Zen and the Abstract Machine of Knitting

Abstract

When approaching the crafts, especially knitting, the craft's long history and refined traditional techniques can easily give the impression that everything has already been invented, or at least that innovation is limited and specific to certain forms, either in patterns or technology. However, a craft like knitting should not be too dissimilar to chess, where young masters will beat their predecessors because they find new, clever paths through the immense possibilities of the game. Crafts like knitting are not usually connected to the idea of progress, yet innovation is an inherent but often overlooked part of the practice, and rarely do we encounter new methods at the very material level. This article approaches knitting with a Deleuzoguattarian perspective and frames the "virtual" mechanisms behind knitting that could be tweaked and tuned in order to power innovation. Comparing knitting to the protocols of software or the "Zen" of the loops themselves may add a theoretical framework to help expose new dimensions of the underlying diagrams of knitting. With such an approach we may better understand the capacities with which to "hack" the abstract machine of knitting, as we can see in the works of artists like Amy Twigger Holroyd and Rudiger Schlömer.

Keywords: knitting, Zen, abstract machines, hacking

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> *Peace of mind isn't at all superficial, really [...] It's the whole thing. That which produces it is good maintenance; that which disturbs it is poor maintenance. What we call workability of the machine is just an objectification of this peace of mind. The ultimate test's always your own serenity. If you don't have this when you start and maintain it while you're working you're likely to build your personal problems right into the machine itself.* (Pirsig 2006 [1974]: 206)

Introduction

The crafts have, especially since the Arts and Crafts movement, been framed as a special mental activity, a knowledge and practice distinctly different from the logic or mechanization represented by industrialism. This romanticization of a special demarcation between craft and technology has met critique along the way, perhaps most famously in David Pye's *The Nature and Art of Workmanship* (1968) but also recently, and from other perspectives, in the works of Richard Sennett (2008), Matthew Crawford (2009), and Sir Christopher Frayling (2011).

Knitting is the technique of looping a thread around itself through loops connecting to the previous row of loops. As I will point to in this text, we can understand knitting also as the repetition of specific interconnecting protocols, similar to those in software, that come to shape the finished knit. These protocols guide how the needles make the thread loop into the previous course in various ways. Often, when we look for innovation in knitting, we look to the overall silhouette, shape, pattern or expressive use of colors, or to the artistic context. But other forms of innovation are driven by micro-interventions into the loops themselves, on what we could call a "mathematical" level, perhaps most referenced in the "lace knit" of Rei Kawakubo, or specific styles like entrelac or "scrumbling," or in the playful hyperbolic textile forms of *Institute for Figuring* (which are crochets, but have successfully shown how a mathematical perspective on domestic crafts can expose new understandings of textiles).

As I will argue in this text, we could approach this type of innovation as a certain "Zen of knitting," not only as a mode of operation in the mind of the knitter, that is, as a state of mind, but "Zen" as a *process of investigation and intervention*. This kind of intervention happens on an emergent level, more in resonance with the biological growth of organisms and the growth of complexity in living systems, than

the restraining tendencies of patterns and top-down organization. If using special mindful attention of reverse engineering and decoding of the material code of knitting, the artisan can employ a "hacker mentality" when approaching the way the loops are interconnected, thus enabling the knitter to "bend reality itself."

Knitting and Protocols

Since the rise of industrialism the crafts have often been associated with anti-progressive lines of thought, with parallels to the machine-smashing Luddites or the idealization of medieval guilds. Perhaps most obviously this has been exposed in the preservation of traditional techniques, or most often their forms. Conservation of folklore patterns, expressions, and stories were central concerns when the craft associations were formed over a century ago, but have been put under critique today as issues on ethnicity and historicity have been problematized. The historical and political traits of the nineteenth century have often put the institutionalized crafts in a petrified state with hardly any self-image of innovation, of promoting new explorations, developing new ideas or techniques. Colleges of Arts and Crafts were instituted, where regrettably, as Frayling puts it, "the look of the Arts and Craft Movement was made orthodox while its social philosophy was abandoned" (Frayling 2011: 69).

When attending a craft course, one often gets the impression that everything worth knowing was developed before industrialism and we today live in the "craft's dark ages." Institutionally the crafts often appear in the backwoods of cultural heritage and museum organizations, where conservation rather than innovation is the main point on the agenda. It is "nostalgia masquerading as history," as Frayling points out (2011: 66). The revival of knitting today is, as craft theorist Joanne Turney argues, a luxury embraced both by radical anti-consumerists as well as Hollywood stars. But whatever the cause, it is still a luxury of leisure rather than need (Turney 2009). Similarly, when today's "craftivists" act to change the world, it is more their rebellious or arty attitude than exceptional level of innovation on a miniscule level that is emphasized (cf. Greer 2008; Gschwandtner 2007), or how artisans challenge art's frontiers of representation (cf. Buszek 2011; Padovani and Whittaker 2010).

Let us just have a quick look at what knitting is. Knitting is a craft technique to shape and interlock a thread with the help of two needles. Most often just one continuous thread shapes a whole garment, even though some patterns require the assembly of several individual parts, which in turn can be made from one thread. Still, there are a multitude of patterns and expressions available in knitted pieces of textiles. What create these expressions are alterations in the ways that the thread is knitted around itself and with previous stitches along the thread.

Knitting is a thus a repetitive technique of looping and assembling stitches. Almost all knitting techniques are based on the loop of a single thread, but the thread can be looped into the next stitch in many different ways, thus a variety of basic protocols can be distinguished. The thread follows a *course*, and loops can be made perpendicular to the course of the yarn, called weft knitting, or in parallel stitches, called warp knitting. Basically, the loops can be made from the front, as a knit, or from the reverse, a purl; furthermore, the loops can be twisted, plaited, and shifted between columns or *wales* as a cable stitch. Knitting thus follows an iterative process of looping and conforms to certain rules or procedures where the yarn is looped around itself, almost "communicating" with itself.

To approach the loops of knitting from another angle we could have a look at other stringent forms of interconnection, such as in the world of computers or the Internet. Communication between computers and programs is guided by "protocols." Protocols are systems of organizing interactions, assembling parts into a larger assemblage or interconnected system. For computers protocols take the form of mathematical contracts, while socially protocols connote diplomatic code of conduct. But in both contexts they connote to forms of interconnection. Protocols are thus standardized or uniform procedures that allows for liberal inter-operation and dynamic exchange. On a very material level they are algorithms that facilitate interconnection, feedback systems, or loops, which make sure communication works. As noted by media ecologist Alexander

Galloway, we should keep in mind that protocols are not only guiding speech acts for shared understanding, but also regulate material flows, as bits in computers or container traffic in global trade.

> *Protocols are systems of material organization; they structure relationships of bits and atoms, and how they flow through the distributed networks in which they are embedded.* (Galloway 2006: 319)

So even though protocols have an everyday connotation to software, they are ubiquitously present. To understand knitting from the perspective of protocols we should neither look at the macro totality, like the silhouette of a garment or a mix of colored fields, nor at the micro parts, like the twisted fibers in yarn or type of needles. We should not focus on the human knitter or ask for her artistic intentions. We should rather examine knitting as the decentralized inter-operations of the looped network of protocols. It is a feedback system of one thread catalyzed by two needles. Knitting is an endless process of repetitions without inner hierarchy (even if it can also become a sweater).

> *Protocol functions largely without relying on hierarchical, pyramidal or centralized mechanisms; it is flat and smooth; it is universal, flexible and robust.* (Galloway 2006: 317)

The protocols of knitting are thus situated *in-between* the looped thread, in the loops themselves. This interconnection protocol of the thread could be seen as a catalyst, as it produces a bigger whole from the single thread. Normally a catalyst is a chemical substance which in relation to other substances produces a change in these, but which does not consume the catalyst itself. But as philosopher Manuel DeLanda points out, on a more general scale a catalyst is aiding growth "from within" or "from in-between" two chemical substances to facilitate interaction and trigger an autocatalytic loop, a self-sustaining process of change in the substances (DeLanda 2004[1997] 62ff., 291f.). The autocatalytic loop is not only self-stimulating but also self-maintaining, connecting "mutually stimulating pairs into a structure that reproduces as a whole" (DeLanda 2004[1997]: 62). One could say that the protocol of the looped thread "echoes" throughout the final knitted piece as the catalyst produces the conditions for emergent behavior (the inter-loops of the thread).

It might appear far-fetched to compare knitting with protocols or chemistry, but these domains help us better see how and where some knitting innovation happens. But let us return to the basics of knitting for a moment, the very "zen" of the knit and purl, to expose how we operate with protocols as we knit.

Zen and the Mechanics of Knitting

In her book *Zen and the Art of Knitting,* Bernadette Murphy aims to "expose the creative and spiritual benefits of knitting that are not commonly known, to explore the more metaphysical and esoteric elements of this craft" (Murphy 2002: x). For Murphy, a

big reward with knitting is the combination of presence, skill and physical production, and the experience of getting a result beyond one's first expectation:

> … *learning a new stitch; discovering a different manner of reducing for shoulders; creating an alternate way of piecing a sweater together. Those were the real moments. And in doing so, I have created something beautiful, something original—a piece of wearable art that has never existed before.* (Murphy 2002: 27)

Murphy elaborates on the curiosity of knitting, how it is always open for new forms of stitches, and for this one needs a special kind of wit and inquisitive attention: "Intelligence isn't having all the answers. Intelligence is the capacity to learn what you don't know. The sweaters I knit remind me of this" (Murphy 2002: 27).

According to Murphy, knitting is not merely a craft of endless repetition of stitches and micro-patterns, which could popularly be believed. To finish a project there is not only a need for strict discipline and hard work, but also an attitude of continued interest, to focus on the rhythm and the patterns of repetition, with "a willingness to follow all the steps necessary, and a lack of impatience to get the end" (Murphy 2002: 40). This systematic approach produces room for applied curiosity where new stitches can be tried out within a framework of the known and repetitive, the knit and purl, the basic protocols of knitting.

To learn and understand the processes of knitting, as with thinking, metaphors are common to create a deeper understanding of one's work. Murphy notes that the founder of the Waldorf pedagogy, Rudolf Steiner, argued "thinking is cosmic knitting" (Murphy 2002: 64). The use of stories is a common feature to teach knitting stitches or visualizing the loops for beginners. In one chapter of the book, Murphy visits a Waldorf school to follow their knitting classes and she notices how the teachers tell stories which the children then repeat. As the children learn to cast on, they "catch the yarn like a bird on the fence," they cast off with "frogs jumping over each other," or make longer rhymes to learn the knit stitch, in which the knitter is being a helping shepherd: "under the fence/catch the sheep/pull him through/away he leaps" (Murphy 2002: 68). These are simple protocols communicated through stories, which help the beginner to understand and take on the basic loops. The mind's eye is focused at the very element of the stitch, the way the new loop interconnects with the previous one.

In his now legendary book *Zen and the Art of Motorcycle Maintenance* (2006[1974]), Robert Pirsig explores the concept of quality and how it is reached by means of a "mechanic" approach to the world. The motorcycle, as an extension of the body but also a vehicle that incarnates a worldview, becomes for Pirsig a practical metaphor for a journey into the human condition. One could easily make a comparison between Pirsig's motorcycle maintenance and the art of knitting, taking the initiative by Bernadette Murphy a step further.

Knitting, like motorcycle riding, is about being present (as Murphy says), or as Pirsig would put it, about "being *in* the scene, not just watching" (Pirsig 2006[1974]: 5). Pirsig makes a distinction between the worldview among the "spectators" of reality versus the "mechanics" of reality. Spectators are involved in reality, but not in such way as to care; they take reality for granted and are not concerned about its workings. The mechanics on the other hand has an attitude of attentive examination and carefulness (2006[1974]: 33f.). Pirsig compares his mechanic's view on the motorcycle to that of his friend John, who is a "spectator":

> *It's the understanding of this rational intellectual* idea *that's fundamental. John looks at the motorcycle and he sees steel in various shapes and turns off the whole thing. I look at the shapes of the steel now and I see* ideas. *He thinks I'm working on* parts. *I'm working on* concepts. (2006 [1974]: 119)

A good mechanic approaches the motorcycle with an intertwined method of induction and deduction, synchronizing their mental images of ideas with the physical motorcycle. This is how he comes to understand the workings and interactions between the mechanical parts, through mental images and hierarchies of functions. Not the parts themselves, but their conceptual inter-operation. Mechanics are "looking at the underlying form" of the motorcycle (2006[1974]: 134). In the world of knitting, we could say Pirsig's mechanic encourages us to look at the underlying loops,

rather than the spectacular overall shape.

Such a mechanical approach can give the impression of a very rigid and cold scientific understanding of the world, but for Pirsig this is not the whole truth. To reach deeper into the workings of the mechanic's mind one needs to see the use of lateral *drifting*. It is a "growth of knowledge that doesn't move forward like an arrow in flight, but expands sideways [...] Lateral knowledge is knowledge that's from a wholly unexpected direction, from a direction that's not even understood as a direction until the knowledge forces itself upon one" (2006[1974]: 148). But to take in and comprehend lateral knowledge one needs to let the attention drift. "Drifting is what one does when looking for lateral truths" (2006[1974]: 149).

Drifting could be seen as a slightly untamed and fuzzy line of practice, but it is a special tool for reaching *quality*, the overall concept and goal of Pirsig's journey. He finds this qualitative mindset at a good mechanic or craftsman, whose work is a form of art in itself.

> *To say that [mechanics] are not artists is to misunderstand the nature of art. They have patience, care and attentiveness to what they're doing, but more than this—there's a kind of inner peace of mind that isn't contrived but results from a kind of harmony with the work in which there's no leader and no follower. The material and the craftsman's thoughts change together in a progression of smooth, even changes until his mind is at rest at the exact instant the material is right.* (2006[1974]: 380)

For Pirsig, the trick with lateral and artistic drift is to produce models of understanding that do not severely reduce the width of quality. A talented knitting mechanic would study the loops but allow for experimentation with lateral drifts and bastard techniques. The mechanic will know when to break the rules as this produces a multitude of new approaches to the object at hand, allowing for new interconnections. Even within the strict parameters of protocols there is room for ambiguity of the final outcomes. "*Ambiguity assures the potential for change*," as Paul Feyerabend would say in his argument against too rigid methods (1999: xvii).

Skills of Risk and the Complexity of Protocols

But does not a perspective on knitting as protocols produce an uncanny determinism and predictability in the work, one might ask? Rather the opposite is true. Protocols, in their minimalist dictatorship, widen and expand freedom, just like the protocols of the Internet have coordinated immense and unpredictable co-production and communication. One take on this paradox can be the works of philosopher Daniel Dennett, especially his book *Freedom Evolves* (2004), in which he shows how the concept of freedom evolves as complexity grows in systems which still have determinist rules at the basic level of interaction. As Dennett put is, "a whole can be more *free* than its

parts" (2004: 48). Dennett exemplifies this through Conway's "Game of Life," a simple cellular game that is "played" on a grid, where the general rules are strictly limited and deterministic. The rules on a basic level cannot be broken, but at a higher and abstract "design" level, where thousands or millions of rule-bound "cells" interact, new patterns and actions evolve, seemingly free from the predictability of the small-scale regulations. Some interconnected patterns even seem to live a sustained yet unpredictable life of their own, far from the certitude at micro-level. The certainty of the rules is seemingly bent as abstraction and complexity grow, and an understanding of the underlying protocols helps to tweak the technique to produce "life" in the rule-bound mathematical organism or automata.

In a similar vein, repetitive mathematical or "fractal" designs can be observed in nature, for example in fern leaves or shells, which produce very dynamic or vivid shapes. Famously explored in Ron Eglash's *African Fractals*, repetitive fractal patterns have inspired indigenous geometric patterns in Africa, in everything from hair braids to village plans, and of course textiles, from cloth to windscreens (Eglash 1999). Over the last decade the *Institute for Figuring* has also rendered the mathematics of textile craft visible in its well-known hyperbolic crochets, building on the experiences of Latvian mathematician Diana Taimina (Buszek 2011; Wertheim 2007). They have successfully showed how the crochet technique, very similar to knitting in its repetition of simple algorithms (increasing or decreasing stitches), makes up complex shapes, far from the linear or deterministic models most people think of. In such mathematical fractal patterns or hyperbolic crochets, the innovation is not in the overall artistic shape, but in the way the mathematical loops come together into new systems.

As mentioned earlier, attentive skill is needed to handle the connection between the certainty of rules and the erratic modes of operation in the higher levels of complexity. This is indeed also true in knitting, where a good handling of stitches does not guarantee a good design of a sweater or a complex pattern of stitches in, for example, a Latvian mitten. On a slightly larger scale, this involves the dynamic combination of knitted elements or modular knits, like modular entrelac knitting with its diamond-shaped patterns, or the domino knitting documented by Vivian Høxbro (2002, 2008). Another method, perhaps the opposite of the modular knit, is the freeform, or "scrumbling" techniques, popularized by Sylvia Cosh and James Walker in the 1970s. This type of fiber art, challenging and breaking up the protocols in an attempt to release an unconstrained creativity, is today once again widespread (cf. Dowde 2004, 2006).

The complexity of fractals and modular knits resemble the protocols and complexity in chess, which are described in John Holland's book *Emergence* (1998). And just like the moves in chess, the possible connections of knitting are vast. For chess the amount of attainable positions are limited by the rules of the game. A bishop for example, moving diagonally across the board, can only end up on the same colored square as it started on, thus limiting its positions. Similarly, the interconnected loops of knitting needs to form a fabric, a connected whole, a limitation which "orders" the pattern in specific ways. These are the patterns of protocol.

As with chess, knitting starts with the same point of departure, and all games and knits start with the same set-up. But during the process, even within the limits of rigid protocols, the moves diverge very rapidly, and in chess the amount of possible moves exceeds the number of atoms in the whole of our planet Earth (Holland 1998: 37). This means that new tactics in chess constantly evolve and every new master beats the previous, not because of superior intelligence, but through the development of new techniques and tactics, actualized within these vast possibilities. Innovation in chess does not happen through conservation, but through constant confrontation and risk-taking.

In her text "Thinking the New: Of Futures Yet Unthought" (1999), theorist Elizabeth Grosz explores the "vectors of becoming" in what constitutes the future and the new. She argues that in threat of chaos, we are usually too restrictive in the imagination of the new. What we consider possible is most often severely limited by the present, which in turn is always defined by melancholy and nostalgia. Even social revolution, by many

considered the ultimate arrival of the new, is perhaps the most predictable and conservative of all transformations, in its fear of risking a future not any better than the present (Grosz 1999: 17). To offer an open-ended future Grosz proposes a look at the mechanics of emergence, "which is neither free nor determined but both constrained and undecidable" (1999: 19). Just like Dennett, Grosz seeks a "direction without destination, movement without prediction"—just like that found in Conway's cellular automata—and here she reveals a paradox between the futures of biology and physics:

> *Biologists no longer accept a simple subsumption of the principles of biology to those of physics and chemistry; instead, they have insisted on boundaries and conditions specific to the nature of biology. In doing so, physics has been forced to accept certain of its well-known presumptions (entropy, to mention the most obvious) need reconsideration in the light of biology (which breaches the principle every minute of the day).* (Grosz 1999: 19)

To exemplify this hard-defined twilight zone between vitalism of biology and mechanism of physics, Grosz chooses to put her optics on viruses and asks if they are self-reproducing organisms or biochemical programs. And as life forms "does it literally matter whether they are enacted in carbon- or silicon-based form?" (Grosz 1999: 23). A virus, a program disrupting the normal protocols or workings of a cell or software, has a certain presence, a way in which it tunes the surrounding according to its need. It is "infecting" the everyday protocols, transforming the shapes, yet still works within the rules.

To play with these metaphors, we could say that where the traditionalists may have had a fear that knitting would face the cold physicist's entropy death of oblivion when facing industrialism, we can instead take the biologist's view. With a vitalist's perspective, it is the viruses and mutations in knitting's protocols that will make it grow and reinvent itself, actualizing new possibilities, new moves, just like the chess players do. Such viral interventions are not necessarily new, as a lot of artisanship has been taught in such manner, actualizing new ways of craftsmanship.

The Abstract Machine of Craftsmanship

Questions of protocols and skill in art and craft practices were examined in the teachings of legendary Bauhaus and Black Mountain College teacher Josef Albers, even if he did not use those concepts or connotations. To Albers, craft skill was not cultivated by exposing a deeper essence in form or the transcendental "laws of design," which many early modernist masters, like Johannes Itten's theories of color (1988 [1961]) or Wassily Kandinsky's (1977[1914]) theories of the spiritual in the arts, were focused on. But on the other hand, neither were they refined by indulgences in liberal "self-expression," where the artist's feelings were at display, which was a keystone in John

Dewey's theories on pedagogy. In the words of craft theorist Glenn Adamson, Albers wanted practice to reveal something else:

> *Alber's teaching of skill was adaptive, rather than final, and evolutionary, not perfectible. The artistic object was but a stage within an ongoing process, rather than an end in itself, even the end of "self-expression"—thus, perhaps, his refusal to allow his students to sign their pieces. As a former Black Mountain student recalled, Albers "wasn't terribly concerned with what we felt. He was concerned with what we saw and what we learned to see. And he would say, 'If you want to express yourself do that on your own time. Don't do it in my class.'"* (Adamson 2007: 86)

The education given by Albers was an attempt to escape the formalism of rigid method on the one hand, and the genius myth of artistic self-expression on the other. To achieve this balance Albers worked with a multitude of short assignments with cheap materials, often with newspaper, exposing the students "to a continuous experience of process, by which they would acquire skill in the most generic sense" (Adamson 2007: 84). These generic skills were formed by simple assignments where students explored different patterns, scales, and relations of form and color, remaking the assignment over and over again. Albers avoided readings of theory or perception. Instead he tried to focus on the experiment, as he meant, "the best education is one's own experience. Experimenting surpasses studying" (Albers in Adamson 2007: 84). The artistic evolution proposed by Albers happens in continuously looping reiterations.

One could argue that the teachings of Albers were attempts to facilitate systematic and iterative explorations into the "virtual" of workmanship, the micro-level protocols and skills of practice, where the systems of the possible were continuously challenged in favor for virtual potentialities. The students were not aiming final products, but the qualities of the interconnected abstract mechanics, or protocols, of their models. If we once again look to knitting we can see the workings of a special logic of assembly between the two knitting needles and the thread following certain protocols is what the philosophers Gilles Deleuze and Felix Guattari would call an "abstract machine" (2004).

An abstract machine is a morphogenetic structure-generating process (DeLanda 2004[1997]: 263). It is *the engineering diagrams that guide the processes of becoming*, a specific model of assembly, like the chemical process of a catalyst, the geologic sorting of pebbles producing limestone or the DNA in a gene that guides the biological process of *morphogenesis*, the same process that produces a seemingly living organism out of the mathematical rules in Conway's "Game of Life." Morphogenesis is the dynamic process controlling the interconnected mechanisms producing cell growth and cellular differentiation, which gives the shape to living organisms.

To Deleuze and Guattari, the term "machine" should not be understood in the limited modern sense of being purely a technical device, optimized to produce a specific outcome, but rather as an evolving morphogenetic process. Deleuze and Guattari use the engineer Franz Reuleaux's definition from the nineteenth century that a machine is "a combination of resistant parts, each specialized in function, operating under human control to transmit motion and perform work" (Patton 2000: 2). It is thus a machine of interconnected functional parts, looping their own functions or "programs" which in turn assembles and gives shape to new forms.

The abstract machine of knitting should thus not be understood as a domestic or industrial knitting machine. Rather the domestic knitting machine utilizes and actualizes *some* potential in the virtual abstract machine of knitting. The abstract machine of knitting consists of *the virtual capacities* or the very logic of knitting; that is, *what a looped thread can do*. This logic can be expanded, just like the tactics of chess, if we learn to manipulate or maintain the abstract logics of thread assembly. Not too dissimilar to how the architect uses standardized elements and scales to form dynamic environments, or the poet assembles a new poem with pre-fabricated words. The mathematician-cum-architectural theorist Christopher Alexander draws similar parallels in the introduction to his "patterns language" of the built environment, where he compares his proposed

components to the poetic use of language:

> *The difference between prose and poetry is not that different languages are used, but that the same language is used, differently.* (Alexander 1977: xli)

To Alexander, the difference of using language patterns to convey new shapes of meaning is how to interweave connections and density, "The more we can feel all the connections in the language, the more rich and subtle are the things we say at the most ordinary times" (Alexander 1977: xliii). Alexander's components of his "pattern language" are protocols that form interlocking diagrams, producing the emergent patterns and the poetry of the cities we live in; the architectural framework shaping the social fabric itself.

Knitting and Hacking

Tinkering with the protocols of knitting can happen in many ways and perhaps the most obvious is the everyday dropped stitch. But as mentioned earlier in examples of entrelac or "scrumbling," different techniques are used to "bend" the protocols or workings of the abstract machine of knitting. Many artisans also set out to tinker with the protocols themselves. Rei Kawakubo, the designer of Comme des Garçons, has "hacked" industrial production, like in her so-called "lace" knitwear of 1982, in which her knitwear was purposely jammed to incorporate various-sized holes that appeared as intricately geometric webs of lace. In Kawakubo's example, the Japanese aesthetic of imperfect simplicity, or *wabi-sabi,* is used for machine manipulation. On another level, Issey Miyake and Dai Fujiwara's APOC (A Piece of Cloth), the fully finished garments knitted from one tube, can be seen as reimaginations of knitting protocols but on a full garment scale (cf. Black 2010). Further exploring motivated breaches in assembly and purposeful "hacks" of production may open new passages of innovation as well as new understandings of the work process of designers and crafters.

It is tactical interventions at the scale of protocols, engaging with reverse engineering and tuning the interconnected loops, that artisans like Amy Twigger Holroyd and Rudiger Schlömer utilize in their artistic work. Holroyd opens up already finished knits, to remodulate the patterns of these old or "tired knits" (Holroyd 2010). She calls these techniques "stitch hacking" and "knit interventions," as they take on a "hacker" mentality, producing unexpected results that differ greatly from the linear knitting most of us do, back and forth, course on course. Holroyd's explains her stitch hacking as:

> *methods of material intervention in knitted garments […] which involves the laddering and reconfiguration of knitted stitches. It enables me to retrospectively add personalised content to an existing knitted garment […] changing the garment's appearance and affecting my own relationship with the piece in the process.* (Holroyd 2011: 8)

Holroyd reverse engineers the garment, opens the stitches to then

"re-program" them with a new message, adding an intervention (seemingly) seamless into the very structure of the knit itself. And just like the hacker, she wants to "encourage others to tinker with mass-produced objects, which we often see as 'closed'" (Holroyd 2012).

Approaching knitting from another angle, Rudiger Schlömer used a remade sound editing software to remix football fan scarves in his project for the World Cup in football 2006 "Schalalala" (Schlömer 2006). On a very basic level the program allows the user to cut and paste parts of (images of) fan scarves to create new messages and designs on the screen. Then, by pressing the print button, the new remixed design is printed as a knitting pattern. But Schlömer has taken this method to another level and created new entrelac-looking methods to facilitate the complex patterns of fan scarf remixes.

In the works of Twigger Holroyd and Schlömer, the mechanic's mindset resonates well with that of the "semionaut" defined by art critic Nicolas Bourriaud (2002). For Bourriaud, the semionaut is an agent of cultural re-appropriation and this role embodies the cultural logic of today in the shape of semantic DJs who sample, remix, and transpose signs across media. Where the fan scarves remix knitting with jazz notes and unorthodox knitting practices, as well as distributed production with new music software, they also invigorate the space of possibilities with which we understand knitting. It produces lateral drifts between concepts and techniques. Perhaps resonating with the words of Bourriaud: "We tinker with production, we surf on a network of signs, we insert our forms on existing lines" (2002: 19).

This approach, of Pirsig's mechanic or Bourriaud's semionaut, exposes similarities to the "hacker mentality" described by philosopher Manuel DeLanda. DeLanda means that hacking is to go beyond distanced analysis and formal critique to reverse-engineer the systems of reality and intervene in them directly with dirty hands. DeLanda encourages to "hack reality itself," which means to:

> *adopt a hacker attitude towards all forms of knowledge: not only to learn UNIX or Windows NT to hack this or that computer system, but to learn economics, sociology, physics, biology to hack reality itself. It is precisely the "can do" mentality of the hacker, naive as it may sometimes be, that we need to nurture everywhere.* (DeLanda cited in Miller n.d.).

Concluding Discussion: Hacking the Machine of Knitting

Alexander shapes cities by protocols, Conway the interactions between basic living cells, Albers the repetition of shapes in art, Twigger Holroyd and Schlömer the way we do knitting. Yet all tinker with their abstract machines through Pirsig's *mechanical perspective*. The mechanic can reverse-engineer the protocols and interactions between the loops, expose new potentials, and further the art of interlocking one single thread with two needles. The mechanic artfully curates catalytic protocols of knitting into new machinic diagrams or assemblages of techniques. Examples of this might be the "perfect" knitted figures by Freddie Robins (2010).

The hacker attitude mentioned above tunes the abstract machine of knitting by suggesting alternative techniques of "new knitting," or proposes bold combinations of new media and traditional knitting, such as in Schlömer's semionautic scarf remixes. But as Twigger Holroyd also shows, with a hacker's perspective, to loop a thread around itself with the help of two long needles is just the beginning, and finished knits can be reopened and repurposed, or "relooped."

From this perspective it may not be a coincidence that hacker guru Richard Stallman actually uses chopsticks in a ludic example to show how to hack domestic rituals (Stallman 2002). At a restaurant, Stallman explores how to improve eating skills, "hacking" into the use of chopsticks. With three or more chopsticks in each hand he makes a playful effort to grab the food, and he means this way of applying the eating utensils has a certain "hack value," that is, "exploring the limits of what is possible, in a spirit of playful cleverness" (Stallman 2002). Stepping out from his normal world of free software, Stallman engages, with playful cleverness, the protocols of eating, or perhaps what DeLanda would call to "hack reality itself."

But we must not forget that when engaging with the protocols of chopsticks or knitting needles we also intervene in the social practices of our world. We

transgress the dichotomies between the traditional and progressive, the historic and future-oriented, distanced critique and direct intervention. To return to the argument of Pirsig, we need to approach this sphere with attention and caution. We need to be Zen-like hackers. As described in the initial citation, for Pirsig the peace of mind of the mechanic is a "material reflection of a spiritual reality," which in turn produces right values and thoughts. Such a mindset is also the basis for development of craft as well as social change.

> *The social values are right only if the individual values are right. The place to improve the world is first in one's own heart and head and hands, and then work outward from there.* (Pirsig 2006 [1974]: 381)

Knit, purl, and interconnect. Then work outwards from there.

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