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Immersed In Pellet Technology: Motivation Paths of Innovative DIYers

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Abstract

What drives and moves an individual towards certain goals and activities is a familiar question for scholars dealing with motivation in the context of schooling or (techno-scientific) work practices. However, non-school contexts such as Internet-enabled volunteer-based technical DIY communities are also important to understand since a growing part of everyday social life is spent on the Internet. This article offers the analytical concept of 'motivation path' for understanding changing and dilemmatic motives in innovative pellet DIY development. It also introduces the concept of 'innovative DIY' to show the blurring of the boundaries between profession/hobby and past work life/retirement of technically competent, innovative people. The findings indicate that Internet-enabled making can be an important medium for continued personal growth, competence development, and (self) reflection. The findings could also help us understand how motivations may be carried over from professional work to private DIY work.

Introduction

What drives an individual towards certain goals and activities? How do people justify their motivational choices in life? Studies in Cultural-Historical Activity Theory (CHAT) have shown that individual motives are materially, socially and contextually rooted (e.g. Miettinen, 2005; Roth, 2007). While earlier CHAT studies have primarily dealt with motives in the context of schooling or (technical and scientific) work, this study introduces a historically new context for motivation studies, namely Internet-enabled volunteer-based technical making. It is important to understand such non-school contexts as Internet discussion forums, constitute a growing part of everyday social life. Especially

interesting from the point of view of motivation is that people who contribute to such contexts are not compelled to do so nor do they get paid for their efforts. How and what people learn in these contexts, what motivates them to contribute, and how volunteer contributions could be of value to business, is attracting increasing research attention (e.g. Franklin et al., 2014). Hence, examining these more informal settings could contribute to our understanding of the development of human motivation and continued personal growth in the Internet era. Conceptually, my aim is to explore what CHAT studies could offer for understanding individual motivation to participate in Internet-enabled technical making.

Internet-enabled Do-It-Yourself (DIY) technical projects offer an example of new informal innovative user-driven settings (e.g. von Hippel, 2005; Tapscott & Williams, 2007; Ratto & Ree, 2012). The DIY phenomenon, which emerged in the 1960s as an antithetic response to the categories of manufacture and consumption, and the user/creator and developer/consumer divide, is currently—thanks to the Internet—extremely rich and varied (e.g. Ratto & Bolanger, 2014, 9). DIY is associated with a multitude of different areas of interest such as the music and punk scene, car and boat building, home renovation, knitting, the making of clothes, open source software development, 3D printing, citizen science, to name just a few (e.g. Ratto & Bolanger, 2014). Broadly speaking, DIY is associated with leisure practices where the individual uses raw and semi-raw materials in producing, transforming or reconstructing material possessions (Wolf & McQuitty, 2011). However, as Ratto & Bolanger, (2014, 19) suggest, 'DIY citizens' may be thought of as a broad continuum ranging from political activists to people who underline the importance of creativity in everyday life. A recent conceptualization of the collaborative Internet-mediated dimension of DIY is 'DIWO' (Do-it-With-Others).¹ Historically, open source software developers were among the first to use the Internet for collaborative volunteer work (e.g. Weber, 2004). Today DIWO has widened to include the crafting of physical objects on the Internet, thus exemplifying the movement towards the 'materialization of digital knowledge' (Ratto & Ree, 2012, 2).² This paper, however, introduces a very specific type of Internet-mediated DIY and DIWO of physical hands-on-technology, namely the development of wood pellet technology, and challenges the prevalent notion of DIY/DIWO as belonging solely to the realm of hobby and leisure. It also shows that DIY and DIWO can be done at home alone or with family members, as well as alone or with others on the Internet

The empirical site is a Finnish Internet user forum for wood pellet technology (biomass burning).³ In countries with a boreal climate, such as Finland, wood pellets are being used as energy for heating in a growing number of detached houses. Wood pellet technology offers an interesting combination of software (e.g. burner automation and monitoring systems) and metal hardware (burner), thus enabling smoother burning at a distance. Skill-wise, pellet DIY differs greatly from the DIY associated with for example home renovation or IKEA furnishing practices (e.g. Rosenberg, 2005). The innovative making of pellet technology requires profound software programming knowledge as well as

¹ <http://www.psfk.com/2010/04/diwo-as-the-new-diy-psfk-conference-good-ideas-onchangemaking.html>;
<http://www.techopedia.com/definition/28410/do-it-with-others-diwo>

² They studied 3D printing, which is an extreme case of digital (design) knowledge turning into 'material' paper prints.

³ Wood pellets are a form of renewable energy.

thorough knowledge of welding, metal work, and even home construction. Hence, by innovative⁴ pellet technology I do not mean the replication of existing technology, but rather products that have been designed in a novel way from scratch with the help of recycled materials.⁵ Further, 'innovative' means that the creative project/product is collectively recognized as being innovative by others (see Miettinen et al., 1999, p. 3).

I choose to call the designer/users of pellet technologies innovative DIYers because their technical contributions exhibit a high degree of professionalism. Their contributions are widely cited, copied and used by other forum members, thus implying broader cultural significance. Such pellet development activity highlights the significance of the technical object for self and others: skills and competence or 'volunteer professionalism' (Freeman, 2011), and the partially collaborative nature of Internet-mediated pellet technology development (the actual physical tinkering is done at home while blueprints are shared on the forum). Currently, pellet technology-making presents an interesting mix of Internet-mediated DIWO, home-bound DIY, and home-bound DIWO.⁶ I choose to differentiate between innovative pellet development as an activity, and DIY and DIWO as modes of engagement within this activity, because the development of any single pellet-related innovation requires both home-bound DIY/DIWO as well as Internet-mediated DIY/DIWO.

The pellet forum features over 48000 posts in the Finnish user forum for pellet technologies (pellettikeskustelu.net). A section called 'DIY' (comprising 128 discussion threads and 1683 posts) was screened and chosen as a starting point for finding research subjects. I conducted personal in-depth interviews with 11 innovative DIYers identified in these discussions. The partly retrospective and discursive nature of the data sets certain limits for motivation research. Hence, this study focuses on the publicly visible verbal and written expression of their motives by asking: what motivates innovative DIYers to engage in pellet technologies, and to participate in the Finnish user-run Internet forum? The ensuing analysis of innovative DIYers' motivation paths will show that Internet-enabled making could be seen an important medium for adult competence development and personal growth. The analysis also exemplifies the importance of multiple intersecting and competing communities in an individual's life and work trajectory.

The article proceeds as follows. First, I introduce the topic and phenomena of interest. I then discuss empirical DIY motivation studies, and introduce my conceptual resources. Next, I set the scene for the data collection. Thereafter, I offer an empirical analysis of motive-giving behaviour through examples of motivation paths. I finish with a discussion and conclusions.

⁴ Although open source developers re-use code in the form of design patterns, libraries and architecture, the outcome of the coding activity is new.

⁵ The home renovation and decorating practices and IKEA furniture-assembling DIY practices enabled by power tools (e.g. Rosenberg, 2005; Watson & Shove, 2005; Shove et al., 2007; Norton, Mochon & Ariely, 2011) are not innovative in this sense because the layperson has at his/her disposal a ready-made set of power tools, materials and instructions.

⁶ This is why both notions (DIY and DIWO) are used in this article.

Understanding motive-giving behaviour in the Internet era of making

Earlier DIY/DIWO motivation studies

The early survey-based open source motivation studies took as their starting point the distinction between intrinsic (just for fun) motives and extrinsic motives (receiving a reward) (e.g. Ghosh, 2005; Krishnamurthy, 2006). In addition, peer recognition and satisfying a personal need for tools have been brought to the forefront as explanations for volunteer participation (e.g. Weber, 2004). The more recent literature on open source communities indicates that Internet-enabled software DIY/DIWO offers an interesting case of hybrid activity comprising play and work.⁷ In an earlier study on open source language technology developers' motivations, I found that each core developer had a unique set of changing motives related to their respective life situations: studies; profession as a researcher; sabbatical; unemployment; own use of linguistic aids; mother tongue/bilingualism; family reasons; and/or larger societal and economic concerns. Such activity inhabited a set of different (and often competing) goals, rendering the boundary between hobby and work blurred and shifting for the individual (Freeman, 2007; 2011). Hence, expressions like 'hacker ethic' (Himanen, 2000) or 'hobbyism' (Torvalds, & Diamond, 2001) seem too simple an explanation for the motivation to engage in DIY, since programming just for the fun of it was only one aspect of such activity. Previous empirical work also critiques the static intrinsic–extrinsic motive distinction (Freeman, 2007). The central contributors of the community were in fact professional software developers, whilst members (end-users) on the more peripheral boundaries tended to contribute by asking questions of more knowledgeable members (Freeman, 2007). However, these communities exemplified little or no movement from periphery to core (Freeman, 2007, 2011; see also Berdou, 2007). Core members did not guide newcomers nor did newcomers become core members, thereby problematizing the notion of the gradual mastering of skills by socialization (Freeman, 2011; see also Takhteyev, 2009b).⁸ Hence, the intrinsic-extrinsic motive distinction does not seem to take into account the social structure of the community, for instance that some developers are more committed, or central members, whilst others reside in the more peripheral layers (e.g. Lave & Wenger, 1991). Further, the motive dichotomy also neglects the artifact-mediated nature of human motivation (e.g. Miettinen, 2005, p. 65).

The DIY discussion has also been related to a historically new consumer category, the 'craft consumer'⁹, who uses mass-produced products as raw materials, turning them into new products (Campbell (2005, p. 34). The craft consumer is motivated principally by a desire to engage in creative acts of self-expression by investing his or her personality into the object produced (pp. 24, 27), and a desire to avoid the alienating and homogenizing

⁷ Others have characterized DIY as ambiguous 'productive leisure' (Rosenberg, 2005).

⁸ I am aware that focusing on the innovative DIYers may lead to an impression of a certain type of person. However, constructing the category was necessary for understanding the community structure and the level of skills of the contributors.

⁹ According to Campbell, craft consumption differs from the practices of personalization—marking the product "mine"—and customization—making technology better meet ones needs without any significant modification to the product, or using it for purposes other than intended by developers.

effects of mass consumption (p. 36). Here craft consumption refers mainly to power-tool-enabled home renovation and decoration practices. IKEA furnishing has for instance been viewed as 'productive leisure' (Rosenberg, 2005), and home renovation DIY ambiguously as both leisure and work (Watson & Shove, 2005, pp. 71-75). Labelled as the 'IKEA effect', when successful, DIY can lead to an increase in the valuation of self-made products (Norton, Mochon & Ariely, 2012). A sense of accomplishment, control and enjoyment are also seen as important outcomes of home renovation DIY (Watson & Shove, 2005, pp. 71-75; Wolf & McQuitty, 2011, p. 164). Crawford (2009, p. 17) maintains in his book 'Shop class as soul craft' that capitalism has done to knowledge work in the office "what was previously done to factory work". He urges people to learn about the material constraints of one's environment by actively engaging in practices that involve manual competence, instead of passively submitting to one's artefacts-in-the-world. This DIY discussion however seems to take as its starting point a "universal" 'consumer' or 'user', not the innovative DIYer.

A recent study by Rotman et al. (2012) on the other hand, discusses the complexity of volunteer motivation in citizen science online projects, where scientists and volunteers work together. Their mixed methods study uses as its starting point an existing model of motivation, comprising egoism, altruism, collectivism and principalism. The analysis communicates the important observation that motivation changes during the time from initial participation to the final decision to stay or leave a given project, and that participation is strongly grounded in personal interest (Rotman et al., 2012; see also Freeman, 2007). While Rotman et al. (2012) focus on the motivation to collaborate, the (present) study seeks to find out how personal off-line DIY/DIWO trajectories intersect with Internet-mediated DIY/DIWO trajectories to form unique motivational paths.

Conceptual resources for understanding the dynamics of motivation

In this study, individual motivation to participate in pellet DIY is understood as a dynamic process of unfolding changing relations with material objects and other people, thus departing from individual-psychological context-free notions of motivation and the intrinsic-extrinsic motive dichotomy widely used in DIY motivation studies (for a notable exception, see Rotman et al. 2012). As the cultural-historical activity theory acknowledges, motivation is not a static abstract thing nor is it solely innate or universal, but depends on what people concretely do, how they engage with the objects and people in their lives:

"Psychological processes need to be conceptualized as object-related actions out in the world, making a difference in the world and participating in its construction and development" (Stetsenko, 2005, p. 82).

However, there has been debate among CHAT scholars on the relation between individual motivation and subjectivity, and the developing object of activity and collective motive (e.g. Kaptelin, 2005; Miettinen, 2005; Nardi, 2005; Stetsenko, 2005, Roth, 2007). This discussion illuminates how one should go about studying individual activity or, as characterized by Stetsenko (2005, p. 82), "activity in which the subjective moment can dominate".

Kaptelin (2005, p. 16) interprets Leontjev's idea of 'object of activity' as something that can be carried out either by an individual or a collective, yet always being of social origin. While objects of activity as powerful sense makers for individuals and collectives, they can also be problematic, since motive is then equated with the object of activity:

"The object is different from any of the effective motives and is cooperatively defined by the whole set of motives that the subject strives to attain in their activity" (Ibid. 2005, p. 16).

Consequently, he suggests separating the motive from the object of activity to better address 'poly-motivated' activities, that is, activities that can have several motives simultaneously, and as a result may demand conflict resolution (p. Kaptelin, 2005, p. 9). Similarly, Stetsenko notes that motive-object-goals can appear as juxtaposed (2005, p. 85). As my earlier empirical studies show, a person can have multiple (competing) motives simultaneously, and they can change during participation in an activity (Freeman, 2007). Since innovative making can be seen as hybrid activity, combining play and work, it potentially inhabits mixed and conflicting goals. Hence, the proposed separation could offer a way to differentiate between the DIY and DIWO dimensions of innovative making, and a way to understand the conflicting motives that arise. I use the analytical tool of 'dilemmatic discourse' (Freeman, 2011; 2012), which I developed on the basis of the concept of ideological dilemmas by Billig & et al. (1998) and the theory of critical discourse analysis by Fairclough (1992). The tool aids in identifying conflicting and dilemmatic expressions about motives—the manifestations of poly motivation on the level of speech.

Miettinen (2005, p. 65) offers the notion of 'artifact-mediated desire for recognition' as a resource for making sense of the formation of individual motives in collective work activities. The object-related individual capabilities generated in collective activity are transferable to other activities, thereby constituting the basis for professional recognition, identity and career aspirations. The concept directs attention to questions of continued professional growth and knowledge generation across community boundaries. It also highlights the fundamental human need to be noticed by others for one's skills and knowhow—highly relevant for understanding the semi-professional aspect of innovative making, and the use of publicly visible peer-to-peer Internet forums. In my mind, the concept relates indirectly to Wenger's (1998, p. 103-105) 'multimembership' idea: that a person can belong to many 'communities of practice' (CoP) simultaneously, and that s/he naturally brings his/her unique working history into the community. Hence, the individual's changing motives can become visible through tracking the person's trajectory. Stetsenko's (2005, p. 75) work has also special significance here, as she underlines the role of human subjectivity and 'life processes' in carrying out activities. Hence, the analytical tool 'personal participation path' (Freeman, 2007) is used as a concrete way of finding out how people express their changing motives in relation to their work and life histories¹⁰: in the present case, to how innovative DIYers' unique life histories and motive combinations relate to the activity of making.

¹⁰ The work by Dreier (1999) on 'personal trajectories' and by Gruber (1980) on 'networks of enterprises', bears resemblance to these ideas.

Since playing with material object-contributions is central to the activity of making, I will extend my theoretical discussion to include the work of the English pediatrician and psychoanalyst Donald Winnicott (1958; 1971), whose main thesis is that one finds one's true self in play. Although Winnicott does not explicitly write about motivation, his work on 'transitional objects' (1971, pp. 10, 19) illuminates the deep emotional role of objects in a person's life. The basic idea is that the use of objects, first by the infant in his/her travel from the purely subjective to the objective, and later throughout the adult's engagement in creative work, is located in the intermediate area of experiencing, or potential space, belonging to neither inner nor external reality (Ibid).

It is assumed that the task of reality-acceptance is never completed, that no human being is free from the strain of relating inner and outer reality, and that relief from this strain is provided by an intermediate area of experience which is not challenged (Winnicott, 1971, p. 98). Winnicott distinguishes between object-relating, which is subjective, 'a bundle of projections' or 'me-extensions', and object-use or 'not-me extensions', which are part of a shared reality involving the consideration of the nature and behaviour of the object (1971, pp. 118, 135). In this in-between space of experiencing, transitional objects provide psychological comfort for the child entering new situations (e.g. using a blanket as a substitute for a breast). While transitional phenomena are first manifested in the creative act of playing, they later appear in all creative life (Ibid. p. 138). Building on Winnicott and extending the theory beyond child psychology, Woodward (2011, p. 367) sees consumption as "a continual process of imaginative engagement with objects". What matters is the promise of self-transformation with the help of the object (Woodward, 2011, 376-377). What I find valuable here for understanding innovative making is the transforming potential of objects for continued adult growth. In this study the above ideas are used in seeking to understand how the innovative DIYer's technical object relates to the boundary and transition between work and hobby (play). This way we might better understand the continuity and persistence of the activity of innovative making. Motives (the expressed 'whys' of the doing) are hence closely tied to motivation (the persistence and determination of the doing). Hence, I set out to explore what the theoretical resources presented here, 'the subjective movement that dominates' (Stetsenko, 2005), the 'poly-motivated' (Kaptelin, 2005) nature of making and the motive dilemmas that arise, the importance of communicating skills and knowledge across community borders to significant others (Miettinen, 2005), and the underlying persistence and continuity of making, the 'transitional' and 'transformative' (Winnicott, 1953) nature of the material objects of innovative DIY—could offer in terms of understanding the intertwining of the present DIYers' projects, lives, and motivations.

Site, Data & Analysis

The site of this study, the Finnish wood pellet discussion forum¹¹, is a citizen-driven platform for people interested in alternative forms of heating. Wood pellets, a form of wood fuel, are considered fully renewable energy. They are made from high-density wood with low moisture content, thus allowing efficient and clean burning. Their shape and size allow them to be fed to a burner by an auger or by a pneumatic conveying system. The feeding process is controlled by a thermostat. Pellets can be transported over a long distance and can be blown from a tanker into a storage tank or silo. Some choose to

¹¹ www.pellettikeskustelu.net

purchase pellets by the sack. It was estimated in 2010 that 23 000 Finnish households were already using pellets. A pellet-burning system was estimated to cost around 500 to 15 000 euros.¹²

Many of the detached households represented in the forum discussion had changed or were in the midst of switching their heating system from oil to pellets. The entire forum comprises 46 830 posts in 3 194 threads by 2 103 people. The purpose was to find innovative users and analyse their contributions (see Hyysalo, Juntunen & Freeman, 2013a; 2013b). The forum DIY section (featuring 1 635 messages in 123 threads) was screened and chosen as a starting point for the data collection. Close scrutiny yielded 74 innovations by users in this section, including burners, boilers, burning crates, pellet vacuums, cyclones, silos, and automation and monitoring devices (see Figure 1).

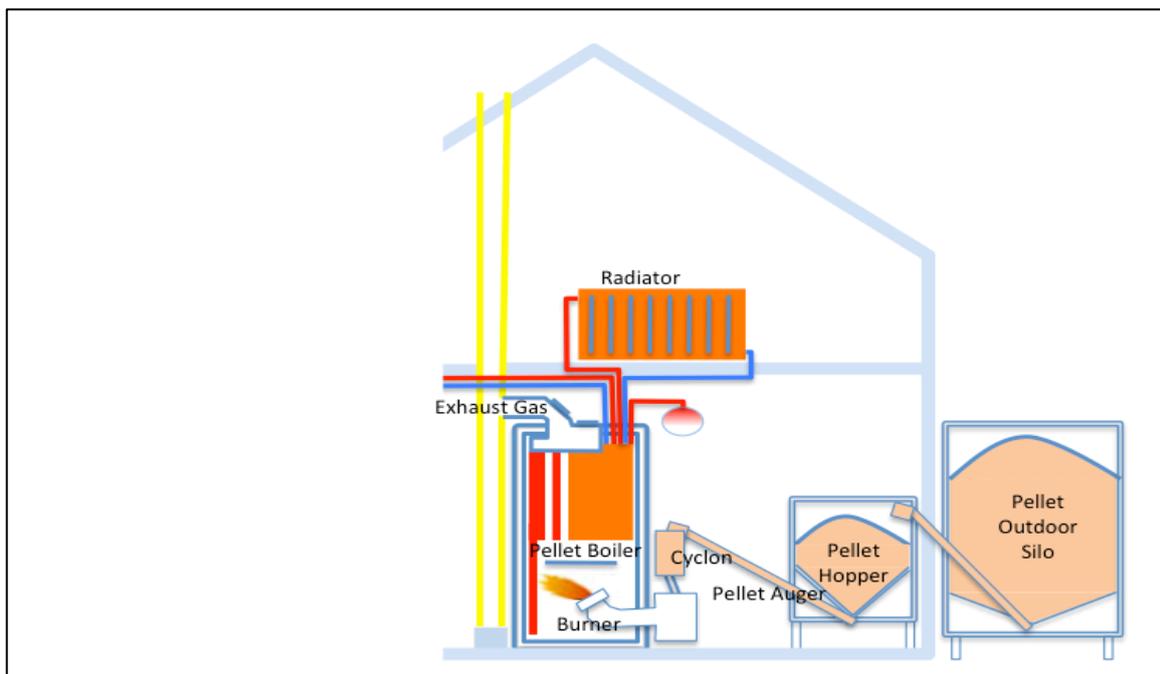


Figure 1. The pellet burner system in a detached house.

I identified 39 innovative DIYers and 35 peripheral DIYers on the basis of their pellet technology-related skills and competence (see Table 1). By 'innovative' here, I mean pellet technology that is 1) not merely a replication of existing technology or a product enhancement, but a new design, 2) made from recycled materials, thus contributing to a more sustainable future, 3) made by using professional knowledge and skills, and 4) recognized as innovative by other forum members as well as outside experts in the energy technology field (the criteria and evaluation of pellet innovations is reported elsewhere in detail, see Hyysalo & et al., 2013a). Innovative/committed DIYers and peripheral DIYers were first categorized according to the number of their messages. This procedure however did not necessarily yield information about their innovativeness, as I realized when reading the posts. Hence, active and committed discussants were not necessarily

¹² <http://www.ilmankos.fi/uploads/ilmankos27-10-2010.pdf>

innovative. Some of the innovative DIYers were not very active on the forum, yet they were acknowledged by their peers as innovative. Hence, it is possible to be 1) committed but not innovative, 2) innovative and committed, and 3) innovative but not committed. The innovative DIYers often provided signatures and links to their own DIY sites, thus communicating their expertise to peers, and leading one outside the confines of the forum. Their personal projects were complicated, which is why both internal and external expert evaluators were also used in verifying the categorizations (see Hyysalo, Juntunen & Freeman, 2013a; 2013b for a detailed analysis of pellet innovations).

Component of the technical system	Innovative/committed DIYers	Peripheral DIYers
The whole pellet system	1	
Pellet burners	11	
Pellet boilers	11	
Pellet transfer augers & cyclones	5	3
Pellet storage (silos)	2	12
Pellet burner control logics	2	
Pellet system measurement & automation	4	12
Heating system hot water tank	1	
Other pellet-burning systems (e.g. furnace grates)		3
Pellet production	1	
Other (cleaning the system)	1	5
Total DIY inventions 74	39	35

Table 1. The distribution of contributions by innovative DIYers and peripheral DIYers.

I chose to study *innovative DIYers* in more detail because their inventions were widely cited and used as exemplary models by others on the forum, testifying to their wider social significance and the fact that their making required semi-professional competence or ‘volunteer professionalism’ (Freeman, 2011). I sampled the DIYers and sent 30 interview requests to them. Between 2011 and 2012, 13 agreed to be interviewed either by phone or face-to-face in their homes. These 13 by and large matched the sampling criteria (innovativeness and semi-professionalism of their DIY projects). The interviews provided the rich data on their projects, lives and motivations that they had been intended to capture. This kind of purposive sampling is widely used in qualitative research when time and resources are scarce (e.g. Silverman, 2010, p. 150). Hence, no further interviews were sought. I compared motive-related expressions in the interviews to those posted on the discussion forum. Thus, the use of complementary data (real time data in the form of Internet discussions, and retrospective data in the form of interviews) enabled data triangulation (e.g. Hine, 2008). Furthermore, entering the field in this way (e.g. Denzin & Lincoln, 1994), by reading all the forum posts, provided the necessary background for conducting the interviews. I asked both how questions (see also Mills, 1940) and why

questions. Two interviews were too short to be analysed from the perspective of individual motivation, leaving 11 interviews (ranging from 60 to 240 minutes) as the main data source. I analysed the in-depth interviews¹³ by identifying the changing positioning of the self-referential ‘I’ in relation to the activity of making. I colour-coded all the motive-related expressions, and temporarily categorized them according to the DIY/DIWO events, material objects, and social relations pertaining to them. This made it possible to further identify dilemmatic expressions regarding motives. I constructed 11 personal participation paths, and identified what had happened prior, during and after online participation. These were then incorporated into a table comprising two columns: person and type of pellet technology, and expressions revealing changing motives as well as dilemmatic motives (See Table 2). The thicker lines on the table enclose the four people and their trajectories that I chose to present in the eventual narratives of motivation paths. These four were chosen because 1) their interviews provided the richest communicative data, 2) they all seemed highly professional in their orientation to pellet technology, 3) their projects were highly innovative yet different from one and other, and 4) their projects were widely known and recommended by others on the forum.

I briefly describe the role of the pellet discussion forum in the lives of the 11 interviewees, as an introduction to the analysis. According to the innovative DIYers, the forum had been at its most active in 2006-2008, and the importance of the DIY section had been highest in the early phases of their own pellet-related projects. Moreover, the forum was mostly used for reporting on their own projects. As table 2 shows, eight had a welding background; one was a student of software and electrical engineering, one a wood production engineer, one a researcher, and one had a diploma in computer science. Three of the eight welders were regarded as the best experts on the forum by the forum members. They made their expertise visible to others by presenting detailed descriptions and photos of their projects and providing links to their personal web pages. They helped others by providing knowledge on different materials, and gave warnings on what not to do. Warnings were considered important since improper tinkering with the pellet technology could potentially result in a fire. Overall, the forum was described as a kind of spell checker and test lab for ideas and finished projects. It was also considered an important place for finding links, sharing knowledge and seeing (mainly in photos) what others had done, something akin to the importance of ‘visual imagery’ in crafting (see Keller & Keller, 1999). The actual tinkering was done at home alone or with family members, not with other forum members.

Person & Type of DIY contribution	Changing motive combinations & Dilemmatic motives
1 Retired diesel technician, welding skills, self-taught electrician	Interest in technology runs in the family Making use of prior occupational expertise Obsessed with tinkering Feeling useful while retired

¹³ The broad interview themes were: could you describe your DIY/DIWO project/s and your participation in the pellet discussion forum. Why and how pellets in the first place? Why and how DIY? Why and how forum participation?

<p>The entire pellet system except for the commercial burner: Silo, pellet vacuum</p>	<p>Rise in oil prices → cost savings via recycled materials Lack of commercial system & bug in commercial product Cost-savings versus using equipment (tools) that use a lot of electricity Spare time: having the time but not being able to stop DIY Social recognition: expertise and fame versus too much fame</p>
<p>2 Retired welder, self-taught electrician Pellet burner with automation</p>	<p>Making time pass quicker while retired Making use of occupational expertise Rise in oil price - > cost savings Keeping in touch with son Learning from son about electronics Commercialization of innovation in mind Cost savings versus lots of “unnecessary electrical devices” at home Working for free versus barter (gets annual supply of pellets)</p>
<p>3 Student, software and electrical engineer (son of welder 2 above) Pellet burner with automation</p>	<p>Father decided on his behalf Own project made him change to electrical engineering Learning for profession -> reporting & publishing work Commercialization in mind Hobby around versus educational learning reasons</p>
<p>4 Retired welder, wife electrician Two pellet burners</p>	<p>Plenty of time due to retirement Making use of occupational expertise Fun to work with hands Making life easier Prior experience in RE (solar panels) Cost savings via recycled materials Fighting against exploitative electricity companies and low pension Would like to disconnect from the grid but needs his hobby hall, which uses extra electricity Making life easier versus attending to the burner on a daily basis because cannot totally trust the system</p>
<p>5 Welder</p>	<p>DIY together for self & others. Seeing the first working pellet burner at an exhibition inspires</p>

Turns old oil boiler into pellet burner by extending the burning caveat	<p>Rise in oil price -> cost savings</p> <p>Making use of occupational skills (believing in one's skills)</p> <p>Recognition from a more advanced professional</p> <p>Wants to help people out of goodwill</p> <p>Excitement of helping others has faded because he is not paid</p>
6 Welder Built a slightly modified version of the burner developed by welder 5 (above)	<p>DIY together for self & others.</p> <p>Seeing the first working pellet burner at an exhibition inspires</p> <p>Rise in oil price -> cost savings</p> <p>Making use of occupational skills (believing in one's skills)</p> <p>Recognition from a more advanced professional</p> <p>Wants to help people out of goodwill</p> <p>Excitement of helping others has faded because he is not paid</p>
7 Metal technician and plumber, and landlord and IT contact person Developed a "Pellet elephant" for pellet transfer	<p>Cost savings from using recycled materials</p> <p>Making use of occupational skills</p> <p>Making life easier</p> <p>Enhancing commercial product</p> <p>"Lazy person has to create"</p>
8 Welder and automation technician Own burner out of recycled materials	<p>DIY for self and others</p> <p>Cost savings</p> <p>Green ideas</p> <p>Lack of commercial product</p> <p>Large-scale use makes problems visible in technology</p> <p>Producing for others for a minimal material fee</p> <p>Grey zone of economy: DIY for others for a minimal fee versus cannot speak of commercial business</p>
9 Wood production engineer An almost finalized pellet transfer system	<p>Family owns forest</p> <p>Cost savings by using recycled materials (new from old)</p> <p>Pellet the only option because the town does not supply district heating circuits</p> <p>Freedom from energy companies</p> <p>Testing ideas</p> <p>Hobby versus not quite good enough forum for serious discussions</p>
10 IT support person, ex-entrepreneur	<p>Cost savings</p> <p>Neighbour encouraged to use pellets</p>

Long distance monitoring system	Move to home town forces him to find a way to monitor the system from distance Encouragement encourages further Making life easier versus chance to hobby around Following monitor on a daily basis (can see what the tenant is doing)
11 Computer scientist and hobbyist A pellet silo for storage	Making life easier Cost savings by using recycled materials Inventing is fun Challenging oneself The forum as a spell checker

Table 2. All 11 interviewed innovative DIYers, their projects and changing combinations of motives. The first four have been analyzed in more detail in the subsequent chapter.

Motivation paths of innovative DIYers

The motivation paths detailed below illustrate how the innovative DIYer moves between individual and collective modes of doing—between DIY and DIWO (Do-it-With-Others)—and how these different modes of activity contribute to their changing motivational landscapes. The first path exemplifies an activity in which individual making clearly dominates (c.f. Stetsenko, 2005, p. 82). The second path illustrates individual-based making, supported by a close family member, the participant’s wife. The third path illuminates a more collectively oriented (e.g. Nardi, 2005; Miettinen, 2005), yet individually conducted activity: a father and a son complement each other by following individually different parts for their joint pellet system. I have differentiated between the conditions enabling DIY (i.e. motives for DIY at home) and motives for DIWO on the forum. Each motivation path shows a unique set of (dilemmatic) motives. All the paths also illustrate multiple motives for engaging in innovative pellet development (cf. Kaptelin, 2005). The transitional character (Winnicott, 1953) of DIY pellet technology—between studies, work, hobby and retirement—can be seen in the subsequent narratives.

Path 1. From DIY at home to DIWO on the Internet to DIY at home

Background skills and spare-time as enablers of DIY and DIWO

This ex-diesel technician has profound knowledge in pneumatics and hydraulics. He can construct anything from electronics, masonry, woodwork and HVAC engineering to car collision repair. He explains that tinkering “is a family fault”: both of his brothers are also technicians, and his son is a software engineer. The making of technical things and playing around with materials was highly encouraged in his childhood. He has wanted to pass this technical ambience on to his son. He has constructed two family homes from scratch, a self-made stream that goes around the garden, and a skid (even documented in a Finnish TV program because it was so innovative). His upbringing and past working life skills enable innovative making.

Motives for DIY at home: economic savings, health versus obsession, and need for quality time alone

In 2006, he started planning and constructing an entire pellet burning system. He mainly used recycled materials that he had acquired from his past work-related network. His system includes a silo (big storage house); a vacuum system for pellet transfer; and an old twin wood/oil boiler attached to a commercial pellet burner (the only item that he had not made himself). At the beginning of the interview he offered two practical motives: the rises in oil prices (his financial savings motive), and the lack of a pellet transfer system on the market (a practical-rooted motive of “being forced” to do it himself). Later on in the interview, he expresses some further, rather dilemmatic, motives. He has a health-related motive for building the large outside silo and pellet transfer system, that is, to “avoid carrying pellet buckets on a daily basis”, thus “avoiding back pain”. Yet retiring early due to work-related back injuries does not stop him from continuing physically demanding tinkering in the house:

I’ve never had any spare time in my life. If only I could sit down and enjoy all of this (pointing to the house including the heating system)...recently I’ve been thinking of about life and its limits...at the moment there just isn’t enough time (due to another project). (Interview)

While retirement seems to enable DIY timewise, spare time is also a dilemmatic object of sense-making. On one hand, he needs to engage in DIY or is *obsessed* with DIY (see also Freeman, 2007, p. 73). On the other, he wishes that he could relax and enjoy what has been achieved. He also explains that he wants to make life easier for himself, but ends up spending all his spare time on the very project that was supposed to have made his life easier.

His DIY workshop, a garage, is in a separate building. It has an Internet connection and a sound system, thus offering him an escape from the local world and connecting him with an Internet-mediated world of peers. He calls it his “second living room”, and with a twinkle in his eye, asks me: “when has a garage been used as a garage?” While pellet burning socially includes neighbours and peers (as we shall see), it seems to exclude his wife, who interrupts our interview by saying:

But can I say something. I don’t understand why we no longer use chopped wood. When we used to have oil heating, we also used to heat with wood. We were lucky we didn’t end up fighting over who gets to light the fire. For example, once when he (husband) was at work, there was a terrific snowstorm outside. I kept on heating the house throughout the day. It was really fantastic, I thought. After we started using pellets, I’ve asked for the possibility to use wood, but the burner has not been installed in a way that would allow it to happen. (wife, interview)

Motives for DIWO on the Internet-forum: knowledge sharing, peer recognition and self-reflection

He joined the pellet discussion forum in late 2006. By then his pellet project was in full swing. It is at this point that his mode of pellet development changes momentarily from DIY to DIWO. He is one of the most active members, with 429 posts altogether. However, since he mostly reports in detail about what he has done, and does not seek help from

others, his communication tends to be one-way. In his own words, he wants “to share and exchange knowledge on the successes and errors of his DIY project”. He links his forum posts to his own separate website “My project in words and pictures”, which comprises detailed visualizations, photos and commentaries pertaining to his pellet project. This motive-related explanation can have two interpretations. It seems highly plausible that he used the public forum as tool for self-reflection (cf. Turkle, 1995). Another interpretation could be his desire for recognition and getting appraised for his work (Weber, 2004, p. 135; Miettinen, 2005, p. 65). Indeed, a peer welder notices his project:

I can see you really have invested time and effort (in your project). By the way, what is that bendable outer shell of the ash screw made of? (peer ex-welder, forum post)

Two forum members actually visit him in person to see his work “for real”, despite having to travel some distance.

Motives for DIY for others at home: from recognition by neighbours to loss of motivation

His neighbours also recognize his technical equipment and high quality welding, to the extent that he has to get rid of an expensive professional tool:

I would have been constantly working on my lathe for someone. It takes 11 kilowatts...it weighed over 2 500 tons that lathe. It was really big. So there would have an infinite number of jobs to do, but the hell with it, I’m not going to use my evenings in my garage for no pay, so I sold the damn thing and thought ”well now I don’t have a lathe”. I was totally exploited. (ex-welder, interview)

In this case, having the time, socially recognized metal bending skills, and the right tools, led to *demotivation* to engage in DIY for others. This implies that ‘artefact-mediated desire for recognition’ (Miettinen, 2005) can become demotivating if over-exercised. Tools and skills seem to function as active shapers of motivation (Kaptelin, 2005; Miettinen, 2005; Nardi, 2005).

Path 2. From DIWO on the forum to DIY and DIWO at home

Background skills, spare-time and wife as enablers

This early-retired ex-welder has prior experience with renewable energy technologies. In the 1980s he constructed and installed solar panels, and in the 1990s he built a windmill. He has plenty of time and thus can make use of his prior occupational skills and passion. He also enjoys doing things with his hands, and describes himself as “a curious metal guy”. His wife calls him “Gary Gearloose”. His neighbours and friends value his welding skills¹⁴ and generosity. His wife, the “spare hand”, as he calls her, is a retired electrician and DIWO buddy at home. She has planned and implemented the lightning system for their house. Together, they built a factory facility in 2009-2011. It was first intended for business use, but they ended up using it as a workshop. It resembled a hardware store with

¹⁴ While interviewing, someone called twice and asked him something related to welding, to which he responded that he would have to come and see for himself.

well-organized shelves stacked with all kinds of raw (and recycled) metal materials, and heavyweight welding tools. Most of it is left over from his past working life. In the middle of the hall stands an ultra light airplane, which he has been working on for years (he even asked me, the interviewer, to join him for a test flight!). Upstairs, in her own room, his wife is designing wing pockets for the air plane. Her role in the pellet project should not be underestimated, since she enabled him to participate in the discussion forum:

She was the one who taught me about computers, I was over 40 when computers came into the picture, so I was pretty clueless. (ex-welder, interview)

The husband's motives for DIWO on the forum: seeking information for a specific problem (learning)

In 2006, the husband started following the pellet discussion forum with the intention of building a burner from a single piece of metal. Occasionally, the husband-wife team read the pellet forum postings together. Mostly, however, the wife follows out of the corner of her eye, and helps if needed. Being a professional ex-welder, the husband is equipped with enough knowledge to create a burner by reading a few discussions and following links to other sites:

I've found everything that I need on the forum. It has links, so I've been able to look at producer pages and so on. Then someone uploaded a photo of an explosion and I thought "Well, thanks!", and then just started to compose. (ex-welder, Interview)

Once the forum has satisfied his learning motive, he no longer needs the discussion group.

Joint motives for DIWO at home: cost savings versus a high maintenance hobby hall, making life easier versus making life harder, fighting against electricity distribution monopoly and connecting with one another.

The husband explains that his wife is included in the pellet project, because "metal is so heavy" and "a second or third pair of hands is often needed". They even co-created a "SOS system" for communicating with one another about the project. The household sewer pipes run from the boiler room in the cellar (where the husband works on the burner) to the toilet upstairs (his wife is mostly in the living room or the kitchen near the toilet). Hence, all he has to do is tap the pipes, and she can hear him upstairs, and immediately knows she is needed.

They have always wanted to live at minimum cost, and more so now that they are retired and have low pensions. Cost savings and fighting against the exploitation of the electricity companies—the economic and the ideological—are the primary motives for starting the pellet project. Since the weather in Finland is cold in the winter, and the hobby hall is used regularly, heating with oil is costly. They are forced to find an alternative form of heating. Luckily, a friend gives them an old wood burning stove from a train, which they start using. After a series of trials, he quickly concludes that the stove does not work smoothly enough. He turns the wood stove into a pellet burner. He is encouraged by this successful experiment, and builds another pellet burner, now for the main house. However, they also

express two motive dilemmas in relation to pellets. The first dilemma is related to wanting to save money and wanting to engage in DIY: they would like to disconnect themselves from the electricity grid altogether, but this would mean giving up the hall (because of the electricity bills), in which the DIWO takes place. Another dilemmatic motive arises from wanting to make life easier through DIY yet having to attend to the burner on a daily basis because the system cannot be trusted:

I go there (to see the burner) on a daily basis. (ex-welder, Interview)

Daily. I listen through the toilet pipes to check that our burner works. (wife, Interview)

Well, originally there was the idea that it would work independently, but I have not dared to leave it unsupervised yet (ex-welder, Interview)

Path 3. From DIWO at home to DIWO on the forum

Background complementary skills and professions as enablers

This father-son team complement each other. The father, a retired welder, has profound knowledge of metal work. He owns a 400-square meter warehouse, which he built in 2004, just after retiring early due to sickness. He rents part of his warehouse to a commercial pellet burner firm. He also distributes pellets locally. However, his role is not merely that of a landlord and village pellet distributor, but also an expert user and designer of pellet technology:

This new Finnish burner was developed by the guys from firm X. They planned it and I gave advice on how to design it. They changed their drawings after I told them what it should look like. The design is now easily taken apart, that is, if one wants to be able to monitor the system while using it. It is my design, the present system. (ex-welder, interview)

The ex-welder receives a yearly supply of pellets from the firm in return for helping with the design.

His son is a student of electrical engineering. For the son the entry into pellet technology was through his father, whom he obediently followed:

Well, I don't really have any reason (for choosing pellets), because it was dad who decided and changed the system for me. The burner project was a kind of hobby for me. My father is more into pellets. He is very talented with his hands, and has done a lot of metal work. (son, interview)

Interlinked motives for DIWO at home: cost savings, killing time, learning from and for a profession, commercialization, and staying in contact with one another

The father's initial motive for choosing pellets was the rise in oil prices (economic motive of wanting to save money). Seeing a commercial pellet burner at a local exhibition in 2004 "in person" (as he expressed it), inspired him to change to pellet heating. He purchased a commercial pellet burner (the one he saw at the exhibition) in 2006. He stated that he

needs to have something to make time go by now that he is retired. He also helps local people when he is not working on the burner project:

I do renovation work and other stuff too. So that time passes by better. When I don't have anything else in mind, I always try to help others. (ex-welder, Interview)

In 2007, he detects a weakness in his commercial burner. He is discontented with the way the burning is controlled. This practically rooted motive drives him towards the idea of collaborating with his son:

Well, we started. I, myself, started thinking. And my son, he designs the burner logics. So I got excited. I knew better control logics could be created. My son has also developed the second version (control logics) for the burner. It is even more versatile now. It even has a net monitoring system so you can follow the heating process online. He (the son) has a third, even more elaborate version, in mind. (ex-welder, Interview)

The son sees this as an opportunity to enhance his electronic engineering skills in his future profession (his learning motive for their joint activity). He also characterized his engagement as “a kind of hobby” “because it is fun” (his enjoyment motive for their joint activity). Their collaboration is a success. While the father uses his welding skills to create the hardware, the son develops the much needed software. Since the son no longer lives with his father, they use a real-time computer connection, “Paul”, for communicating. Hence, a joint motive could also be to stay in touch with one another, to maintain family ties.

Interlinked motives for DIWO in the forum: helping, peer recognition, and commercialization

The father starts following the pellet discussion forum just after he and his son have started working together. He is extremely active in helping others, posting a total of 300 messages. His posts are related to different boiler types and fittings, and commercial burner modifications. He is much appreciated on the forum. All the interviewed innovative DIYers know him and their burner project. The son on the other hand, does not engage in helping behaviour. Instead, he reports on his own progress with the burner logics project by posting detailed photos and commentaries. He even celebrates the birthday of version 2.0 with cake and candles, thus giving technology the status of a family member or friend:

At last, something to report ☺ Today, on Sunday 26.10.2008, a year has passed since the burner was test-driven in the yard. To mark this event, we had a celebration cake. 1 Year. (son, forum post, 2008)

He speaks of “wanting to just blog about own work”, and “not being interested in others' stuff”. This publicly visible motive-giving behaviour could be interpreted as seeking peer recognition (see also Weber, 2004, p. 135). However, it can also imply that he uses the forum as a personal site for learning. Today the father-son team also have a joint commercial interest or profit-seeking motive: the burner and control logics work well, and

the firm renting the warehouse has shown interest in their burner. Indeed, this case illustrates the polymotivational nature of activity (cf. Kaptelin, 2005): how joint activity can have very different motives for different people, and how a single person can exhibit multiple changing motives for his own participation.

Similarities and differences in the innovative DIYers' motivational landscape

Shared dilemmatic motives among all interviewees have mostly not been reported in earlier DIY studies. While economic savings¹⁵ has been previously offered as a motive (see also Wolf & McQuitty, 2011), what is actually meant by cost savings has not been explored before. In all 11 interviews, it meant using recycled materials: turning old into new; using one's own competence and time; a passionate fight against the exploitation of electricity companies; and/or making use of one's (previous) working-life tools and equipment. Poor product quality and the need for customization (see also Wolf & McQuitty, 2011) were the primary practical motives for DIY. The commercialization of DIY innovation is another motive not previously reported. Other new motive-related findings were: the need to feel useful while retired; health-related reasons such as avoiding back pain; in some instances, seeking solitude at home, while in others, seeking company and maintaining links with the family. Learning a trade (e.g. Ghosh, 2005) has not been previously discussed in relation to 'transitional objects' (Winnicott, 1953), that is, that DIY could provide a smoother transition to work life. Further, social recognition (Weber, 2004; Miettinen, 2005) can have a downside: too much fame may lead to exploitation by neighbours. Hence, the desire for artefact-mediated recognition (Miettinen, 2005, p. 65s) can become demotivating.

A summary of the shared motive dilemmas of all the 11 interviewed innovative DIYers is presented in Table 3. While cost savings was stated to be the ultimate goal, all the welders reported having equipment and a garage that used up unnecessary electricity. Hence, calculating the monetary compensation gained could be difficult, which makes the cost savings argument rather dilemmatic. However, it could be, that in the long run, their economical practices will in fact result in actual monetary savings, dissolving the apparent dilemma. Another dilemma relates to wanting to make life easier while actually having to put effort into achieving this in the first place, and then having to attend to it (especially the burner) on a daily basis. In the light of the motivation paths identified here, it seems that there is nothing wholly convenient about pellet burning. The interviewed innovative DIYers seem to be able to make pellet burning just as easy or hard as they choose to. Perhaps this is just a way to make sure that one stays busy. All except the father-son team, expressed they had no interest in commercializing their innovations. However, some forms of expression allowed for another interpretation: people either produced small quantities of components for a pellet system for minimal (land mail) fees, or made some other barter arrangements through the forum, thus participating in the economic grey zone. Furthermore, (spare)time was a dilemmatic concept and an enabling condition: it seemed that either there was too little time or too much, depending on the work-life position of the DIYer. They were also rather obsessed with pellets (see also Freeman, 2007, p. 73). Even if they found time to sit around, they would have a hard time enjoying being "useless". The line between hobby and work was extremely blurred for them: they all had some kind of connection through pellets to a previous, current or upcoming profession (see also

¹⁵ This motive was expressed throughout the entire pellet discussion forum.

Freeman, 2007). Innovative DIYers seem to use and develop technology largely for communicating their professional expertise to peers (cf. Miettinen, 2005).

Expressed dilemmatic motives	Number of people expressing this dilemma
Cost-savings versus using equipment that use a lot of electricity	5
Making life easier versus having to attend to the pellet system on a daily basis	7
No commercialization objectives versus making for others for a minimal fee or in exchange for something	4
Hobby/leisure time versus extension of work or education	11
Taking time to rest versus not being able to stop DIY (obsession)	5
Retiring for health reasons versus continuing physical making at home	2

Table 3. Summary of shared dilemmatic motives among interviewees.

The motivation paths of the all 11 innovative DIYers had some processural features in common (See Figure 2). Firstly, the modes of DIY and DIWO were present in all phases of innovative pellet DIY (from home to Internet forum and back home): the individual and the collective evolved hand in hand. Secondly, all had started their projects at home alone or with family members before entering the Internet forum, and then left the Internet forum once their ideas gained recognition. Thirdly, a privileged sequence of motives could be found. Some of the initial motives faded as the project proceeded (e.g. lack of suitable product on market, learning for profession, monetary savings, health issues), giving way to new ones (e.g. self-reflection, gaining self-confidence through peer recognition; advertising one's own innovation, making barter arrangements, and later, in one case, commercialization). However, there were also motives that persisted throughout the development of each respective pellet innovation (e.g. learning for a profession, making use of a (ex)profession and feeling useful while retired, seeking solitude, connecting with family, and plain obsession).

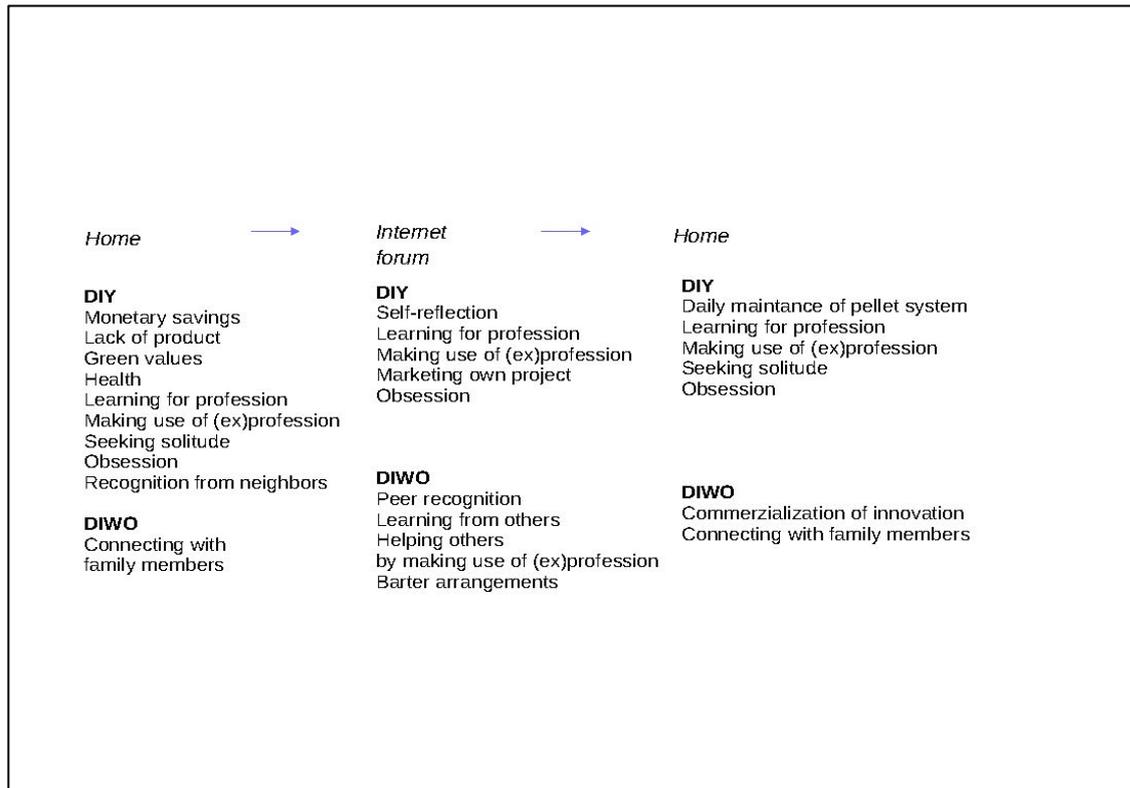


Figure 2. Sequence characteristics of all 11 motivation paths.

Discussion and Conclusion

This article contributes to a more multifaceted and nuanced understanding of DIY and human motivation. It demonstrates that human motivation is more complicated than might be understood from attitudes measured by questionnaires at a specific time. Instead of asking people to answer a set of predetermined questions on pre-determined motive categories, participants were allowed freedom to narrate their lives as they wanted and with as much time as they needed. Yet the conceptual notion of a *motivation path* provided a theoretically well-grounded frame for formulating questions and making sure that events, objects and people were discussed in such a way as to exhibit a timeline. The concept provided insight into the innovative DIYers projects, lives, and intertwining motives and hence acted as a sensitizing resource. Further, the analysis confirmed that objects, tools, competence, and social relations are active shapers of motivation (cf. Kaptelin, 2005; Miettinen, 2005; Nardi, 2005, 2005; Roth, 2007). Albeit human motivation is not reducible to objects or other people, the experiencing subject-body expresses emotional valence always in relation object-and subject relations (see also Stetsenko, 2005). While a fairly small sample size may be regarded as a limitation of this study, the in-depth analysis of the motivation paths illuminated aspects of motivation that might have passed unnoticed with a larger sample size and a less intensive data-gathering method. Furthermore, while I am aware that motive-giving communicative behaviour (in speech or text) can be heavily influenced by context and concerns with self-presentation, paying attention to discrepancies in speech can reveal important aspects of motivation, as the present findings indicated.

The motives expressed were strongly related to using, developing and communicating one's competence to peers (cf. Miettinen, 2005, p. 65). More specifically, to making use of one's previous profession or preparing for one's upcoming professional career (see also Freeman, 2007). The activity of innovative pellet development potentially enabled the DIYer to transition between the life stages of studies, work and retirement. Hence, the studied pellet technologies could be perhaps viewed as comforting toys (cf. Winnicot, 1971), since they provided a feeling of continuation between past work life and retirement, strengthened the working self, or enabled a smoother transitioning between studies and future work.

While the findings support previous DIY motivation studies on the changing nature of motivation (Freeman, 2007; Rotman et. Al, 2012), this article takes a deeper and more detailed look at the phenomenon. The concept of motivation path illuminates both a *privileged sequence of changing motives*, as well as *persistent motives*. The persistent ones lingered throughout the innovative span of the DIYer's activity, raising the question of change versus stability, not previously discussed in DIY studies. For instance, the ongoing need to feel useful when retired—an *existential motive*—has not been reported earlier. Another persistent motive, *obsession*, supports the findings of my earlier study in the field of open source software (Freeman, 2007). However, what is novel about obsession in the present context of pellets, is that it can outweigh or even contradict other motives (e.g. physical health and making life easier). While the innovative DIYers often started pellet technology development because they want to make life easier or more convenient for themselves for health reasons, and to save money, their configurations often end up requiring daily attention, and using more energy, thus appearing to complicate life. Connecting with family members was also a motive that was present both prior and post participation on the pellet DIY forum. Based on the findings, it seems that emotional and social wellbeing may outweigh physical wellbeing.

Multiple motives (see Kaptelin, 2005; see also Nardi, 2005) and emotional valences characterize such hybrid work and play activity, thus potentially creating an uncomfortable feeling of 'cognitive dissonance' (see Festinger, 1957) for the innovative DIYer. The analysis of innovative DIYer's motivation paths revealed a *dilemmatic motive landscape*, not previously reported. The CHAT framework made it possible to find discrepancies in the expressions used, and made visible the coexistence of individual and collective modes of DIY and DIWO in the innovative DIYers' activity. These two modes of making have not been previously reported as co-evolving in a single person's DIY trajectory. Furthermore, not only were these activities poly-motivated (Kaptelin, 2005), but it seems that an individual motivation path can be *poly-activated* by new social relations and communities, thus posing dilemmatic encounters, for example a situation, in which a person may have to give up something he cherishes (an expensive tool) because people are exploiting his skills and generosity. Furthermore, the analysis indicates that innovative DIY activity can be used both for connecting and running away from people. The latter solitude-seeking motive (non-community aspect), has not previously been discussed.

Innovative DIY seemed a never-ending project: one that is hard to give up because it gives meaning to life. This was especially the case with the many retired innovative DIYers found on the pellet discussion forum. These people were motivated by their whole previous career, and innovative DIY saved them from having to give up working life. In a sense, they could be perhaps thought of as *recycled labour*, albeit outside the labour

market. It may be that for the retired person DIY/DIWO is just an excuse to keep on working. Since we identify ourselves in society to a great extent through our work and profession, it can be hard all of a sudden to stop making when retiring. Because many people are currently in this transitional phase, and people generally live longer than before, it would be interesting to explore in more depth how retirement and DIY/DIWO intersect in other fields outside the pellet technology studied here. Further, as leisure studies on retirement have noted (e.g. Nimrod, 2007), those who make as few changes as possible after work life, are physically, mentally and socially better off. Hence, I am tempted to ask whether extending one's work life through making use of past work life skills in a meaningful way could be a solution to this deeper existential problem people face when leaving work life. What happens to people after they exit the labour market, and what kind of *after-work-careers* they develop, and how after-work careers could be supported, are questions that would seem to merit further research. Since retirement—entering into the life field of the third age—is a huge transition in one's life, improved understanding of the relation between retirement, DIY and wellbeing is clearly important.

On a socio-psychological level, Internet-enabled DIY/DIWO can open up a space for continued self-understanding and appreciation by acting as an 'evocative object' to think and reflect with (Turkle, 1994, 159), and as a kind of reflection point for learning (cf. Schön, 1983). On a societal level, innovative DIY is a contribution to the development of a more ecologically sustainable future. As studies in Science and Technology have shown, users do matter: they often have first-hand knowledge of their use-practices and (the best) ideas for improving technology (e.g. Miettinen & Hasu, 2002). Hence, their voices should be heard in the design process (Hasu & Miettinen, 2006). Innovation does not happen solely in laboratories, but on the streets and information highways occupied by retired men and women.

This study of the changing and dilemmatic motivations of innovative pellet technology DIYers showed a strong connection between professional work and leisurely DIY, hence challenging the usual characterisations of DIY as mere hobbyist activity. The concept of *innovative DIYer* offered in this paper, underlines the 'volunteer professionalism' (Freeman, 2007) that goes into pellet technology development. The concept of *motivation path* in turn highlights four aspects of innovative pellet DIY activity: 1) 'the subjective movement that dominates' (Stetsenko, 2005); 2) the 'poly-motivated' (Kaptelin, 2005) nature of making and the motive dilemmas that arise; 3) the importance of communicating skills and knowledge across community borders to significant others (Miettinen, 2005); and the underlying persistence and continuity of making: the 'transitional' and 'transformative' (Winnicott, 1953) nature of the material objects of innovative DIY. Furthermore, the blurring of the boundaries between profession/hobby and past work life/retirement could help us understand how motivations may be carried over from professional work to private DIY work. Hence, Internet-mediated innovative DIY can be viewed as an important medium for continued personal growth, self-appreciation, competence use/development, and (self) reflection.

References

- Freeman, S. (2007). 'The Material and Social Dynamics of Motivation: Contributions to Open Source Language Technology Development'. *Science Studies* Vol. 20 Number 2.
- Freeman, S. (2011). *Constructing a Community – Myths and realities of the open development model*. Doctoral Dissertation. Helsinki: Institute of Behavioural Sciences, 2011, Studies in Educational Sciences 242.
- Freeman, S. (2012) 'User empowerment or user control? The discursive struggle of choosing among Open Source Software tools in the Finnish Public Sector. *Information Technology & People*. 25(1).
- Berdou, E. (2007). *Managing the bazaar: Commercialization and peripheral participation in mature, community-led F/OS software projects*. Doctoral dissertation, London School of Economics and Political Science, Department of Media and Communications.
- Billig, M., S. Condor, D. Edwards, M. Gane, D. Middleton and A. Radley. (1988). *Ideological dilemmas. A Social Psychology of Everyday Thinking*. London: Sage.
- Crawford, M. B. (2009). *Shop Class as Soulcraft: An Inquiry into the Value of Work*. New York: Penguin Press.
- Denzin, N. K., & Lincoln, Y. S. (1994). *Introduction: Entering the field of qualitative research*. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (1-17). Thousand Oaks, CA: Sage.
- Dreier, O. (1999). Personal Trajectories of Participation across Contexts of Social Practice. *Outlines: Critical Social Studies* 5, 5–32.
- Ghosh, R. (2005). Understanding Free Software Developers: Findings from the FLOSS study. In J.
- Feller, B. Fitzgerald, S. Hissam, & K. R. Lakhani (Eds), *Perspectives on Free and Open Source Software*, (pp. 23–45). Boston: MIT Press.
- Gruber, H. E. (1981) *Darwin on man: A psychological study of scientific creativity*. Chicago: The University of Chicago Press.
- Gruber, H. E. (1980). The evolving systems approach to creative scientific work: Charles Darwin.'s early work. In T. Nickles (Ed.), *Scientific Discovery: Case Studies*. Boston Studies of Philosophy of science, 60, 113–130.
- Fairclough, N (1992). *Discourse and Social change*. Cambridge: Polity Press. Festinger, L. (1957). *A theory of cognitive dissonance*. New York: Harper & Row.
- Hasu, M., & Miettinen, R. (2006). *Dialogue and Intervention in Science and Technology Studies: Whose Point of View?* Working Papers 35/2006. Center for Activity Theory and Developmental Work Research. University of Helsinki.
- Himanen, P. (2001). *The hacker ethic and the spirit of the information age*. New York: Random House.

- Hine, C. (2008). Virtual Ethnography: Modes, Varieties and Affordances. In N. Fielding, R.M Lee & G Blank (Eds.), *The SAGE Handbook of Online Research Methods* (pp.257-270). London: SAGE.
- Hyysalo, S., Juntunen, J. & Freeman. S. (2013a). User innovation in sustainable home energy technologies. *Energy Policy*.
- Hyysalo, S., Juntunen, J. & Freeman. S (2013b). Internet forums and the rise of inventive energy user. *Science & Technology Studies* .Vol.26, No.1
- Hyysalo, S., Helminen, P., Mäkinen, S., Johnson, M., Juntunen, J.K., Freeman, S. (2015). Intermediate Search Elements and Method Combination in Lead-User Searches. *International Journal of Innovation Management*. Vol. 19, No. 1 (February 2015).
- Kaptelin, V. (2005). The Object of Activity: Making Sense of the Sense-DIYer, *Mind, Culture, and Activity*, 12(1), 4–18.
- Keller, C. M. & Keller, J.D. (1999). Imagery in Cultural Tradition and Innovation. *Mind, Culture and Activity*. 6 (1), 3-32.
- Krishnamurthy, S. (2006). On the Intrinsic and Extrinsic Motivation of Free/Libre/OpenSource (FLOSS) Developers. *Knowledge, Technology, & Policy* 18 (4), 17–39.
- Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Miettinen, R. (2005). Object of Activity and Individual Motivation, *Mind, Culture and Activity*, 12 (1), 52–69.
- Miettinen, R. & Hasu, M. (2002). Articulating user needs in collaborative design. *Computer Supported Cooperative Work*, 11, 129-151.
- Mills, C. W. (1940). Situated actions and vocabularies of motive. *American sociological review* (5), 904-913.
- Nimrod, G. (2007). Retirees' Leisure: Activities, Benefits, and their Contribution to Life Satisfaction. *Leisure Studies*, 26 (1), 65-80.
- Norton, M., Mochon, D. & Ariely, D. (2012). When labor leads to love. *Journal of Consumer Psychology*, 22 (3), 453-460.
- Ratto, M. & Ree, R. (2012). Materialization of information: 3D printing and social change. *First Monday*, 17 (7).
- Ratto, M. & Boler, M. (2014). Introduction. In M Ratto & M Boler (Eds.), *DIY Citizenship: Critical Making and Social Media* (pp. 1-19). Massachusetts: MIT press.
- Rosenberg, B.C. (2005). Scandinavian Dreams: DIY, Democratisation and IKEA. Issue—Edges and Centres: Contemporary Experience and Lifestyle. *Transformations* 11.
- Roth, W-M. (2007). Emotion at work: A Contribution to Third-Generation Activity Theory. *Mind, Culture and Activity*, 14 (1-2), 40-63.

- Rotman, D., Preece, J., Hammock, J., Procita, K., Hansen, D., Parr, D L., & Jacobs, D. (2012). Dynamic changes in motivation in collaborative citizen-science projects. *Computer Supported Collaborative Work*, Feb. 11-15.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions, *Contemporary Educational Psychology*, 25 (1), 54–67.
- Shove, E., Watson, M., Hand, M. & Ingram, J. (2007) *The Design on Everyday Life*. Oxford: Berg.
- Schön, D. (1983). *The Reflective Practitioner: How professionals think in action*. London: Temple Smith.
- Silverman, D. (2010). *Doing Qualitative Research*. 3rd Edition. London: Sage.
- Stetsenko, A. (2005). Activity as object-related: resolving the dichotomy of individual and collective planes of activity. *Mind, Culture, and Activity*, 12 (1), 70–88.
- Takhteyev, Y. (2009b). Networks of Practice as Actor-Networks: The Case of Brazilian Software Development, *Information, Communication and Society*, 12 (4), 566– 583.
- Tapscott, D. & Williams, A.D. (2007). *Wikinomics: How mass collaboration is changing everything*. USA: Portfolio.
- Torvalds, L., & Diamond, D. (2001). *Just For Fun: The Story of an Accidental Revolutionary*. New York: Harper Collins.
- Turkle, S. (1994). Constructions and Reconstructions of Self in Virtual Reality. *Mind, Culture, and Activity*, 1 (3).
- Von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, MA: MIT Press.
- Watson, M. & Shove, E. (2008). Product competence project and practice: DIY and the dynamics of craft consumption. *Journal of Consumer Culture* 8, 69–89.
- Weber, S. (2004). *The Success of Open Source*. Cambridge: Harvard University Press.
- Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge, U.K: Cambridge University Press.
- Winnicott, D.W (1953). Transitional objects and transitional phenomena. *International Journal of Psycho-Analysis* 34, 89–97.
- Winnicott, D.W. (1971). *Playing and Reality*. London: Tavistock Publications.
- Wolf, M. & McQuitty, S. (2011). Understanding the do-it-yourself consumer: DIY motivations and outcomes. *AMS REVIEW*, 1 (3-4), 154-170.
- Woodward I. (2011). Towards an object-relations theory of consumerism: The aesthetics of desire and the unfolding materiality of social life. *Journal of Consumer Culture* 11(3), 366–384.

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