct reading” of the object (in the same way that art sometimes does).

Like the functional, yet absurd Suicide Machine, humour is important to the Kit, albeit in a very different way, because here the humour especially resides in the paratext found on the FAT website: presentation videos (on sound as well as image plane), project description, and posters are all tongue-in-cheek humorous, even if they are also highly informative and sometimes even polemical. In this way it echoes Gérard Genette’s description of the paratext as the place where an author’s own interpretation of the object often becomes visible and attempts to assert an influence on the viewer that “is at the service of a better reception for the text and a more pertinent reading of it (more pertinent, of course, in the eyes of the author and his allies)” (1997, 2). Stylistically, the Kit’s paratext follows the style of the rest of the FAT website that clearly references the style and culture of memes and “internet lulz” (Goriunova 2013) by using a very “un-stylish” visual form and combination of colours, images, blinking objects etc. This particular style of bad taste is obviously not a result of the actual ‘bad taste’ of the members of FAT, but instead creates a connection to the ambiguity of internet puns; a style where (sometimes harsh) critique is provided with sarcasm and humour. When we meet this type of web presence, we sense (and sometimes know) that it is a critique, but it is also just silly, ugly, and playful. Through mimicking this ambiguity, the paratext thus sets the stage for perceiving the Kit as more than a functional project concerned with providing toys that industry is not making.

13. Making an (In)tangible Argument

If we understand the Free Universal Construction Kit as critical design, that is, as highly conceptual and (highly) useful—perhaps even bordering on the ridiculously useful—at the same time, then what is it actually critiquing? Obviously, it is posing (as) a critique concerned with incompatible systems in the world of toys. Yet, besides providing adaptors for construction toys, it is also commenting on and critiquing digital culture of software and hardware, perhaps even contemporary capitalism at large, and it does this in several ways.

First, by re-designing construction toys—a toy genre specifically designed to encourage the practice of remixing discrete elements into constantly evolving constructions—the sensual materiality of the bricks reminds us what it means that something can be endlessly formed,

manipulated and copied. On a basic level, the material properties of a digital file can be hard to fathom, when you move a file from your computer and onto Dropbox, or when you upload a picture to Facebook, because it seems like you are looking at the same object even if it is often a new version in a slightly different format. But when you are holding a strange amalgamation of LEGO and FischerTechnik in your hand—an object which is both and none of those at the same time—the concept of digital materiality and its modularity and remixability (Manovich 2005) becomes very tangible. In fact, it is even possible that this tangibility can be made clear just by the pictures of the objects, since almost everyone has some physical, sensorial, or aesthetic experience with at least one or two of the construction toys in the Kit.

Second, we are literally able to see how some systems are designed in ways that are highly practical within their own world, but also highly incompatible with other similar and often competing worlds, and that they are designed so intentionally. Although not in the same way as construction toy systems, every digital file is endlessly formable, manipulable, modular, and copyable too, and much of this modularity/manipulability is what many corporations based in the digital realm seek to restrict in more or less subtle ways. So although people might not necessarily realise that the critical interventions of the Kit also is about Apple, Amazon, Microsoft, the music industry, the pharmaceutical industry, etc., still they potentially get the gist. Even if these connectors are not printed into physical existence at all, the Kit still serves as a physical-philosophical resistance towards the mechanisms of proprietary formats in all its many shapes, raising important questions concerning for instance the “creative freedom” we are being granted by those much heralded web 2.0 systems of the software industry.

The Kit also highlights a central aspect of most of the 3D printing phenomenon and its alternative/disruptive business models: that it is actually to a large extent co-dependent on other inventions and objects. Especially when the Kit is uploaded to Pirate Bay, it highlights the necessary simultaneity of the parasitic and the “anti-”: Pirate Bay has come into existence and—it could be argued—has been kept alive (as well as sought killed) only because of capitalist, proprietary social systems. In many ways, the Kit highlights the complexities of these issues. The connectors are only fun, and only toys, because something else makes them toys. Otherwise, they would merely be strangely shaped objects. Processes of appropriation to some extent will always need the “original” forms. They can only display resistance because there is something to appropriate, and they can only be functional objects of play, because they parasitically feed off of the proprietary and trademarked toy systems. In this particular perspective, the fun of the project is not really related to the usability or playability of the connectors. The Kit’s “funness” is on a different, much more speculative level. Yet, on a general and principal level, the parasitical nature of such design interventions—whether deliberately critical/subversive or not—certainly does pose a complex set of problems. Some of them are of a socio-economic character that possibly backfires at the Kit itself: It could be argued that the Kit is a hack for kids whose parents are rich enough to provide them with multiple systems of construction toys. (Why else the need for cross-brand interoperability?) And in extension of this: Is the economic democratisation of 3D printing presently—or will it in the future become—so radical, that these connectors will become available to all children? The counter-argument to this would of course be, that this is exactly why the Kit is *critical* design, and not just design: it is deliberately ambiguous (often bordering on paradoxical) in order to force people to think for themselves. Hence, the Kit also pokes at another of the fundamental tenets of Maker Culture—regardless of whether we’re talking about the Anderson-wing or the anti-capitalism-wing—by pointing to the fact that simply making new stuff uncritically, will not suffice to change much on a larger scale, if anything at all. As the last sentence in the online presentation of the Kit reads: “We hope that the Kit will not only prompt people to create new designs, but more importantly, to reflect on our relationship with material mass-culture—and the rapidly-evolving ways in which we can better adapt it to our imaginations” (F.A.T. 2012).

14. Concluding Remarks

In this article we have argued that by using the tactics of critical design, the Free Universal Construction Kit opens up for a nuanced critique of our present, digital culture and political economy at large—even though it on the manifest level primarily thematizes play and toys. Thus, the Kit is interesting in that it seems to have a double status: On the one hand, it simply appears to be a practical project aimed at being useful—at providing objects that would in all likelihood never be made by the companies themselves. In this sense, it can be interpreted as a democratizing project that will give customers/users what they have (silently) longed for all the time, while the toy companies have only been willing to make objects that fit into their own business model. In the words of the Award Committee of Ars Electronica, at which it won the Award of Distinction in 2012, these adaptors “provide a public service unmet, or unmeetable, by corporate interests”.

On the other hand, if we, instead of understanding it from a utilitarian perspective, look at the Kit from the perspective of a cultural analytic, it shifts status and becomes a potential commentary. But it is worth noting, that it does so as a political commentary manifested in physical form, instead of (only) in words; or as Latour (2005) would put it: it becomes “Ding-politik”. Irrespective of if it is actually printed or not, it can be interpreted as a conceptual artwork engaging in socio-economic and political issues. In this perspective, the connectors can also be understood as an art project embodying a critical, perhaps even Marxist-inspired, analysis that aims to simultaneously reveal the true state of things and to show to the world that things—in this case: the world of toys and play—could be quite different. The critical dimensions of the Kit are, in other words, simultaneously embedded in what we might term the “tradition of revealing/exposing” and that of “prefigurative politics” or “prefigurative action” (Graeber 2002, 72–73).

It is this double agenda that gives the Kit a particular, critical nature. It is both art and design; it is both aesthetic objects made for contemplative, critical pondering and practical objects made in order to be useful (at least hypothetically). And furthermore, both aspects are highly dependent on each other in order for the design to be interesting. Thus, as we have argued, aside from being a set of fun adaptors that aim to enrich the activity of play by offering hitherto unseen combinations of toy systems, the Kit also critically manifests the restrictions that construction toy systems physically embed into their parts. Visibly as well as tangibly, the critical awareness and philosophical underpinnings of the project *become* the project—even if it at times seems slightly inconsistent (for instance in relation to the Kit’s implicit notions of both creativity and play).

Strategically placing it(self) between the utilitarian and the speculative, the various aspects of the project (can be brought to) work on many levels and raise a number of important questions: *Will 3D printing constitute a genuine challenge to capitalist economy as we know it? Or will it at least transform it considerably?* But also questions like: *What is a good toy? Do kids and adults look at toys in the same way?* And even questions that perhaps appeal mostly to academics: *Is the design the files, the critique, or the actual printed objects? Is this project even concerned with toys at all, or are toys used as stand-ins for legal aspects? In what materiality can political and economic critique be raised (and understood)?* Especially other aspects than the mere usefulness of actual printed objects end up commanding attention, and perhaps this is why the Kit is such a successful and interesting project. In either case, without its potential use it wouldn’t be much fun either.

References

- Ackerman, Edith K. 2013. Cultures of Creativity and modes of appropriation: From DIY (Do It Yourself) to BIIT (Be In It Together). In *Cultures of Creativity: Nurturing Creative Mindsets Across Cultures*, edited by David Gauntlett and Bo Stjerne Thomsen, 51–55. Billund: LEGO Foundation.
- Adorno, Theodor W. 1997. *Aesthetic Theory*. Minneapolis: University of Minnesota Press.
- Anderson, Chris. 2006. *The Long Tail: How Endless Choice is Creating Unlimited Demand*. New York: Random House.
- Anderson, Chris. 2012. *Makers: the New Industrial Revolution*. New York: Random House.

- Bardzell, Jeffrey and Shaowen Bardzell. 2013. What Is "Critical" About Critical Design? In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 3297–3306. Paris, France: ACM.
- Bardzell, Jeffrey, Shaowen Bardzell and Lone Koefoed Hansen. 2015. Immodest Proposals: Research through Design and Knowledge. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Seoul, Korea: ACM.
- Barthes, Roland. 1991. *Mythologies*. New York: The Noonday Press.
- Barthes, Roland. 1977. From Work to Text. In *Image-Music-Text*, London: Fontana Press.
- Bauwens, Michel et al. 2012. *Synthetic Overview of the Collaborative Economy*. Chiang Mai: P2P Foundation. Accessed August 14, 2014. [http://p2pfoundation.net/Synthetic Overview of the Collaborative Economy](http://p2pfoundation.net/Synthetic_Overview_of_the_Collaborative_Economy).
- Benkler, Yochai. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven and London: Yale University Press.
- "Bifo" Berardi, Franco. 2009. *The Soul at Work: From Alienation to Autonomy*. Los Angeles: Semiotext(e).
- Bilton, Chris. 2010. Manageable Creativity. *International Journal of Cultural Policy* 16 (3): 255–269.
- Boltanski, Luc and Eve Chiapello. 2005. *The New Spirit of Capitalism*. London: Verso.
- Boyle, James. 1996. *Shamans, Software, and Spleens: Law and the Construction of the Information Society*. Cambridge, MA: Harvard University Press.
- Bradshaw, Simon, Andrian Bowyer and Patrick Haufe. 2010. The Intellectual Property Implications of Low-Cost 3D Printing. *SCRIPTed* 7 (1): 5–31.
- Breines, Wini. 1980. Community and Organization: The New Left and Michels' 'Iron Law'. *Social Problems* 27 (4): 419–429.
- Brickfair. 2014. Accessed August 15, 2014. <http://www.brickfair.com/faq/afol.asp>.
- Bröckling, Ulrich. 2006. On Creativity: A Brainstorming Session. *Educational Philosophy and Theory* 38 (4): 513–524.
- Bruns, Axel. 2008. *Blogs, Wikipedia, Second Life, and Beyond: From Production to Produsage*. New York: Peter Lang.
- Burkart, Patrick. 2014. *Pirate Politics*. Cambridge, MA: MIT Press.
- Bürger, Peter. 1984. *Theory of the Avant-Garde*. Minneapolis: University of Minnesota Press.
- Corsaro, William A. 1997. *The Sociology of Childhood: Sociology for a New Century*. Thousand Oaks, California: Pine Forge Press.
- Crowell, T.R. 1899. Amusements of Worcester School Children. *Pedagogical Seminary* 6 (3): 314–71.
- Danto, Arthur C. 1964. The Artworld. *The Journal of Philosophy* 61 (19): 571–584.
- Dickie, George. 1997. *Introduction to Aesthetics: An Analytic Approach*. New York and Oxford: Oxford University Press.
- DiSalvo, Carl. 2012. *Adversarial Design*. Cambridge, Mass.: MIT Press.
- Dunne, Anthony. 1999. *Hertzian Tales: Electronic Products, Aesthetic Experience, and Critical Design*. Cambridge, Mass.: MIT Press.
- Dunne, Anthony. 2007. Frequently Asked Questions. *Design Interactions Yearbook 2007*. London: Royal College of Art.
- Dunne, Anthony and Fiona Raby. 2013. *Speculative Everything: Design, Fiction, and Social Dreaming*. Cambridge, Mass.: MIT Press.
- Edgerton, David. 2008. *The Shock of the Old: Technology and Global History Since 1900*. London: Profile Books.
- Ericsson, Daniel. 2001. Creative Leaders—or prisoners of the past? In *Invisible Management: The Social Construction of Leadership*, edited by Sven-Erik Sjöstrand, Jörgen Sandberg and Mats Tyrstrup, 188–211. London: Thomson Learning.
- Fairclough, Norman. 2000. *New Labour, New Language?* London and New York: Routledge.
- Fallman, Daniel and Erik Stolterman. 2010. Establishing Criteria of Rigour and Relevance in Interaction Design Research. *Digital Creativity* 21 (4): 265–272.
- Florida, Richard. 2002. *The Rise of the Creative Class: and How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Basic Books.
- Flusser, Vilém. 1995. On the Word Design: An Etymological Essay. *Design Issues* 11 (3): 50–53.
- Foucault, Michel. 1991. What is an Author? In *The Foucault Reader*, edited by Paul Rabinow, 101–120. London: Penguin.

- Free Art and Technology [F.A.T.]. 2012. Free Universal Construction Kit. Accessed August 15, 2014. <http://fffff.at/free-universal-construction-kit/>.
- Fuller, Matthew. 2007. Towards an Evil Media Studies. Accessed August 15, 2014. <http://www.spc.org/fuller/texts/towardsevil/>.
- Fuller, Matthew. 2008. Art Methodologies in Media Ecology. In *Deleuze, Guattari, and the Production of the New*, edited by Simon O'Sullivan and Stephen Zepke, unpag. London: Continuum. Accessed August 14, 2014. <http://www.spc.org/fuller/texts/art-methodologies-in-media-ecology/>.
- Gabrys, Jennifer. 2011. *Digital Rubbish: a Natural History of Electronics*. Ann Arbor: The University of Michigan Press.
- Gauntlett, David and Bo Stjerne Thomsen, eds. 2013. *Cultures of Creativity: Nurturing Creative Mind-sets Across Cultures*. Billund: LEGO Foundation.
- Genette, Gérard. 1997. *Paratexts: Thresholds of Interpretation*. Cambridge: Cambridge University Press.
- Gorz, André. 2010. *The Immaterial: Knowledge, Value and Capital*. Chicago: The University of Chicago Press.
- Graeber, David. 2002. The New Anarchists. *New Left Review* 13: 61–73.
- Hanna, Peter. 2011. The Next Napster? Copyright Questions as 3D Printing Comes of Age. *arstechnica*. Accessed August 14, 2014. <http://arstechnica.com/tech-policy/2011/04/the-next-napster-copyright-questions-as-3d-printing-comes-of-age/>.
- Hardt, Michael and Antonio Negri. 2004. *Multitude: War and Democracy in the Age of Empire*. London: Hamish Hamilton.
- Harman, Graham. 2007. The Importance of Bruno Latour for Philosophy. *Cultural Studies Review* 13 (1): 31–49.
- Hesmondhalgh, David and Andy Pratt, eds. 2005. The Cultural Industries and Cultural Policy: Special Issue, *International Journal of Cultural Policy* 11 (1).
- Hesmondhalgh, David and Sarah Baker. 2011. 'A Very Complicated Version of Freedom': Conditions and Experiences of Creative Labour in Three Cultural Industries. *Variant* 41: 34–38.
- Howkins, John. 2001. *The Creative Economy: How People Make Money from Ideas*. London: Penguin Books.
- Huws, Ursula. 2003. *The Making of a Cybertariat: Virtual Work in the Real World*. New York: Monthly Review Press.
- Jaszi, Peter. 1992. On the Author Effect: Contemporary Copyright and Collective Creativity. *Cardozo Arts and Entertainment Law Journal* 10 (2): 293–320.
- Johns, Adrian. 2009. Piracy as a Business Force. *Culture Machine* 10: 44–63.
- Kant, Immanuel. 1987 [1787]. *Critique of Judgment*. Indianapolis: Hackett Pub. Co.
- Kaarto, Marcus and Rasmus Fleischer. 2005. *Copy Me. Samlade texter från Piratbyrå*. Stockholm: Roh-Nin Förlag.
- Kaplan, Benjamin. 1967. *An Unhurried View of Copyright*. New York: Columbia University Press.
- Kaufmann, James C. and Ronald A. Beghetto. 2009. Beyond Big and Little: The Four C Model of Creativity. *Review of General Psychology* 13(1): 1–12.
- Kinsley, Sam. 2012. Towards Peer-to-Peer Alternatives: An Interview with Michel Bauwens. *Culture Machine* 13: 1–16.
- Knights, David, Faith Noble, Theo Vurdubakis and Hugh Willmott. 2002. Allegories of Creative Destruction: Technology and Organization in Narratives of the e-Economy. In *Virtual Society: Technology, Cyberbole, Reality*, edited by Steve Woolgar, 99–114. Oxford: Oxford University Press.
- Latour, Bruno. 1996. On Actor Network Theory: A Few Clarifications. *Soziale Welt* 47: 369–381.
- Latour, Bruno. 2005. From Realpolitik to Dingpolitik or How to Make Things Public. In *Making Things Public*, edited by Bruno Latour and Peter Weibel, 14–41. Cambridge: MIT Press.
- Lehmann, Niels. 2011. A Secret Art of Rehearsal. *Peripeti* 16: 147–152.
- Lessig, Lawrence. 2004. *Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity*. New York: Penguin.
- Lessig, Lawrence. 2008. *Remix: Making Art and Commerce Thrive in the Hybrid Economy*. New York: Penguin.
- Lovink, Geert and Ned Rossiter, eds. 2007. *MyCreativity Reader: a Critique of Creative Industries*. Amsterdam: Institute of Network Studies.
- Makexyz. <http://www.makexyz.com>. Accessed August 15, 2014.
- Manovich, Lev. 2003. New Media from Borges to HTML. In *The New Media Reader*, edited by Noah Wardrip-Fruit and Nick Monfort, 13–25. Cambridge, MA: MIT Press.

- Manovich, Lev. 2005. *Remixing and Remixability*. Accessed August 14, 2014. <http://imlportfolio.usc.edu/ctcs505/manovichremixmodular.pdf>.
- Marcuse, Herbert. 1978. *The Aesthetic Dimension: Toward a Critique of Marxist Aesthetics*. Boston: Beacon.
- Mackenzie, Adrian. 2010. *Wirelessness: Radical Empiricism in Network Cultures*. Cambridge, Mass.: MIT Press.
- Marx, Karl. 1967. *Writings of the Young Marx on Philosophy and Society*, edited by Loyd David Easton and Kurt H. Guddat. New York: Anchor Books.
- Mason, John Hope. 2003. *The Value of Creativity: The Origin and Emergence of a Modern Belief*. Aldershot: Ashgate.
- Maxwell, Richard and Toby Miller. 2012. *Greening the Media*. Oxford: Oxford University Press.
- McRobbie, Angela. 2004. 'Everyone is Creative': Artists as Pioneers of the New Economy? In *Contemporary Culture and Everyday Life*, edited by Elizabeth B. Silva and Tony Bennett, 186–202. Durham: Sociology Press.
- Nepper Larsen, Steen. 2014. Compulsory Creativity: A Critique of Cognitive Capitalism. *Culture Unbound* 6: 159–177.
- O'Rourke, Maureen A. 2000. Toward a Doctrine of Fair Use in Patent Law. *Columbia Law Review* 100 (5): 1177–1250.
- Peters, Michael A. 2007. Opening the Book: (From the Closed to the Open Text). *The International Journal of the Book* 5 (1).
- Prahalad, C.K. and Venkatram Ramaswamy. 2002. The Co-Creation Connection. *Strategy + Business* 27. Accessed 15 August, 2014. <http://www.strategy-business.com/article/18458?gko=f472b>.
- Prichard, Craig. 2002. Creative Selves? Critically Reading 'Creativity' in Management Discourse. *Creativity and Innovation Management* 11 (4): 265-276.
- Ravelry, <http://ravelry.com>. Accessed August 15, 2014.
- Ritzer, George and Nathan Jurgenson. 2010. Production, Consumption, Prosumption. *Journal of Consumer Culture* 10 (1): 13 –36.
- Rochat, Phillippe. 2013. The Meaning of Play in Relation to Creativity. In *Cultures of Creativity: Nurturing Creative Mindsets Across Cultures*, edited by David Gauntlett and Bo Stjerne Thomsen, 103-107. Billund: LEGO Foundation.
- Ross, Andrew. 2009. *Nice Work If You Can Get It: Life and Labor in Precarious Times*. New York: New York University Press.
- Sadowski, Jathan and Paul Manson. 2014. 3-D Print Your Way to Freedom and Prosperity: The Hidden Politics of the 'Maker' Movement. *Al Jazeera America*. May 17, 2014. Accessed August 22, 2014. <http://america.aljazeera.com/opinions/2014/5/3d-printing-politics.html>.
- Schiller, J. C. Friedrich von. 1794. *Letters Upon The Aesthetic Education of Man*. Accessed August 14, 2014. <http://www.fordham.edu/halsall/mod/schiller-education.asp>.
- Sengers, Phoebe, Kirsten Boehner, Shay David and Joseph "Jofish" Kaye. 2005. Reflective design. *Proceedings of the 4th Decennial Conference on Critical Computing: Between Sense and Sensibility*. Accessed August 15, 2014. <http://www.nyu.edu/projects/nissenbaum/papers/reflectivedesign.pdf>.
- Sims, Shawn. 2012. The Free Universal Construction Kit. *THE BIG PICTURE Symposium*. Accessed August 15, 2014. <http://youtu.be/d5jBdOZ535s>.
- Söderberg, Johan and Adel Daoud. 2012. Atoms Want to Be Free Too! Expanding the Critique of Intellectual Property to Physical Goods. *tripleC* 20 (1): 66–76.
- Sourceforge. Accessed August 14, 2014. <http://sourceforge.net>.
- Stallman, Richard. M. 2010: *Free Software, Free Society: Selected Essays*. Boston: Free Software Foundation.
- Stephensen, Jan Løhmann. 2015. Material Participation, Publics, and/or Democratic Deliberation. *Working Papers from AU IDEAS Pilot Centre: The Democratic Public Sphere* no. 8. Aarhus: Aarhus University.
- Stephensen, Jan Løhmann. *in press*. Knowledge, Creativity and Performativity: Talking the Creative Economy into Being. In *Profiting from Words: the Intellectual History of Economic Normativities*, edited by Mikkel Thorup. Houndmills and New York: Palgrave Macmillan.
- Sterling, Bruce. 2013. Patently Untrue: Fleshy Defibrillators and Synchronised Baseball Are Changing the Future. *Wired UK*, October 11, 2013. Accessed August 15, 2014. <http://www.wired.co.uk/magazine/archive/2013/10/play/patently-untrue>.
- Sutton-Smith, Brian. 1997. *The Ambiguity of Play*. Cambridge, Mass.: Harvard University Press.

- Sutton-Smith, Brian. 1986. *Toys as Culture*. New York: Gardner Press.
- The Global IP Center. Accessed August 15, 2014. <http://www.theglobalipcenter.com/>.
- Thingiverse. Accessed August 14, 2014. <http://thingiverse.com>.
- Toffler, Alvin. 1980. *The Third Wave*. London: Collins.
- Thrift, Nigel. 2006. *Knowing Capitalism*. London: Sage.
- Verbeek, Peter-Paul. 2012. Politics at Issue. On Art and the Democratization of Things. In *Open: The Politics of Things: What Art and Design do in Democracy* 24: 18–29.
- Virno, Paolo. 2004. *A Grammar of the Multitude: For an Analysis of Contemporary Forms of Life*. Los Angeles and New York: Semiotext[e].
- Woodmansee, Martha. 1984. The Genius and the Copyright: Economic and Legal Conditions of the Emergence of the 'Author'. *Eighteenth-Century Studies* 17 (4): 425–448.
- Woodmansee, Martha. 1992. On the Author Effect: Recovering Collectivity. *Cardozo Arts and Entertainment Law Journal* 10 (2): 279–292.
- Wright, Steve. 2005. Reality Check: Are We Living In An Immaterial World? *Mute Magazine* 2 (1). Accessed August 14, 2014. <http://www.metamute.org/editorial/articles/reality-check-are-we-living-immaterial-world>.

About the Authors

Lone Koefoed Hansen

Associate Professor in digital design and aesthetics, currently part of PIT, Center for Participatory IT, Aarhus University. Her research focuses on how we might analyze and understand digital technologies through the way that artists use and criticize them. She has published papers in journals and at conferences covering the spectrum of design, aesthetics, social sciences, cultural studies, and IT research.

Jan Løhmann Stephensen

PhD, Postdoc at the AU IDEAS Pilot Centre The Democratic Public Sphere, Aarhus University. He is co-founder and editor of *Conjunctions: Transdisciplinary Journal of Participatory Culture*. Most recent relevant publications include *Kapitalismens ånd & den kreative etik (The Spirit of Capitalism & the Creative Ethic)*, Aarhus: DARC, 2010; *Performative Economics, Knowledge and Creativity: Talking the Creative Economy into Being*, in *Profiting from Words: the Intellectual History of Economic Normativity*, edited by Mikkel Thorup (*in press*); *V-v-Vertov R-r-Re-made—From Avant-Garde Documentary to Participatory Culture: the Digital Journey of Man With a Movie Camera*. *Acta Universitatis Sapientiae. Film & Media Studies* 9, 2014 (co-authored with Peter Ole Pedersen).