Design-driven innovation through Minimum Viable Products

Validation of utility before designing for usability and desirability

Johan Bertnes Røed
Department of Product Design
Norwegian University of Science and Technology

ABSTRACT

Design-driven research is argued to have most impact when being carried out in early phases of technological development. Still, designers struggle getting valuable contributions from users when developing completely new product or service concepts for the future. Design Thinking provides methodologies to discover and define assumptions about user needs, yet these assumptions remain hard to validate before product launch. With the concept of developing Minimum Viable Products (MVPs), Lean Startup introduces a process that seeks to address this contradiction. This article studies how MVPs affect the design process and how it corresponds to concerns in design literature about the value of user research in disruptive innovations. Results show that MVPs imply a shifting rationale behind design decisions and lead to new opportunities for high-value user research. MVPs prove to be an effective tool to test vulnerable assumptions on the utility of an innovation before spending development effort on usability and desirability considerations. The value for the designer is that with MVPs the design phase does not end in a final delivery yet to be implemented for launch. The real learning starts when the product is launched to market.

KEYWORDS: Design-driven innovation, Design Thinking, Lean Startup, Minimum Viable Products, Product-market fit, Technology-push, Technology Epiphany, User Experience Research, Utility

1. INTRODUCTION

How design can act at the initial phase of an industry, when a breakthrough technology emerges, is a yet unexplored field of research (Verganti, 2011). Norman (1998) has disputed the importance of user experience in the early stages of a new technology. Verganti (2009) later introduced the theory of design-driven innovation where user-centered design is questioned as a source of radical innovation. According to Verganti (2009), design-driven innovation does, however, describe a radical innovation potential in design as *radical innovation of meanings*.

Design Council (2013a) has found that "consumers are less able to contribute to the development of completely new product or service concepts for the future." Design Thinking methodologies may discover and define assumptions about how a future product may respond to user needs. However, these assumptions remain – per definition – assumptions until they have been validated. At launch, the product may be well designed and developed though iterations of user research, prototyping, usability testing etc. Yet the greatest risk remains – will customers find the new

product valuable enough to end up buying and using it?

Realizing the biggest risk for a startup lies in these uncertainties about the product/market fit, Ries (2008) introduces Lean Startup as an approach that seeks to reduce them. Ries defines a startup as "a human institution designed to create new products and services under conditions of extreme uncertainty" (Ries, 2011, chapter: Introduction). The conditions are defined as extremely uncertain because who the customer is and what the customer might find valuable is yet unknown. Lean Startup proposes *learning about the product-market fit* as the essential unit of progress for startups. Any effort that does not contribute to learning about what provides value for customers is considered wasteful.

The Lean Startup approach builds upon Steve Blank's concept of Customer Development, where a startup continuously is *searching* for a business model that works instead of executing on a business plan (Blank, 2013). Customer Development originates from the realization that the greatest risk for a startup lies "not in the development of the new product but in the development of customers and markets" (Blank, 2007, p. 5). Ries developed the methodology further and popularized it under the term Lean Startup, culminating in a book on the topic in 2011 (Ries, 2011). The Lean Startup approach has grown popular among startups lately and the methodology has already reached curriculum at 25 universities (Blank, 2013).

To accelerate learning about the product/market-fit, Lean Startup introduces the process of iterating on Minimum Viable Products (MVPs). The process of iterating on MVPs resonates well with the ethos of Design Thinking. Both can be said to approach ill-defined problems with methods of solution-based design with rapid iterations in close contact with customers. However, with MVPs Customer Development is the driving force of iteration cycles. This implies that launch to customers needs to be included in iteration cycles. Even though there already is a lot of design activity related to lean startups, research lacks on how this shift of process affect design decisions and user research in practice.

The process of MVPs implies a proactive and customer-centric approach compared to design-driven innovation. It provides a framework for prioritizing research efforts as an innovation adapts to the market. Rohrer (2008) divides User Experience into Utility, Usability, Desirability and Brand Experience, which may be a useful framework for evaluating how MVPs increase opportunities for high-value user research when the real market incrementally is used as context. This may help to nuance Normans model of the transition from technology-driven products to customer-driven and human-centered products (Norman 1997).

2. METHOD

This article is a review based on a literature study intersecting the topics of Design-driven innovation, User Experience Design and Lean Startup Methodology. Sources are mainly textbooks, reports published by user experience research institutions and relevant articles, blog posts and conferences of the contemporary design debate. Further, the review is supplemented with experience from use of MVPs in a startup in the emergence of a possibly disruptive innovation.

Following this section, Design Thinking is reviewed through the framework of the Double-Diamond, Diverge-Converge Model of the design process (Design Council, 2013b). Findings are then discussed with special emphasis regarding *the risk of not answering to market needs at product launch.* The analysis is visually presented through a graph of accumulating risk as a function of *effort* and *inventory of unvalidated assumptions on product-market-fit.*

Section four of this article presents a review of the role of User Experience in disruptive innovation. Christensen's (1997) theory of

disruptive innovation is presented in combination with Norman's model of the transition from technology-driven products to customer-driven, human-centered products (Norman 1997). The quality attributes of User Experience are reviewed though Rohrer's model of User Experience (Rohrer, 2008), which describes the relative value between Utility, Usability, Desirability and Brand Experience. Brand Experience is not reviewed with special interest in this article. Findings are then discussed, culminating in an attempt to nuance Norman's model of the transition from technology-driven products to customer-driven, human-centered products (Norman 1997).

Verganti's (2009) theory of Design-driven innovation is reviewed in section five, with special weight on design-driven research. Findings are then discussed – as in the review of Design Thinking – with an emphasis regarding *the risk of not answering to market needs at product launch.* The analysis is visually presented with the same framework as used in the review of Design Thinking.

Further, in section six, the Lean Startup methodology of Minimum Viable Products is reviewed in relation to Design Thinking and Design-driven innovation. An analysis is then discussed regarding how the process of developing MVPs affects the design process and opportunities for user research.

In section seven, the literature review is supplied with experience from the use of MVPs in a Norwegian startup developing Building Information Model (BIM) software for the construction industry. The software is not commercialized yet, but it has for the last four months been launched in two different pilot studies with 15 users in total. Users are employees of contractors in two relatively advanced hospital building projects in Norway. The participating building organizations can be categorized as early adopters, however all participants do not share the characteristics of early adopters individually.

The case is a technology-push innovation (namely *remote rendering of 3D-models*) where heavy BIMs are remotely rendered and then streamed to a tablet application. As BIM is a New-Market Disruption (Tobin, 2013), findings are discussed in relation to Verganti's theory of Design-driven innovation (Verganti, 2009) and Norman's model of the transition from technology-driven products to customer-driven, human-centered products (Norman 1997). Emphasis is made on the implications of MVPs as a tool to learn about the user experience.

3. DESIGN THINKING

Design Thinking is described by Tim Brown, CEO of IDEO, as:

> innovation (…) powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported. (…) Put simply, it is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity. (Brown, 2008, p. 1-2).

The Design Council (2013b) models the design process as a double-diamond of divergence and convergence (Figure 1). Design Thinking combines this process with the iterative Human-Centered Design process of Observation, Ideation, Prototype, and Test (Norman, 2013).

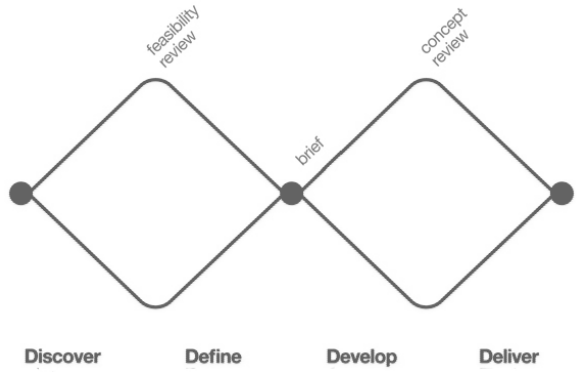

Figure 1: The Double-Diamond, Diverge-Converge Model of the design process (Design Council, 2013b). The process can vary in effort put into each stage and in number of iteration cycles before launch. Stages are not necessarily separated in time: A Brief may for instance be re-Defined based on Discoveries made in a Development phase.

3.1 The Discover stage

The Discover stage is a divergent phase where perspectives are kept wide in order to gain understanding and insights on user needs, opportunities and the context of the project. The stage most commonly begins with teams finding initial inspiration about user behavior through interpretation of market research or by conducting primary research by for instance observation of end users (Design Council, 2013a). The stage "establishes that a problem or opportunity exists, and that a product or service development or iteration is necessary as a result" (Design Council, 2013c).

3.2 The Define stage

The Define stage is a convergent phase where the insights and ideas from the Discover stage are filtered and distilled into problems to be solved and ideas and solutions for these are started being pitched and prototyped (Design Council, 2013d). The designer must seek understanding of the wider context of the problem or the opportunity, for instance cultural, economical and social issues, as well as to gain understanding of what is feasible within the capabilities of the company (Design Council 2013c). The goal of the stage is to "refine the scope of the project, and to home in on which solutions can have impact, which product or service has scope or potential, which product or service would push the business and design in the right direction" (Design Council 2013c). The stage synthesizes into a design brief – a clear definition of the problems and a plan for how to address this through a possible product or service.

3.3 The Develop stage

The Develop stage is a divergent phase where the product development team develops one or more of the concepts that seek to address the problems identified in the Discover and Define stages. This stage is often highly iterative where prototypes are refined and improved many times, often in close contact with end users. The prototyping also mitigates the risk of implementing a product with severe technical or user experience errors. The stage concludes in a delivery of final specifications for production (Design Council, 2013e).

3.4 The Deliver stage

The Deliver stage takes the final concept through final implementation and testing before launch. The stage "will result in a product or service that successfully addresses the problem identified during the Discover stage" (Design Council, 2013f). Many companies have routines for evaluating the success of the launched product or service, with the common aim to gain internal learning for future projects as well as to help gain buy in for other design projects (Design Council, 2013g).

3.5 Discussion

The Design Council presents the process as *one process* with no active strategy to iterate on the product once it is launched. Findings of the Discover and Define stage result in a product brief. Iterations then circulate around how well proposed solutions address this product brief. This implies that the value of these iterations depends heavily on how well the brief actually address market needs in the first place. Combined with the fact that designers struggle getting valuable contributions from consumers in developing completely new products, one may

deduce that a single run of the double diamond process of design involves considerable risk at launch of new products for new markets (Figure 2).

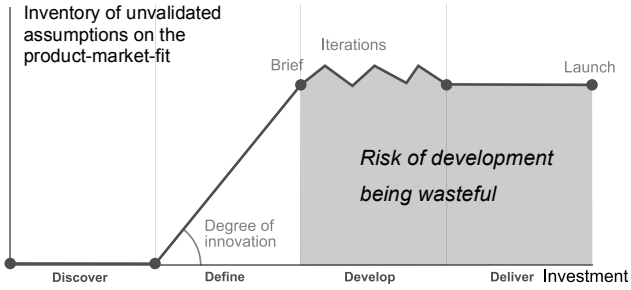

Figure 2: My analysis of accumulated risk at launch of a new-market innovation after one run of Design Council's (2013b) double diamond model of the design process. Assumptions pile up in the Define stage as a function of the degree of innovation. The value of the investments spent in the Develop and Deliver stage is then premised on how well these assumptions in the brief actually address market needs: If the degree of innovation in the Define stage is high, iterations in the Develop stage become relatively irrelevant.

4. USER EXPERIENCE DESIGN IN DISRUPTIVE INNOVATION

4.1 Disruptive innovation

A disruptive innovation is an innovation that creates a new market and value network and ultimately disrupts an existing market and displaces earlier technology (Christensen, 1997). As a market cannot be analyzed before it exists, "suppliers and customers must discover them together" (Christensen, 1997, p.117). "Not only are the market applications for disruptive technologies *unknown* at the time of their development, they are *unknowable*" (Christensen, 1997, p.117).

The theory of diffusion of innovations describes how an innovation adapts into a market. Customers change as the technology matures, where different customer groups value product qualities differently (Figure 3). Early adopters drive the market in its early days. They are willing to take risks and adopt technology that may ultimately fail. They are mostly interested in the technology and its potential and "overlook instability, difficulty in use, inelegant appearance" (Norman, 1998a). According to Norman (1998a), late adopters, on the other hand, "hold off until the technology has proved itself, and then they insist upon convenience, good user experience, and value". From this, Norman (1998a) deducts that user experience is less important as a competitive advantage in the early stages of a disruptive innovation.

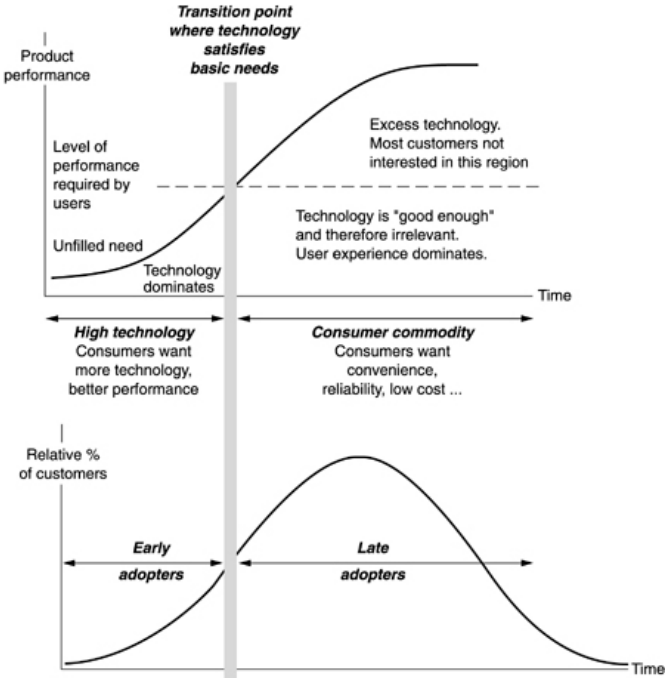

Figure 3: The needs-satisfaction curve of a technology (Norman, 1998a). New technologies begin by delivering less than customers require, before customers demand better technology and more features, often regardless of the cost or inconvenience. A transition occurs when the technology can satisfy the basic needs – this is where Norman argues that user experience begins to dominate performance indicators.

4.1 The Value Proposition of User Experience

Norman (1998b) contrasts User Experience with Technology and Marketing. Rohrer (2008) subdivides User Experience into the quality attributes of Utility, Usability, Desirability and Brand Experience (Figure 4). Rohrer's model may help to nuance the prioritization of user experience research in early stages of disruptive innovations.

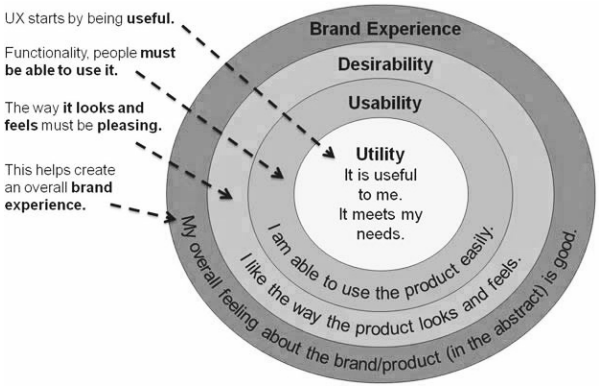

Figure 4: The quality attributes of User Experience (UX) as Utility, Usability, Desirability and Brand Experience (Rohrer, 2008), with Utility as the core.

Utility

The utility of a product refers to "the design's functionality: Does it do what users need?" (Nielsen, 2012). Utility is the core of any user experience, and by that guides the feature specification of a product: What should the product do? What is the product's reason of existence? Understanding and defining the utility scope of a product is therefore the domain of the Discover and Define stage of the design process. Through exploratory research, the product development team can discover user needs and define which of them to target. This can for instance be carried out by participant observation, participating as a user, depth interviews, questionnaires, focus groups, creative sessions and competitor analysis (Kuniavsky, Goodman and Moed, 2012).

Usability

The usability of a product refers to how easy and pleasant the feature set of a product is to use. According to Nielsen (2012), usability is defined by five quality components: Learnability, Memorability, Efficiency, Error rate and Satisfaction. Usability testing is widely recommended as a relatively low threshold methodology with high return on investment (Usability.gov, 2013). A usability test answers how easy it is to perform a given task with the product. Usability is mainly a concern of the Develop stage in the design process; usability is neutral to fulfillment of possible user needs. Depending on how easy it is to prototype the different features and functions of a product, the usability of a product can be well tested in a controlled environment. All quality components of usability except Memorability can in principle be researched independently without a need of sequel testing.

Desirability

The desirability of a product refers to the degree of pleasure and happiness in using a product. Desirability is an emotional response and is the least tangible aspect of a good user experience. Measuring desirability is therefore more difficult compared to usability. Desirability is important to engage users to act according to the intended use of the product. With content, language and visuals, a design can persuade users to an intended behavior (Riddle, 2012). Desirability data can for instance be collected from questionnaires and interviews, but the research is often too time consuming and hard to analyze to be considered worth doing (Benedek, 2002).

4.3 Levels of insight

The process of collecting insights may include a wide variety of research methodologies, specifically design, usability, and ethnographic methods (Løvlie et al., 2013). The goal is usable insights that lead to better grounds for designing. For innovation work, insights should ultimately give answers to the question "Will our offering make sense in the context of people's lives, and will they find it valuable?" (Løvlie, Polaine and Reason, 2013, chapter 3, section 3).

What methods to chose is a trade-off between time, money, and quality. There is a considerable threshold involved in conducting user research, as much time and money is spent on recruiting and scheduling. Kuniavsky et al. (2012) budgets for instance between 25 % and 45 % of time to administration when conducting usability tests and focus groups, whereas around 85 % of money is budgeted to recruiting incentives. The quality of insights has by Løvlie et al. (2013) been categorized into three levels of detail and effort: *Low – What they say, Middle – What we saw, and High – What it means*.

Low – What they say

What people say is restricted to memories of past use or speculations about the future. Human memory is fallible, users can make up stories to rationalize, and users are often too pragmatic and concrete to envision future solutions. People may think they want one thing when they need another. Further, by *social desirability bias*, people have a tendency to give answers that are more socially acceptable than their true attitude or behavior (Kaminska and Foulsham, 2013). What people say can therefore often be quite misleading (Nielsen, 2010). Statements where people predict what they may do in the future are especially vulnerable (Nielsen, 2001). Interviews and focus groups can, however, be suitable for exploring people's general attitudes towards problems, and for low-effort probing on how people perform activities that span many days or weeks.

Middle – What we saw

A more rich and valuable source of information is observing what people actually do. Watching how people perform tasks help discover which designs work best (Nielsen, 2001). Field study observations have more disruptive potential than observations from controlled usability tests. Field studies are especially favored over usability testing if the design team already has some previous experience with usability heuristics (Nielsen, 2012).

High – What it means

Interpreting the relevance of the findings, and what they mean require a better understanding of potential patterns of meanings. This often requires that research and observations are linked to an understanding of how society and culture are changing. There is a risk of becoming blind from current paradigms of existing products and usage (Norman and Verganti, 2012). Because radical innovation implies a different context and user approach than with already existing products, users are not necessarily the most valuable subjects of research.

4.4 Discussion

Norman argues that user experience is less important as a competitive advantage in the early stages of a disruptive innovation. However, Norman's model does not have any dimension to describe the process of defining possible other market directions of the technology: The market adaptation in the model is premised by only one potential application of the technology and one given market. Rohrer's model of user experience may suggest that the Utility of a technology still is subject to Discovery and Definition in early stages of development. One may therefore be able to nuance Norman's model with definitions of what quality attributes of the user experience that dominates performance indicators as a technology matures (Figure 5).

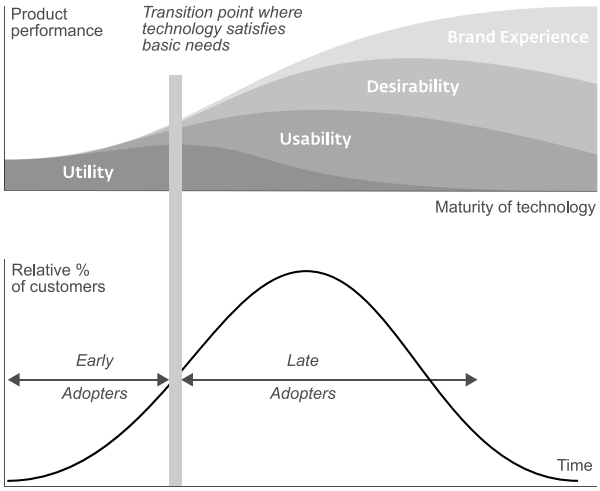

Figure 5: My suggestion to nuance Norman's (1997) model of the needs-satisfaction curve of a technology through use of Rohrer's (2008) model of User Experience. Utility dominates product performance indicators in early stages of a technology before Usability, Desirability and Brand Experience gradually becomes more competitive advantages as the technology matures.

As high-value research is within the domain of *what things mean*, high-value research has vulnerable conditions when developing products and services for new markets; the market of research is unknown. To describe this dimension of innovation strategy, Roberto Verganti's (2009) theory of design-driven innovation may be useful.

5. DESIGN-DRIVEN INNOVATION

Design-driven innovation challenges the assumption that design is less relevant in disruptive innovations (Verganti, 2009). Verganti (2009) uses Krippendorf's (1988) definition of design as "making sense (of things)" to argue that design-driven innovations are innovations that create new markets by addressing radical innovation of meaning. By radical change of meaning, Design-driven innovation is differentiated from technology-push and market-pull innovation (Figure 6). A technology-push innovation, such as remote rendering of 3D, can for instance emerge before its potential utilities – *possible new meanings of the technology* – are discovered.

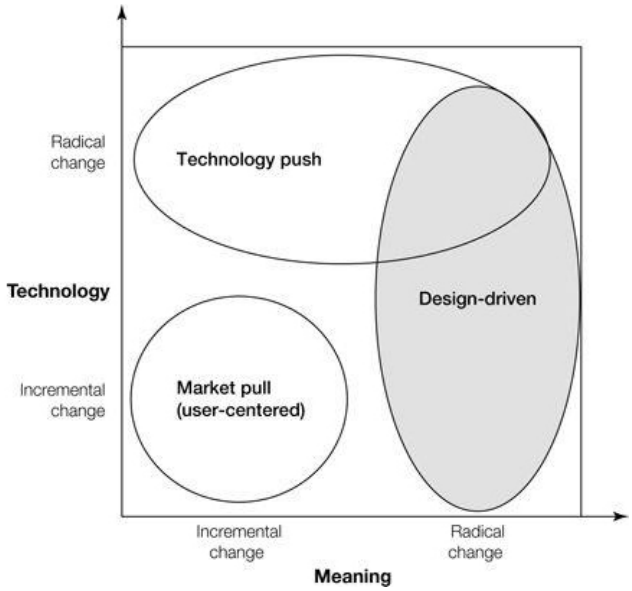

Figure 6: Design-driven innovation as the radical change of meanings (Verganti, 2009, chapter 11, section 11).

Technology-push innovations originate from technological research. Technological breakthroughs can have a disruptive impact on industries and are often the source of long-term competitive advantage (Verganti, 2009). Technology-push innovations do not come from study of users, but are often driven by an inner vision from the inventors (Norman and Verganti, 2012). Technology-push innovations usually capture a need identified by the inventor. Whether the need is real or imagined is not necessarily considered – the potential utility of the idea is seldom examined. The motivation is often that it is an attractive challenge or that it simply is possible (Norman and Verganti 2012).

User-centered design is considered to be market-pull innovation, as it starts with user needs and then searches for technology to better satisfy them (Verganti, 2009). User-centered design can therefore cause incremental innovation on existing technologies, but is unlikely to cause radical innovation unless there is a radical change of meaning (Norman and Verganti, 2012).

Design-driven innovation questions the deepest reasons why people buy or use a product, and from that seizes to create market opportunities by proposing products with new meanings (Verganti, 2009). Radical innovations of meaning are rarely pulled by the market, they are pushed by a company's vision about possible breakthrough meanings (Verganti, 2009).

5.1 Technology epiphanies

A new technology can come with a huge range of potential applications. To turn a new technology into reality, a company must consider which markets to apply it to and what possible new meanings it can drive in these markets (Verganti, 2009). The full potential of a technological breakthrough happens when the quiescent meaning of the technology is unveiled. Merging technological breakthroughs with radical innovation of meanings is therefore an especially effective innovation strategy (Verganti, 2009). Identifying the most powerful meaning of a new technology can be the weapon that allows a breakthrough technology to disrupt an industry – this discovery is called *technology epiphany* (Figure 7). A technology epiphany is often more disruptive to competition than the technological breakthrough itself (Verganti, 2009).

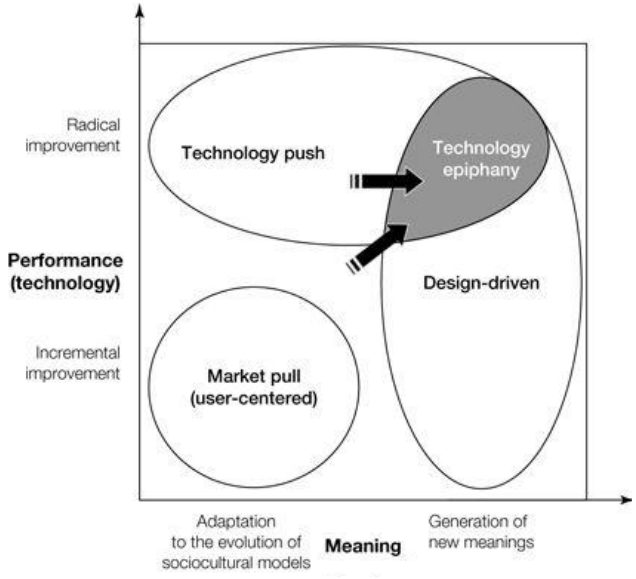

Figure 7: Technology epiphany happens when existing market needs are questioned – and the possible meaning of a product is redefined – through the new technology (Verganti, 2009, chapter 4, section 1).

5.2 Design-driven research

Design-driven research has most disruptive potential when being carried out in early phases of technological development. In order to lead to radical innovation of meanings, design-driven research "must be directed towards new interpretations of what could be meaningful to people" (Norman and Verganti, 2012, p. 17). Verganti (2009) advocates stepping back from users and instead getting close to *interpreters*. Key interpreters are people to which a company can "exchange information on scenarios, test the robustness of their assumptions, and discuss their own visions" (Verganti, 2009, chapter 1, section 6). They are often diffused throughout many industries and contexts and are "forward-looking researchers who are developing, often for their own purposes, unique visions about how meanings could evolve in the life context we want to investigate" (Verganti, 2009, chapter 1, paragraph 6).

Verganti (2009) suggests facilitating an active design discourse with interpreters through for instance cultural prototypes. A cultural prototype is "a medium that embeds the results of a manufacturer's research. It codifies and diffuses the company's new interpretation and vision" (Verganti, 2009, chapter 9, section 3). It is not a specific product, but an articulation to interpreters of the new meaning through for instance an exhibition, website and brochure etc. (Verganti, 2009).

In search for a technology epiphany, assumptions on the full potential of the technology are discovered and defined by design-driven research in combination with technology research (Figure 9). As design-driven innovation implies assumptions on potential new meaning, they need to be carried out as *proposals* to new markets. Proposals are visions of a possible future, still not without any foundation. The goal is that these proposals emerge as products users actually are looking for, and by that become market successes (Verganti, 2009).

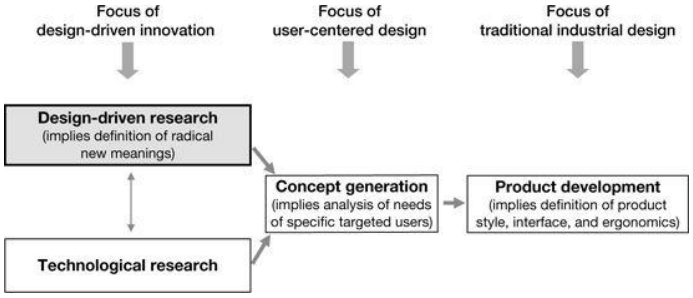

Figure 9: The process of design-driven innovation as research and its position relative to other phases of innovation (Verganti, 2009, chapter 8, section 1). Design-driven research precedes Concept generation by premising new meanings, by which e.g. includes assumptions on which users to target.

5.3 Discussion

Design-driven research seeks to discover valuable new meanings. Still, no matter how well the change of meanings are interpreted, resulting products or services are still *proposals* when they are launched to market. As Christensen (1997) distrust analyzing a market before it exists, interpreters may be useful for connecting dots and inducing assumptions of change of meaning, but may fall short in predicting new markets. Heavy development premised on design-driven research therefore bears with itself considerable risk at launch (Figure 10).

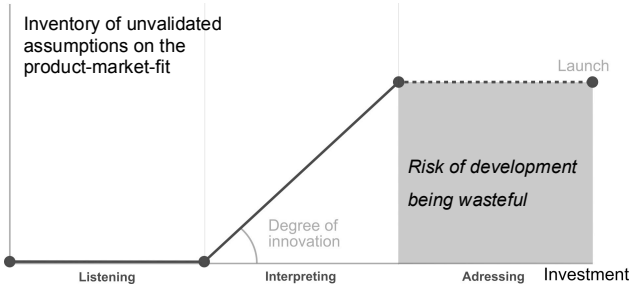

Figure 10: My analysis of accumulated risk at launch of design-driven innovations. The process of design-driven innovation is presented by Verganti (2009) as three stages; Listening, Interpreting and Addressing. As with Design Thinking and new market innovations, the value of development after design-driven research is premised on assumptions about a future market. The stages of Design-driven innovation suggest parallels to Design Council's (2013b) model of the design process: Listening and Interpreting may correspond with Discover and Define, whereas Addressing may correspond with Develop and Deliver.

6. MINIMUM VIABLE PRODUCTS

Lean Startup introduces the process of iterating on a Minimum Viable Products (MVPs). This process may be applied to processes of Design Thinking and Design-driven innovation in order to *mitigate the risk of not answering to market needs at product launch*. The MVP is defined as "that version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort" (Ries, 2009a). Validated learning is defined as "the process of demonstrating empirically that a team has discovered valuable truths about a startup's present and future business prospects" (Ries, 2011, chapter 5, section 1). The process is concerned with learning about what provides value for which customers, and how given product features correspond to this (Laugero, 2012).

In other words, the MVP is a product made with the least set of features in order to start learning about the product-market-fit: A tool to test and eliminate uncertainty about whether the envisioned product will have customers or not. An MVP in itself does not necessarily imply market launch, but the process seek early market launch because much of the uncertainties lie in the premises about what will happen after launch.

MVPs are to be designed to get through a feedback loop of Build–Measure–Learn as quickly as possible (Figure 11). This iterative and solution based approach resonates well with the approach of Design Thinking. MVPs, however, stretches the iterative approach further by also including launch to customers in iterations. Real learning about how the product responds to market assumptions can only start after launch. This shift implies a change of rationale behind design decisions.

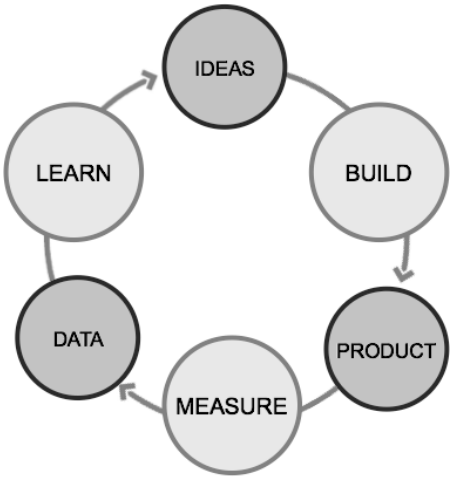

Figure 11: The Build–Measure–Learn feedback loop of MVPs (Ries, 2011).

6.1 Learn

The process starts by declaring hypotheses about how to build a sustainable business around a product. Explorative research and consumer contact is crucial in forming these hypotheses, just as with Design Thinking. Early contact with customers does not seek definitive answers, merely to reveal what assumptions require the most urgent testing: "The first step in this process is to confirm that your leap-of-faith questions are based in reality, that the customer has a significant problem worth solving" (Ries, 2011, chapter 5, section 7).

Hypotheses are to be made about who the customers will be, what they will find valuable, and how they will define quality. Hypotheses could for instance take form as *customer*

archetypes, hypotheses that seek to "humanize the proposed target customer" (Ries, 2011, chapter 5, section 8). These archetypes should be considered hypotheses until it has been "shown via validated learning that we can serve this type of customer in a sustainable way" (Ries, 2009, chapter 5, section 8). Further, hypotheses could also address organizational aspects, for instance efforts invested in each sale. In addition to beginning to free up time for other parts of the startup, iterating on the sales process can help building a feedback loop for the product development team.

The hypotheses are prioritized on the basis of which of them will lead to the maximum amount of validated learning about the product-market-fit. For a startup, the riskiest elements are the parts on which everything depends: Leap-of-faith assumptions that regard the core of the business model are to be tested first (Ries, 2011).

6.2 Build

The MVP is the product that can prove or disprove these hypotheses with the least amount of development effort. The design of an MVP should therefore not necessarily be a materialization of what the designer believes to be the optimal product features and functions feasible at the time. The delivery should rather be prototyped as a medium to support the process of eliminating the most evident market uncertainties at that particular time.

The MVP is not to be confused as a product stripped to as few features as possible. However features and functions that do not contribute to eliminating the most risky uncertainties are considered non-valuable at the time, regardless of how sure the designer may be that they will have to be implemented in the end. In Lean Manufacturing terms, all the work spent on designing an MVP is considered inventory until the moment that the product is shipped (Ries, 2011). Designs are incomplete, assumptions are not validated and the business plan is not tested. Building a product that customers refuse to use is considered the biggest waste of all (Ries, 2011).

6.3 Measure

Hypotheses have to be testable by having specific, concrete predictions about what will happen. This learning has to be grounded in empirical data collected from real customers (Ries, 2011). A strategy of just being open to what will happen misses the point of an MVP. Hypotheses have to be formed so that the test results can be actionable, and give clear guidance for what to do next. Statistics are rarely actionable for designers, therefore qualitative insights on the underlying reasons of behavior are often most useful (Løvlie et al., 2013). The tests should answer whether you are on the right track or not. If the new design does not change customer behavior to the better, it should be judged a failure. Vanity metrics on whether the product gives a good user experience or not, is therefore considered uninteresting in itself.

6.4 Continuous learning

The process of iterating on MVPs gives good grounds for continuous learning on a product. The first hurdle is to get MVPs out in the first place. MVPs target early adopters, as they are "the customers who feel the need for the product most acutely" (Ries, 2011, chapter 4, section 5). Early adopters are often visionaries, and are more willing to spend time exploring a prototype and provide feedback and supplement with visions. Asking for feedback from early adopters is valuable, but they are even more valuable as a population to run experiments on (Ries, 2011).

Therefore, one strategy is to launch MVPs as pilot studies with early adopters. Early adopters can then serve as a pool for feedback and behavior studies. This has an advantage over traditional market research because it leads to a lower threshold compared to commissioning a survey or finding new people to interview (Ries, 2011). There may involve considerable amount of effort in setting up such pilot studies, however, this activity in itself can contribute to valuable learning regarding Customer Development. Further, once contact is established, the threshold for organizing research is lower, which

may lead to more time on gathering insights and less time organizing.

Pilot studies also drive a lasting connection with customers over time. Kolko and Tran (2013) bring up increased empathy and the ability to continue insights beyond an initial research phase as advantages of ongoing partnering with stakeholders during design. They also give weight to the position of being continually confronted with the prospected design's role in a bigger picture.

6.5 Discussion

The Lean Startup ethos of *searching for a viable business model* can be said to correspond with design-driven innovation in its *search for new meaning.* Both processes are lead by a vision, yet, in addition, Lean Startup implies a proactive and scientific based relation to customers by iterating on MVPs. Further, the Lean Startup approach seems to actively target *early adopters as interpreters* in order to also be able to test the viability of the business model. From this, MVPs may possibly, in design-driven innovation terminology, be suitable as an active strategy for *proposal of new meanings* (Figure 12).

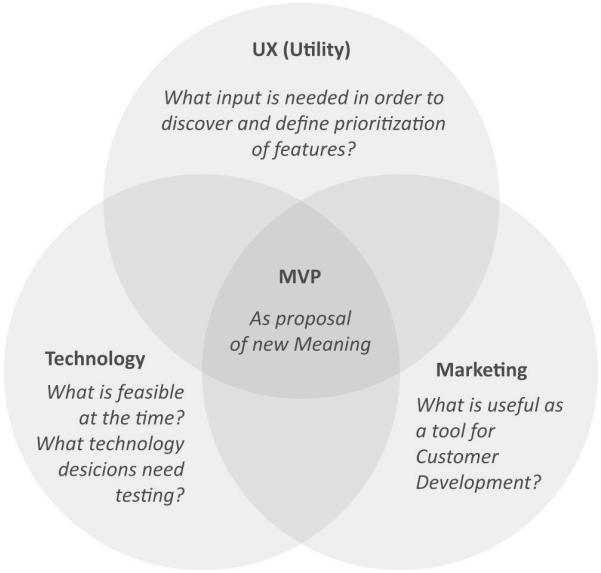

Figure 12: My attempt to model MVPs in the terms of design-driven innovation: As proposals of new Meaning in the intersection of User Experience, Marketing and Technology. In early development, Utility will dominate User Experience considerations, according to what is discussed in figure 5.

In regard to Design Thinking, the Lean Startup approach implies an active process regarding unvalidated assumptions that pile up in the Define stage. As an MVP can be considered a *delivery* in Design Council's (2013) model of the design process, one run of the double-diamond model is not considered sufficient by Lean Startup: Findings from the Discover and Define stages are to be considered as hypotheses, yet to be validated. The Develop and Deliver stage should therefore be as minimum as possible in order to not spend a lot of efforts on unvalidated assumptions (Figure 13). This may lead to fewer-to-none iterations in the Develop stage, as considerations of that domain are less relevant in early development.

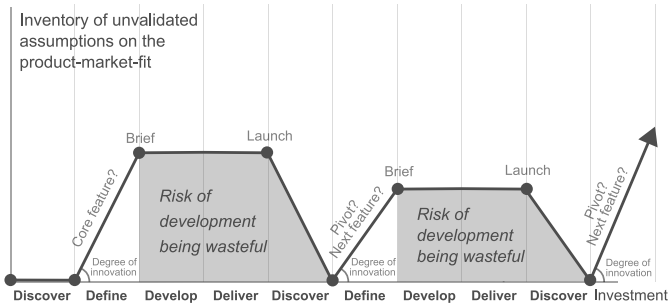

Figure 13: My analysis of accumulated risk at launch of MVPs through the stages of Design Council's (2013b) model of the design process. For new market innovations, most User Experience uncertainty lies within the domain of Utility. Therefore, iterations of Usability and Desirability in the Develop stage are sought to be kept as minimum as possible in order to not premise a lot of efforts on unvalidated assumptions. After launch, the Discover stage seeks to reframe assumptions, before new hypotheses again are formed in the Define stage. The Discover stage can still have its divergent nature; this model only accounts for the inventory of unvalidated assumptions.

Even though the goal of the MVP is to validate hypotheses, the proactive approach also gives extended effects for other domains of user research. Once a pool of customers is established for running pilot studies, the administrative cost and threshold of conducting research has

potential to become considerably lower than the examples given by Kuniavsky et al. (2012). Once there is something new to be tested, reestablishing contact with already known customers has a relatively low threshold. There is undoubtedly a sampling bias regarding running continuous experiments on a small population. On the other hand, a more established relationship with the research population may lead to more comfort in the test setting, therefore reducing social desirability bias (Kaminska and Foulsham, 2013).

7. REFLECTIONS FROM PRACTICE

As part of a design team in a startup developing BIM software from a technology-push innovation, I have gained some experience from designing MVPs for research on new markets. I will here discuss some implications we have encountered.

7.1 Designing MVPs

In forming user experience hypotheses there was an obvious need to focus on the domain of Utility, as we did not know what features to include or prioritize. Therefore, usability and desirability considerations were based on heuristics; iterations on usability were for instance not a priority. This corresponds well with what was discussed in Figure 5; see Figure 14.

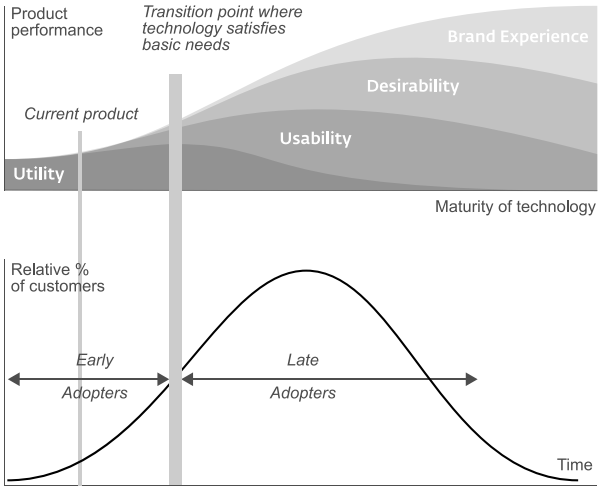

Figure 14: My analysis of the technology maturity of the current state of the product, by use of the model that was discussed in figure 5.

One evident implication of designing MVPs was that we ideated and prioritized on at least two levels. One level of prototyping was for short-term design of features to be implemented on the functional platform that was launched to the pilot study participants. This prototyping addressed early adopters, which was quite liberating when designing. When designing, we *did not need to please every possible end-user* for every delivery.

The other level of prototyping was for visualizing and testing the long-term vision. The visionary prototypes – which may correspond to what Verganti (2009) calls cultural prototypes – did not necessarily address early adopters. These prototypes were kept lo-fi and used for internal visualization of ideas as well as for inquiries with interpreters and pilot participants in creative workshops. The technology-push in itself opens up a wide variety of directions and features; therefore the goal was to prioritize which of the opportunities to target first.

The short-term MVPs were prototypes in the intersection of User Experience (in practice mainly within the domain of Utility), Marketing and Technology (Figure 13). Our case is undoubtedly technology-push, with the vision of reaching technology epiphany. In practice, the development of MVPs was more directed by Technology research than User Experience and Marketing considerations, whereas the visionary prototypes were more design-driven. In this way, User Experience and Marketing considerations did work as significant forces on the prioritization within technology research.

We addressed every *new feature* as an MVP. As an attempt to describe our MVPs in Verganti's (2009) two dimensions of innovation, it may be appropriate to illustrate MVPs as *proposals* on a line from the technology-push towards the vision (Figure 15).

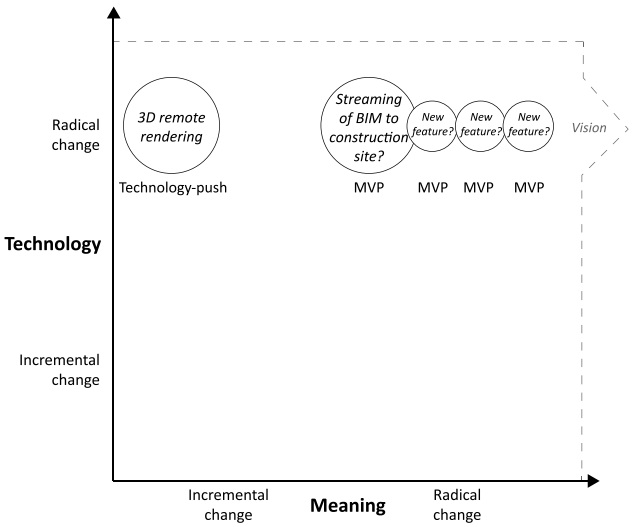

Figure 15: My analysis of our development of MVPs through Verganti's (2009) dimensions of innovation. Development was lead by a vision, while MVPs were developed in order to validate and update the vision along the way. User Experience wise, MVPs were designed to facilitate research on Utility, as features are in the domain of Utility. Possible changes or additions regarding technology are not accounted for in this model.

7.2 User research

Despite the Lean Startup ethos of prioritization of efforts and accounting, MVPs are not magic shortcuts for the Discover stage of the design process. Explorative research for understanding and empathy is work intensive however ruthless the prioritization is. In this regard, creative workshops and general observations were organized in the beginning of the pilot studies to kick start the contact. The workshops and observations contributed to us gaining a thorough understanding of the dynamics at a construction site as well as for probing for pain points during a workday.

After the initial phase, most user research was conducted through participant observation – either with our product, with a competitors' product, or simply without any specific product. Having continuous access to the construction sites gave a low threshold of research. The threshold for contacting participants was lower, and once we were there we didn't have to spend time warming up participants every time. As a side note, the close contact with participants also resulted in us having real "personas" to empathize with and communicate about when we were designing.

Researching utility implied research questions in the domain of: *Is this a meaningful set of features? – In what priority should they be architectured?* For our MVPs, defining questions were also "are people using the product at all?" and "Who are using it / not using it?" – Why / why not?" The conditions of running a continuous study may have been very valuable in this regard. Participants having the product at hand for several months may have contributed to more thoughtful feedback compared to research approaching first-time users. This may be especially relevant for *software for professionals*, as consumer software may be more vulnerable regarding quality of user experience in first-time use. In this regard, a continuous study may also be useful for learning about extended consequences of a product, for instance by researching the need of training, service and support. Furthermore, even though the focus was on utility, obvious usability shortcomings were discovered and noted down during for instance participant observations. Such errors were quickly evaluated and redesigned without heavy analysis.

Differences between characteristics of early and late adopter kind of users were not noticeable in the cases where the research was lead by us. However, some participants – possibly correlated with early adopter kind of users – were more eager to provide spontaneous feedback. This became evident with a feedback-service we had designed into the tablet application, where participants could take screenshots and send in feedback whenever they wished. The feedback-button was quite visible in the user interface. This may have been unconstructive for general use, while it may also have been effective for clearly communicating our eagerness for feedback.

Interpreters were actively contacted during development, especially for Customer

Development. User Experience wise, pilot participants were the main interpreters through workshops and by discussing our visionary prototypes. Especially those with high prior interest in BIM were useful as interpreters. We also actively sought external interpreting by arranging a workshop at a BIM technician school, as those students and teachers are among very few who have the combination of first-hand experience from the construction site and at the same time are up to date on the potential of BIM software. This was very valuable, especially for interpreting *for whom* and *in what situations* our proposed vision could provide value.

7.3 Discussion

Reflections from own practice are highly subjective, only accounts for four months of pilot studies, and are restricted to the domain of a possible new market disruption. The reflections are mainly from iterations on MVPs *after the first launch* to pilot participants.

The relevancy of the findings for *designing in general* is hard to evaluate. One finding may be that MVPs seem less relevant for incremental innovations compared to radical ones. There is a considerable amount of effort involved in facilitating a Lean Startup process, so it may not be worth the extra effort for processes with low uncertainty. Nonetheless, as MVPs are far from solely meant for User Experience Research, there may be a demand for MVPs in lean startups of incremental innovations as well.

Another aspect is that it may be hard to facilitate a process of MVPs through *design consultancy work*. As the valuable metric for a Lean Startup is *learning*, a *consultancy deliverable* may often be a quite vulnerable point of learning. Gothelf and Seiden (2013) preaches the mantra of *getting out of the deliverables business* as one implication of applying lean principles to User Experience Design. The process may therefore demand a high degree of involvement with clients. Furthermore, consultants may need to be involved longer than any first concept delivery or detailing. This may be especially relevant for *software* and *services,* as these are products that may never be considered *finished* in the same sense as many hardware products.

8. CONCLUSIONS

This paper has studied implications of applying the Lean Startup methodology of Minimum Viable Products to processes of Design Thinking, Design-driven innovation and User Experience Design. Analysis of User Experience Design in early stages of disruptive innovations resulted in a new model of the relative importance between User Experience quality attributes as a technology matures: Utility demands full attention, whereas Usability, Desirability and Brand Experience is relatively uninteresting in early development.

The analysis of Design Thinking and Design-driven innovation concluded that there is a considerable *risk of development being wasteful* when developing completely new products for new markets. Minimum Viable Products address this risk by dividing development into smaller chunks intended to validate the core implications before investing development efforts on less uncertain elements. Design process wise, this leads to a demand of several loops of the design process. One implication of this may be that fewer iterations are needed in the Develop stage, as these iterations do not help to address the core assumptions made in the Define stage. Another interesting implication is the new opportunities that arise for conducting high-quality user research on your own product in early development.

Surprisingly few have looked into design research methodology that targets the Utility attribute of User Experience in development of completely new products for new markets. This article suggests that the Lean Startup approach may be an interesting domain for future research in that regard.

9. REFERENCES

Benedek, J., and Miner, T,. 2002. *Measuring Desirability: New methods for evaluating desirability*

in a usability lab setting. [doc] Available at <www.microsoft.com/usability/uepostings/desirabilitytoolkit.doc> [Accessed 2013-04-29]

Blank, S. G., 2007. *The Four Steps to the Epiphany: Successful Strategies for Products that Win.* 3rd ed. CafePress.

Blank, S. G., 2013. *Why the Lean Start-Up Changes Everything*. Harvard Business Review, May 2013. [pdf] Available at <https://archive.harvardbusiness.org/cla/web/pl/product.seam?c=25903&i=25905&cs=f85785d3580feb87e2bce1535af10c2f> [Accessed 2013-05-04]

Brown, T., 2008. *Design Thinking.* Reprint R0806E, Harvard Business Review. Preview available at <http://hbr.org/2008/06/design-thinking/ar/1> [Accessed 2013-05-08]

Christensen, C. M., 1997. *The innovator's dilemma: when new technologies cause great firms to fail.* Boston, Massachusetts, USA: Harvard Business School Press

Design Council, 2013a. *The design process: Discover.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Discover/> [Accessed 2013-04-29]

Design Council, 2013b. *The design process.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Discover/> [Accessed 2013-04-29]

Design Council, 2013c. *The design process: Define: Project development.* [online] Available at: <http://www.designcouncil.org.uk/about-design/how-designers-work/the-design-process/define/project-development/> [Accessed 2013-04-29]

Design Council, 2013d. *The design process: Define.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Define/> [Accessed 2013-04-29]

Design Council, 2013e. *The design process: Develop.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Develop/> [Accessed 2013-04-29]

Design Council, 2013f. *The design process: Deliver.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Deliver/> [Accessed 2013-04-29]

Design Council, 2013g. *Targets, evaluation and feedback.* [online] Available at: <http://www.designcouncil.org.uk/about-design/How-designers-work/The-design-process/Deliver/Targets-evaluation-and-feedback/> [Accessed 2013-04-29]

Gothelf, J. and Seiden, J., 2013. *Lean UX: Applying Lean Principles to Improve User Experience.* [e-book] O'Reilly Media

Laugero, G., 2012. Making Sense of Minimum Viable Products, *Johnny Holland*. [Blog] Available at: <http://johnnyholland.org/2012/02/making-sense-of-minimum-viable-products/> [Accessed 2013-04-29]

Løvlie, L., Polaine, A. and Reason, B., 2013. *Service Design: From Insight to Implementation.* [e-book] Rosenfeld Media, New York

Nielsen, J., 2001. *First Rule of Usability? Don't Listen to Users*. Jakob Nielsen's Alertbox. [online] Available at <http://www.nngroup.com/articles/first-rule-of-usability-dont-listen-to-users/>[Accessed 2013-04-29]

Nielsen, J., 2010. *Interviewing Users*. Jakob Nielsen's Alertbox. [online] Available at <http://www.nngroup.com/articles/interviewing-users/> [Accessed 2013-04-29]

Nielsen, J., 2012, Usability 101: Introduction to Usability. *Jakob Nielsen's Alertbox.* [Online] Available at: <http://www.nngroup.com/articles/usability-101-introduction-to-usability/> [Accessed 2013-04-29]

Norman, D. A., 1998a. *The life cycle of a technology: Why it is so difficult for large companies to innovate*. [online] Available at <http://www.nngroup.com/articles-life-cycle-of-a-technology/> [Accessed 2013-04-29]

Norman, D. A., 1998b. *The invisible computer: Why Good Products Can Fail, the Personal Computer Is So Complex, and Information Appliances Are the Solution.*

Cambridge, MA: MIT Press.

Norman, D. A., 2012. Commentary on: Christensen, Clayton M. (2013): Disruptive Innovation. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human-Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. [online] Available at <http://www.interaction-design.org/encyclopedia/disruptive_innovation.html> [Accessed 2013-04-29]

Norman, D. A., 2013. Rethinking Design Thinking. *Core77.com*. [blog] Available at: <http://www.core77.com/blog/columns/rethinking_design_thinking_24579.asp> [Accessed 2013-04-29]

Norman, D. A. and Verganti, R., 2012. *Incremental and radical innovation: Design research versus technology and meaning change.* [pdf] Available at <http://jnd.org/dn.mss/Norman%20%26%20Verganti.%20Design%20Research%20%26%20Innovation-18%20Mar%202012.pdf> [Accessed 2013-04-29]

Kaminska, O., and Foulsham, T., 2013. *Understanding Sources of Social Desirability Bias in Different Modes: Evidence from Eye-tracking.* Economic and Social Research Council. [pdf] Available at <https://www.iser.essex.ac.uk/publications/working-papers/iser/2013-04.pdf> [Accessed 2013-04-29]

Kolko, J. and Tran, C., 2013. *HourSchool: Engaging Stakeholders in Service Design.* Commentary on chapter 3: Løvlie, L., Polaine, A. and Reason, B., 2013. Service Design: From Insight to Implementation. [e-book] Rosenfeld Media, New York

Krippendorff, K., 1988. *On the Essential Contexts of Artifacts or on the Proposition That "Design Is Making Sense (Of Things)*". Design Issues Vol. 5, No. 2 (Spring, 1989), pp. 9-39. The MIT Press

Kuniavsky, M., Goodman, E., and Moed, A., 2012. *Observing the User Experience: A Practitioner's Guide to User Research.* 2nd ed. [ebook] Morgan Kaufmann. Waltham, Massachusetts

Riddle, R., 2012. The 3 Elements of Good Design: Usability, Utility and Desirability. *ZURBlog.* [blog] Available at <http://www.zurb.com/article/1128/the-3-elements-of-good-design-usability-u> [Accessed 2013-04-29]

Ries, E., 2008. The lean startup. *Startup Lessons Learned.* [blog] Available at: <http://www.startuplessonslearned.com/2008/09/lean-startup.html> [Accessed 2013-04-29]

Ries, E., 2009a. Minimum Viable Product: a guide. *Startup Lessons Learned.* [blog] Available at: <http://www.startuplessonslearned.com/2009/08/minimum-viable-product-guide.html> [Accessed 2013-04-29]

Ries, E., 2009b. Minimum Viable Product: Presentation for the inaugural Lean Startup Meetup in San Francisco. [Online] Available at: <http://www.youtube.com/watch?feature=player_embedded&v=E4ex0fejo8w#!> [Accessed 2013-04-29]

Ries, E., 2011. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses.* [e-book] Crown Business, New York

Rohrer, C. 2009. *User Research Beyond Usability.* Rosenfeld Media. [webinar] Available at <http://rosenfeldmedia.com/webinars/user-research/> Abstract available through <http://www.youtube.com/watch?v=m9wZrQ6DxgY> [Accessed 2013-04-29]

Tobin, J., 2013. *Measuring BIM's Disruption: Understanding Value Networks of BIM/VDC.* [online] Available at: <http://www.aecbytes.com/buildingthefuture/2013/BIMdisruption.html> [Accessed 2013-04-29]

Usability.gov, 2013. *Cost & Return on Investment.* U.S. Department of Health & Human Services. [online] Available at <http://www.usability.gov/basics/usasaves/> [Accessed 2013-04-29]

Verganti, R,. 2009. *Design Driven Innovation: Changing the Rules of Competition by Radically Innovating What Things Mean.* [e-book] Harvard Business School Publishing, Boston, Massachusetts

Verganti, R,. 2011. *Radical Design and Technology Epiphanies: A New Focus for Research on Design Management.* J PROD INNOV MANAG 2011;28:384–388