'Fixation' and 'the pivot': balancing persistence with flexibility in design and entrepreneurship

Nathan Crilly, *University of Cambridge*

June 2017

'Design fixation' occurs when exploration of the solution space is unintentionally constrained by designers' knowledge of prior solutions. The study of fixation is well established in design research but there has been little discussion of what might be learned about fixation from studying related phenomena in other creative practices. To address this, a series of interviews were conducted with technology entrepreneurs and the advisors who guide them. Analysis of the interview data was informed by concepts of creative fixation, cognitive entrenchment and psychological ownership, but also concepts of entrepreneurial pivoting, strategic change and business model innovation. The study shows that entrepreneurs must actively balance persistence with flexibility, a task that is influenced by (i) the entrepreneurs' commitment to their ideas, (ii) the expertise that they have developed, (iii) the information that they seek or are exposed to, (iv) the resources available to them, and (v) their orientation towards either the product or the market. Collectively, these findings can be applied to design research as proposals for new topics to study when investigating fixation. They also hold implications for design practice by suggesting what designers (and their managers) should reflect on when identifying opportunities to change design direction.

Keywords: creative cognition, creative process, fixation

Introduction

The term 'design fixation' was coined by Jansson and Smith (1991) to refer to 'a blind adherence to a set of ideas or concepts limiting the output of conceptual design' (p. 3).

This definition described what Jansson and Smith found in experiments with participants working on creative design tasks. When these designers were set a problem and also presented with an example solution they tended to repeat key features of that solution. As these features were intentionally problematic (e.g. they contradicted the brief) this feature repetition was taken to be inadvertent and counterproductive. These fixation effects have since been investigated extensively (see recent reviews by Sio, Kotovsky, & Cagan, 2015; Vasconcelos & Crilly, 2016; Youmans & Arciszewski, 2014), and across many design disciplines, including engineering design (Linsey, Tseng, Fu, Cagan, Wood, & Schunn, 2010), industrial design (Cardoso & Badke-Schaub, 2011), software design (Goddard, 1976), interaction design (Hassard, Blandford, & Cox, 2009) and service design (Moreno, Hernandez, Yang, Linsey, & Wood, 2014). Furthermore, fixation is a concern for those developing analogical design support tools (Töre Yargin & Crilly, 2015), which provide stimuli intended to promote creative ideas (see Chakrabarti, Sarkar, Leelavathamma, & Nataraju, 2005; Cheong & Shu, 2012; Deldin & Schuknecht, 2014; Goel, Vattam, Wiltgen, & Helms, 2012).

The many design fixation studies that have been conducted, position the phenomenon as an important, widespread and pernicious problem for design creativity. However, design fixation is just one kind of cognitive bias, indicating that fixation-like effects are a problem for human cognition generally (Evans, 2003; 2008; Kahneman, 2011). Despite the general class of phenomena to which design fixation belongs, the connection between 'fixation in design' and 'fixation-like effects' in other creative practices has not received much, if any, attention. This is unfortunate because other creative practices might provide valuable clues for how design fixation can be better understood, mitigated or avoided (Crilly & Cardoso, 2017). This paper seeks to address this oversight by looking at the phenomenon of design fixation through the lens of

entrepreneurship, a closely related creative practice. Comparing design to entrepreneurship is useful for two reasons: firstly and most generally, because design and entrepreneurship are often tightly coupled in the innovation process (e.g. see Shane & Ulrich, 2004); secondly and more specifically, because in recent years entrepreneurship has celebrated the concept of 'the pivot' (Ries, 2009; 2011), where entrepreneurs change direction, giving up some of the ideas they have been working on to explore new opportunities. The entrepreneurial pivot thus provides a valuable counterpoint to fixation, and giving attention to pivoting behaviour promises to yield accounts of where fixation was avoided or overcome.

Despite the links that can be made between pivoting and other aspects of creative behaviour, discussion of the pivot is often at the level of the organisation, industry or market rather than considering the perspectives and experiences of those involved. Perhaps because of this, the concept of the pivot is also disconnected from accounts of how people progress from one idea to another. In particular, the pivot can be considered as an example of people resisting or overcoming fixation. However, the concept of pivoting has not previously been connected to the concept of fixation, with research into these phenomena being separated by traditional disciplinary boundaries. In practice, those who study entrepreneurs are familiar with popular accounts of pivoting but not with theories of fixation, whilst those who study other creative practices are often familiar with concepts of fixation but not with pivoting. Considering the pivot and fixation in terms of each other would potentially allow a better description of how ideas are developed, adhered to and changed, and might also offer guidance for how pivoting and fixation should be managed in a wide range of creative practices, especially design.

To investigate the relationship between fixation and pivoting, a qualitative interview study was conducted with entrepreneurs and their advisors. In presenting the

study and its findings, this paper is structured as follows. To establish the relevant theories and methods that might inform research on how pivots relate to creativity and fixation, the paper starts by connecting literature on the pivot with literature on fixation. Then, the approach taken in the study is reported, characterising the participants involved, the methods used and the nature of the data generated. This is followed by an analysis of the interviews, emphasising the factors that shape whether and how pivots occur, and the ways in which they are experienced by those involved. Finally, the paper discusses the implications of these findings for the conceptualisation of how creative change is recognised, accepted and implemented in entrepreneurship, design or other creative practices. It is hoped that the work presented here will help to develop understanding of the pivot as a creative act and allow design researchers, and those studying other creative activities, to view the pivot as a model for promoting conceptual change.

Literature review

To establish the context within which the experience of pivoting can be understood, two main literatures are relevant. On the one hand, literature on pivoting (and related concepts such as strategic change and business model innovation) provides the foundation for considering what pivots are and how they occur. On the other hand, literature on creative fixation (and related concepts of psychological ownership and cognitive entrenchment) provides the foundation for understanding why opportunities to pivot might be overlooked or resisted.

Pivoting and related concepts

As it applies to entrepreneurship, Eric Ries coined the term 'pivot' in June 2009 in a blog post titled "Pivot, don't jump to a new vision" (Ries, 2009). The concept was

further developed in his subsequent book *The Lean Startup* (Ries, 2011), which promoted the idea of entrepreneurship as an activity of forming and testing business hypotheses. Ries defined the pivot as "a structured course correction designed to test a new fundamental hypothesis" (2001: p. 149), explaining that "we keep one foot rooted in what we've learned so far, while making a fundamental change in strategy in order to seek greater validated learning" (p. 154). Because change can take many different forms (e.g. change in goal or change in method) entrepreneurs can implement many different types of pivot, including the *zoom-in* pivot (refocusing the offering on what had previously just been one aspect of a larger offering), *zoom-out* pivot, *customer segment* pivot, *customer need* pivot, *business architecture* pivot, *technology* pivot, and so on (Ries, 2011).

At first glance, the pivot can be difficult to distinguish from other concepts that describe organisational change, including 'strategic change' (e.g. Greenwood & Hinings, 1993) and 'business model innovation' (e.g. Chesbrough, 2010). Like the pivot, these other concepts are defined and used in different ways by different people, often to refer to a broad set of change-related behaviours (see Todnem, 2005). However, one thing that clearly distinguishes the pivot from these other concepts is that 'pivoting' is celebrated and promoted within the communities to which it relates (Grimes, 2012). For example, in the business press accounts of pivoting have been used to connect the otherwise disparate histories of various companies, most notably in a series of articles appearing in the business press: *Fast Company* (e.g. Baribeau, 2012), *Forbes* (e.g. Nazar, 2013), *Wired* (e.g. Solon, 2012) and *Harvard Business Review* (e.g. O'Connor & Klebahn, 2011). 'Pivoting' is thus part of the everyday language of many entrepreneurs, the advisors who guide them and the investors who fund them. This is something that is not necessarily true of other concepts of organisational change, which may be

prominent within certain academic communities but which are not widespread amongst the entrepreneurs whose behaviour is being described. As such, the concept and language of pivoting is especially useful when trying to understand how these kinds of change are understood and experienced by those involved.

Although pivots are widely celebrated within startup culture and elsewhere, this should not disguise the difficulties that might be experienced by those involved. Drawing from his own experience, Reis (2011) describes the decision of whether to persevere with the current strategy or pivot away from it as one of the hardest decisions that entrepreneurs face. To address this he recommends soliciting the "perspectives of outside advisors who can help us see past our preconceptions and interpret data in new ways" (p. 164). However, both for entrepreneurs and their advisors, it is important to understand how these preconceptions are formed and how they make 'new ways' of seeing so difficult to achieve.

Theories of organizational behaviour have often failed to explicitly address the cognitive aspects of change, even though this is central to decision-making (Mezias, Grinyer & Guth, 2001). However, the literature on disruptive innovation does recognise the conflicts that individuals and organisations face when choosing between already-established business models and new business models which might permit other opportunities to be exploited (Amit & Zott, 2001; Christensen, & Raynor, 2013). In such circumstances maladaptive 'defence mechanisms' might be employed (Bovey & Hede, 2001) such as filtering out information that does not fit with the dominant logic and rejecting that which conflicts with it (Chesbrough, 2010: p358). Such biases can be observed not just in large organisations, but also in startups. For example, entrepreneurs are reported to prefer 'local search' whereby they primarily explore market opportunities that fit with their existing knowledge, leading to the identification of local

rather than global optima (Keinz & Prügl, 2010; Rosenkopf & Nerkar, 2001; Stuart & Podolny, 1996).

Although relatively few studies focus on cognition, identity and experience in entrepreneurship, studying these issues could be central to understanding whether and how pivots are implemented. Those studies of entrepreneurship that consider such matters have identified problems of risk aversion, dysfunctional persistence, extreme devotion, overconfidence and overgeneralisation (Busenitz & Barney, 1997; Cardon, Zietsma, Saparito, Matherne & Davis, 2005). Such issues are the subject of extensive study in other fields, especially those that focus on creative fixation, entrenchment and psychological ownership.

Fixation and related concepts

There is a long history of psychological research into 'fixation', a name given to the phenomenon of established ideas inhibit people's ability to see things in new ways (for classic studies see Duncker, 1945: Ch. 7; Luchins, 1942; Maier, 1931; for reviews of more recent work see Bilalić & McLeod, 2014; Ellis & Reingold, 2014; German & Barrett, 2005). In other words, once people are aware of the solution to a problem, it is difficult for them to disconnect from that solution to properly search the space of alternatives. When viewed from this perspective, design fixation can be seen as a specific form of restricted thought that has been described in more general terms elsewhere. For example, Kuhn (1962) offers an account of how scientific ideas build up into an established paradigm which might be productive, but which also blinds its adherents to alternative interpretations until those new interpretations eventually and dramatically replace the old ones. The structure of Kuhn's account has subsequently been used to describe other practices, including design (Addis, 1990; Crilly, 2010; Vincenti, 1990), technological development (Abernathy, & Utterback, 1978; Constant,

1980; Dosi, 1982; Tushman & Anderson, 1986) and management (Dane, 2010). With respect to management, this paradigm-induced blindness is sometimes referred to as 'cognitive entrenchment', a term, used to describe how managers in organisations are susceptible to individual and collective inertia (Stempfle, 2011; Sanger, 2012).

Fixation-like effects might be exacerbated by the way in which the original (fixating) idea is developed. For example, design fixation has been shown to increase with the resources expended on developing an idea as people succumb to the 'sunk cost' fallacy (Viswanathan & Linsey, 2013), continuing to invest resources on the basis of prior commitments rather than prospective benefits. Also relevant to entrepreneurship is the concept of 'psychological ownership', where people identify with their ideas, seeing them as both a part of themselves and an external representation of themselves (Pierce, Kostova, & Dirks, 2003). This can result in various beneficial effects associated with increased commitment to an idea but may also lead to a selective response to other people's suggestions: only incorporating views that expand upon their idea and dismissing those that diminish it (Baer & Brown, 2012). This psychological ownership does not only influence how people relate to ideas (developing and defending their conceptual possessions) but also how they relate to other people (as they share or exchange these possessions with others) (Rouse, 2013).

Even though entrepreneurship is often viewed in creative terms (Gilad, 1984; Mumford, Connelly, & Gaddis, 2003; Shane & Nicolaou, 2015; Zhou & Shalley, 2007), entrepreneurial pivoting has not been explored from the perspective of creativity. There thus remain open-ended research questions about how pivots are experienced by those involved. For example, do biases such as fixation, entrenchment and psychological ownership influence the propensity to pivot? What factors determine whether those

biases dominate the situation or are addressed and overcome? What might other creative practices such as design learn from accounts of entrepreneurial pivoting?

To address the questions outlined above, this paper reports on a series of interviews with entrepreneurs in technology startups and with the advisors who guide them. Including advisors in the study provides an opportunity to gain insights from those who observe pivot-related behaviour from an external perspective or who seek to influence that behaviour. The study fits with other related work that takes a qualitative approach to pivoting (e.g. Grimes, 2012), entrepreneurial decision-making (Maine, Soh, & Dos Santos, 2015), psychological ownership (e.g. Rouse, 2013), entrenchment (e.g. Sanger, 2012) and fixation (e.g. Crilly, 2015). More generally, it fits with a tradition in creativity research of collecting multiple interviews for synthesis and comparison (e.g. Csikszentmihalyi, 1996; Shekerjian, 1991). In presenting these interviews here, it is hoped that the themes identified point to new avenues of enquiry that can be followed in future research, whether that research uses qualitative, quantitative or mixed methods approaches (for such arguments see Edmondson & McManus, 2007: p. 1160; Eisenhardt, 1989; Eisenhardt & Graebner, 2007).

Method

A key informant from the Vancouver technology innovation community recruited participants into the study. Interviews with ten participants are reported here: five entrepreneurs (sometimes self-identifying as inventors or innovators) and five innovation advisors (sometimes self-identifying as angels or consultants). The entrepreneurs had varying levels of business experience; some had pivoted and some had not yet done so. The advisors all had extensive personal entrepreneurial experience preceding or concurrent with their advising roles. They had overseen ventures that were both successful and unsuccessful, many of which had pivoted more than once. The

participants worked across a range of industry sectors, especially materials, energy and health (see Table 1). Note that pivoting in these science-based sectors is generally considered to be more difficult than in the software-based sectors in which pivoting is most often celebrated (see Linton & Walsh, 2008; Maine, 2013).

Table 1. Basic professional information for each of the interview participants. In the participant identification code, "E" denotes entrepreneurs and "A" denotes advisors. Two of the entrepreneurs worked for the same organisation (denoted by *), as did two of the advisors (denoted by **).

Participant ID code	Self-identified role(s)	Self-identified industry sector(s)	Relevant experience (years)
E1	Innovator	Emissions technology	17
E2	Inventor, Entrepreneur	Health diagnostics	2
E3	Entrepreneur	Sensors	18
E4*	CEO	Thin films	30
E5*	Researcher	Thin films	6
A1	Angel, Innovator	Technology start-ups, cleantech	30
A2**	Innovation advisor	Technology start-ups	18
A3**	Innovation advisor	Technology start-ups	20
A4	Innovation advisor	Energy	25
A5	Innovation consultant	Healthcare, cleantech	25

The interviews were conducted one-to-one, with the exception of those where participants worked for the same organisation. The participants were interviewed at their place of work or at another location of their choosing. Each interview was preceded by a standard process of establishing informed consent, including permission to record the interviews for later analysis. All interviews were conducted using a semi-structured protocol (see Breakwell, 2006) focussing on the participants' experiences of the ventures they were engaged with. After establishing background information on the participants and their ventures, emphasis was placed on the ways in which these ventures had 'changed direction'. In particular, the researcher sought to understand how these changes were anticipated, recognised, accepted, resisted and implemented, and also how the experience of pivoting influenced future pivoting behaviours. The interviews had an average duration of 61 minutes, excluding briefing and debriefing.

All audio recordings were transcribed and augmented with any handwritten notes made during the interviews (e.g. relating to context). The transcripts were then imported into qualitative data analysis software (ATLAS.ti) to assist in the iterative coding processes associated with a general inductive approach (see Braun & Clarke, 2006; Thomas, 2006). When themes were identified, they were assigned to the relevant passages of text, with those themes being split, merged and structured as the analysis progressed, and the corresponding passages being regrouped and reanalysed. After several coding cycles and several written drafts of analysis, the thematic structure had stabilised into the form presented here. Throughout this process, the identification of themes was intended to represent the voice of the participants rather than to satisfy the requirements of classification theory (Bailey, 1994; Marradi, 1990). Emphasis is here placed on identifying themes for their *relevance* to conceptual change (e.g. resistance to

new ideas) rather than their *prevalence* within the transcripts (e.g. the local funding conditions).

All interviews were conducted on the basis of anonymous participation, so the entrepreneurs, advisors and the organisations for which they worked are not named in this paper. Instead, a participant identification code is associated with each interviewee; where participants are quoted, their words are linked to these codes only, indexed to the basic information in Table 1. Where necessary, some quotations have been abstracted, for example where some details about the person, company, technology or market might compromise the anonymity of the participants. These abstractions and other substitutions or additions (made for clarity) are enclosed in square brackets.

Analysis

A central theme emerging from the interviews was that pivoting should be understood in the context of entrepreneurs balancing conflicting requirements: on the one hand they must exhibit *persistence* in the face of scepticism, criticism and adversity as they strive to make their new business ideas work; on the other hand, they must also exhibit *flexibility*, remaining open to new interpretations of what they are doing and what they should be doing. Different factors influence the way in which persistence and flexibility are balanced, especially the *commitment* of the entrepreneur, the *expertise* that they have developed, the *information* that they seek or are exposed to, the *resources* available to them, and their *orientation* to either the product or the market. Each of these factors is discussed in the sections that follow, emphasising their role in determining an entrepreneurs' resistance to pivoting or their readiness to pivot. The *discussion* section then explores the relationships between these factors and those that affect the occurrence design fixation.

Commitment

Many of the participants referred to the commitment, persistence or tenacity of entrepreneurs. In exploring new opportunities and imagining new possible futures, entrepreneurs will inevitably face many challenges as they work to transform their idea or technology into a successful business. In order to succeed, they need to remain focussed on their goals and not be discouraged by early setbacks. As such, entrepreneurs are expected to exhibit commitment to their ideas and to their approach. This commitment can make opportunities for change difficult to recognise and can make change itself difficult to accept.

> *There is something that you need to understand: the mindset of the startup or entrepreneur. You have to be pretty stubborn to be successful in the first place because if you give up early you're probably never going to be successful. And so there's a natural tendency to keep pushing, pushing, pushing. And so it's a difficult decision to make a pivot. It can be quite gut wrenching on various stakeholders in the company. [E4]*

Although an entrepreneur's commitment to an idea can help to establish a vision and recruit others in serving it, this commitment can sometimes be seen as overconfidence or arrogance. An entrepreneur's unwavering belief in the product, the team or themselves can have the negative effect of discouraging or delaying pivots that might be useful or necessary. As such, entrepreneurial commitment, persistence or tenacity can be viewed as drivers of success but also as barriers to change.

> *I never see scepticism. Never. No, everybody thinks they are on their way to home run. That is one of the problems. Sometimes they are not*

humble enough and they don't accept their shortcomings. And they

think that because they have got the greatest idea of the century,

everybody is going to bow down and give them what they want. And it

just doesn't work that way. [A1]

Expertise

As entrepreneurs develop their ventures, they become increasingly expert in the associated processes, technologies and markets. A high level of expertise in that one direction can make a change in direction less possible or less appealing. In such cases, various forms of expertise must be given up during a pivot, expertise that has often been costly to develop. Consequently, when pivoting from one opportunity to another, it can appear that entrepreneurs have wasted energy trying to understand and fit with the first opportunity. This work must then be redone, gaining the necessary knowledge to understand and fit with the new opportunity. The entrepreneur's perception of the lost work and necessary rework can make the decision to pivot very difficult.

I would personally hypothesise that there is a [negative] correlation

between the acceptance of the pivot scenario and the length of time

that the company has been going. … A company that's been operating

for three, five, ten years has a much higher resistance to a pivot.

[That's because of] the length of time that the employees and the

thinkers have had to root their beliefs. [A3]

Just as expertise in the current direction can make pivoting to a new direction more difficult, so can a lack of expertise encourage a readiness to pivot. This is because novices might be almost equally inexperienced in the direction that they are currently pursuing as they are in some alternative direction that they might pursue instead.

Furthermore, a lack of expertise can be associated with the humility required to listen to customers and advisors in an open way, without commitment to the existing direction acting as a barrier to change.

> *For us [pivoting] wasn't really difficult because both my partner and I are straight from our undergraduate degrees. We're also very flexible. We know that we have limitations, technical difficulties in a lot of things. At the same time I think we are willing to adapt. So I'm different [to my] professor, for example, who's an expert in the specific field... For him it's a little bit difficult to come out of that field and do something completely different. [...] Whereas for us, we don't have that kind of expertise. Because of that we're willing to adapt and that's what we did. [E2]*

Information

Exploring entrepreneurial opportunities is a process of confronting new information. This information might relate to the technology, the market, the competition or a range of other factors. An entrepreneur's commitment to an idea might blind them to sources of information that would threaten the validity of the direction they are pursuing. One important instance of this is where a failure to explore real market demands is driven by a fear of learning that a cherished idea would be unsuccessful. In such cases, the entrepreneurs might act in ways that allow them to maintain their ignorance, hesitant to learn that their current approach should be changed or abandoned. In such cases, when entrepreneurs are made aware that others have similar ideas, they might (unreasonably) dismiss this information by claiming that these others are targeting different markets, using different technologies or are adopting different strategies.

Whenever I have our pitch sessions [for entrepreneurs seeking

funding or other support], as people are speaking I'll be Googling

things that they are talking about, and up will come things that look

very similar. And then I'll say to them, 'what about company X here

in California, how is what you are doing different or better?' And

often they say, 'Oh, I haven't heard of that company'. And that is a

problem. Because they don't want to hear that maybe there's

something else out there. ... I think there's a resistance. ... There's

the fear that you are not the only one out there in the front. [A1]

Despite some entrepreneurs' tendencies to avoid 'troublesome' information, they can still be led to initiate a pivot when their advisors introduce them to information of the right kind. This information can relate to markets, regulations, funding, competition and other factors that might be influential to the success of the venture. The advisors reported that one of their roles was to direct the entrepreneurs (especially technology-oriented entrepreneurs) towards those sources of information in the hope of stimulating the kind of reflections from which pivots would result.

In my view, you have to educate them [entrepreneurs], convince them

that there is a need to change. Because often they don't accept that.

They are pretty stubborn sometimes. You have to find a way to

convince them. The best way to convince them is not through talking

to them but by providing information and reliable data and studies

and analysis from third party sources. They have to be educated. They

have to be convinced through education about what's going on out

there: 'Guys, if you keep doing this [the current venture], good luck

to you. But if you look at this [information] and think about how you

can get there you might succeed because of this and this and that [i.e.

facts].' [A4]

Resources

Even if the current direction is not developing into a satisfactory offering, the need to
pivot can still be difficult to accept because the act of exploring new directions
inevitably consumes constrained resources. The time, money, people and other
resources available to the entrepreneur might only be suited to exploring one particular
direction. Changing direction demands renewed resources, and exploring multiple
directions might overly limit the resources available to any single direction of
exploration. As such, entrepreneurs often have to commit to one strategy or another and
might not be able to change strategy quickly or often.

> *That's where the biggest challenge is. How do you start addressing a*
>
> *different sector or a different application area than the one you've*
>
> *spent two years learning about? … You don't have time, you don't*
>
> *have money. … It's just a complete balance or a struggle, a conflict, a*
>
> *balance between pursuing the attitude you understand quite well and*
>
> *yet you've been hitting your head against the wall, it's just not*
>
> *happening. And then switching gears into an unknown territory,*
>
> *starting all over again … That's a really tough [thing] to get over*
>
> *because of hesitation, fear, apprehension. By doing that [change]*
>
> *you're certainly going to sacrifice something [of your current focus],*
>
> *because you're not going to have enough resources … You have to*
>
> *learn all about [the new focus]. You have to have different*

> *connections, different contacts and you are operating on very limited*
>
> *resources. [A4]*

Whilst constrained resources may prevent entrepreneurs from effectively pivoting, an oversupply of resources might reduce the need to pivot. A tendency to continue with the venture in its current form might only be overcome when it is clear that venture is unsustainable. Entrepreneurs seldom pivot just because of new opportunities, but because of constraints and an inability to satisfy those constraints without initiating change. These constraints might require entrepreneurs to pay staff, proceed to the next funding cycle or demonstrate market demand to investors. In contrast, where companies operate in a system without feedback or where the constraints are weak, then pivots are less likely and initial ideas can be pursued for longer.

> *… whenever you're living on someone else's money and there's no*
>
> *criteria for 'live or die' it's just easy. I've seen it […] where the*
>
> *government has put so much money in technology companies to fund*
>
> *the risk that they [the government] don't have the confidence to say*
>
> *'show us purchase orders'. So the entrepreneur's not forced to pivot.*
>
> *[A5]*

Orientation

As entrepreneurs develop their business ideas and explore new ones, they might be orienting towards the product that they are offering, or towards the market that must respond to that product. Product orientation, especially when coupled with high levels of commitment and expertise can be associated with a failure to recognise opportunities

to pivot, or a resistance to act on those opportunities.

> *Very often, people at universities believe they know what's best; it's an ego problem. But in business, [what counts] is what the market needs, not what the researchers offer. It's completely the opposite side. It is the biggest problem in the transfer of technology and innovation and everything else. Because researchers believe they know what markets should have. No. Only the customer knows what the customer needs. [...] If the company does not want to [go out of business], then they must adjust to what the market needs – it's as simple as that. [E3]*

In contrast to product orientation, market orientation is associated with a readiness to pivot. Framing the objective of the venture in terms of market demand reduces the tendency to get stuck on existing ways of doing things. This is because the venture is not defined in terms of what the entrepreneur does but in terms of how the market responds to what the entrepreneur does. As such, identifying markets, approaching customers, understanding their needs and responding to them are all activities that increase the flexibility of the organisation and *encourage* an acceptance of the need for pivoting. This is partly because adopting a market orientation combats some of the challenges of over-commitment, lack of information and the inflexibility associated with expertise.

> *What makes us [my current company] more pivotable is that… [we focus on remembering that] if the customer is not willing to buy it then we need to consider what we're doing **wrong**, [ask ourselves] if the product has value, [ask ourselves] if it's the wrong customer. [A5]*

Discussion

Over three decades ago, Gilad (1984) described entrepreneurship as 'creativity in business', promoting the idea that creativity researchers should study entrepreneurship, both to contribute to our understanding of business innovation, but also to learn about creativity more generally (also see Zhou & Shalley, 2007). Creativity researchers took up this challenge, for example with work investigating the creative entrepreneur's personality (Solomon & Winslow, 1988), motivation (Amabile, 1997) and cognition (Ward, 2004). In recent years, the pivot has gained prominence as an entrepreneurial act that warrants attention but interpretations of the pivot as a creative process have not been forthcoming.

The pivot can be viewed from various perspectives, for example as a process of business innovation or a response to funding trends. However, the study reported here emphasises the pivot as an instance of conceptual change, opportunities for which can be difficult to identify, accept and act upon. Framing the pivot in this way allows us to see how pivoting relates to fixation, and therefore how this specific entrepreneurial practice relates to creative activities generally, and to creative design in particular. If we consider the pivot from the perspective of fixation then a propensity to pivot might be viewed as an inclination to resist fixation. For those who pivot, the precedent offered by the prior direction does not dominate, but is instead seen as a learning experience that opens up new opportunities for enquiry.

In the accounts reported here, success in new business ventures required the entrepreneurs to balance an open, flexible, opportunistic approach with the need to be persistent, tenacious and committed. Managing such tensions is made more challenging by the entrepreneur's susceptibility to fixate on their initial idea, a phenomenon that can be exacerbated by the various commitments they must make to that idea to develop it

fully. This echoes findings from Crilly's (2015) interview study with expert designers, in which he described "an inherent contradiction: designers must remain open to the possibility that their ideas are limited or misdirected whilst also being persistent in developing their nascent ideas in the face of negative feedback" (p. 67).

So, what is it that allows people to most effectively manage the tension between persistence and flexibility in creative tasks? For the entrepreneurs in this study, it was clear that some were are able to pivot effectively, creatively reimagining their nascent venture as new constraints or opportunities arose. This was made more likely through explicitly tackling over-commitment, exercising caution around expertise, achieving the right balance of resources, accessing new information and by defining the venture in terms of what is achieved (strategically) rather than how it is achieved (operationally). Such recommendations partly overlap with Crilly's (2015) observations of how design fixation risks are mitigated in professional practice. For example, his participants explained that the beneficial effects of teamwork could partly be attributed to the variety of backgrounds that could be applied to a problem (i.e. new information). Moreover, in the present study, adopting a strong market orientation was celebrated, especially if it involved the continued testing of business offerings against consumer needs. This supports Viswanathan & Linsey's (2014) finding that designers can overcome fixation by constructing and testing physical models that reveal the flawed assumptions in their initial ideas.

Research on ways to overcome design fixation clearly relate to the accounts of pivoting reported in this study. However, fixation research might also be informed by the broader literature on the cognitive and social aspects of entrepreneurship and other creative activities. In particular, there is prior work suggesting that the 'defence mechanisms' which might be employed when resisting change (Bovey & Hede, 2001;

Chesbrough, 2010) can be associated with the length of time that prior processes are in place and the degree to which the people involved orient towards those processes. A tendency for entrepreneurs to exhibit 'local search' behaviour (Keinz & Prügl, 2010; Rosenkopf & Nerkar, 2001; Stuart & Podolny, 1996) can also be related to the level of expertise they have accumulated and the resources that are available for wider search. Finally, behaviours such as risk aversion, dysfunctional persistence, identity management and overconfidence (e.g. Busenitz & Barney, 1997; Cardon et al., 2005; Grimes, 2012) can be effectively studied by treating entrepreneurship as an emotion-laden activity. Some of the relevant emotions stem from prior investment in, and personal attachment to, the ideas that entrepreneurs have developed. This suggests that 'psychological ownership' effects (Pierce, Kostova, & Dirks, 2003) can exacerbate problems with fixation as it relates to pivoting. Design researchers have already investigated such issues with respect to 'sunk cost' effects (Viswanathan & Linsey, 2013), although clearly there are many other personal factors that might influence the occurrence of design fixation but which have not attracted similar attention (see Crilly & Cardoso, 2017: pp. 11-12). The entrepreneurial literature provides a useful range of concepts for understanding such factors, and for planning new studies that would yield insights into their role in design.

Much of the prior discussion about the pivot has taken place without reference to the cognitive and behavioural biases that influence creative work. The opposite is also true, with research on creativity not considering the phenomenon of the pivot despite the similarities that might be observed between pivoting and other forms of creative change. One particular feature of 'pivoting' that might interest creativity researchers is the widespread use of that term. For example, in this study, all participants confirmed that the concept of the pivot is well known in their specific entrepreneurial community.

Having a clear and accepted language for conceptual change means that this is something that entrepreneurs (even novices) know to expect and perhaps even seek. It might also be that having a distinct and well known terminology for the pivot can be useful in securing its position in the popular consciousness and thus in the consciousness of those who must be creative (e.g. see Grimes, 2012: p. 2).

Other creative disciplines outside entrepreneurship might productively promote the idea of conceptual change by giving a name to this phenomenon (whether using the term 'pivot' or not). This would provide individuals and groups with a convenient linguistic handle for the process of implementing such change, giving a name to something that they might or should do. However, in the entrepreneurial world, the pivot is understood through numerous high-profile case studies (e.g. Baribeau, 2012; Nazar, 2013), and so terminology in itself might not be sufficient. Creative disciplines such as design might thus be encouraged to document case studies of projects that involve fixation and de-fixation (for a rare example, see French, 1998; p. 202) to illustrate the nature and variety of conceptual change. Such case studies would probably most usefully be employed as educational material to represent how designers get into and out of mental ruts during their work.

When considering the forms of training and coaching that might promote effective pivoting (e.g. see Sarri, Bakouros, & Petridou, 2010), research into design creativity has already suggested that knowledge about fixation might help to mitigate its effects (e.g. Crilly, 2015; Howard, Maier, Onarheim, & Friis-Olivarius, 2013). Similar suggestions have been made in the healthcare domain, with the recommendation that medics are encouraged to reflect on the cognitive biases that might influence their diagnostic practices (Kassirer & Kopelman, 1989; Croskerry, 2003). On this basis, designers might be assisted in their work if they are encouraged to reflect on issues such

as fixation, entrenchment, sunk cost effects and other phenomena that could prevent or delay pivoting. Practically, such matters lie in the hands of those who advise and train designers, including those who employ them and manage the environments they work in (see Ko & Butler, 2007; Sarri et al., 2010). As this present study has shown, those overseeing creative work can have a positive effect in encouraging those who might be fixated to recognise that new directions should be explored (also see Crilly, 2015). As such, it might be most effective to provide training in fixation-related issues not just to designers, but also to design managers.

Conclusions

The concept of fixation has gained much attention in recent years from those researching design creativity and also from those developing software tools that aim to support designers in constructing creative analogies. To inform such work, this paper has reported on the study of a professional practice that is related to design but is distinct from it, a practice where fixation-like effects are apparent but also where they are successfully challenged. By examining the experiences of technology entrepreneurs and their advisors, this study has highlighted the relevance of pivoting to fixation-like behaviour, and also given an account of the personal factors that influence pivoting. Despite the difficulties involved, individuals and organisations can recognise the need for and the opportunities for pivoting and can overcome individual and collective resistance to conceptual change. With further research, considering the pivot as a creative act may prove useful in influencing how we think about and talk about creative design work, and in how we train and coach those who must be creative, in design and elsewhere.

As with much qualitative research, the objective here has not been to provide validated and generalisable findings, but to raise interesting themes that might be

investigated further in other studies and by other methods. Looking back on the themes that emerged from the interviews, a number of future research questions can be posed.

(1) Are those factors that are influential in determining the occurrence of entrepreneurial pivoting (i.e. commitment, expertise, information, resources, orientation) also influential in determining the occurrence of conceptual change in design?

(2) What effect would an accepted and shared terminology for conceptual change in design (e.g. 'design pivot') have on the way in which designers think about, communicate about and implement such change?

(3) What is the most effective way to communicate the concept of the pivot to designers, whether through detailed case studies or other means?

(4) What effect does the experience of pivoting have on designers' propensity to pivot again in the future (or, conversely, to reduce fixation)?

(5) What effect can creativity training have on designers' behaviour, especially training that raises awareness of concepts such as sunk cost effects, cognitive entrenchment and psychological ownership?

Such questions and others might be approached through further qualitative enquiry, but also by employing more quantitative and controlled methods such as surveys, longitudinal case studies and experiments. Whatever methods are used, addressing questions of this kind would not only provide useful perspectives on creative design behaviour generally, but on the potential for design research to look at other creative practices for inspiration. More pragmatically, future research might be conducted so as to offer compelling evidence for how we can best encourage designers to balance persistence with flexibility and to learn from the past without being limited by it.

Acknowledgements

References

Abernathy, W. J., & Utterback, J. M. (1978). Patterns of industrial innovation. *Technology Review*, *80*(7), 40–47.

Amabile, T. M. (1997). Entrepreneurial creativity through motivational synergy. *The Journal of Creative Behavior*, *31*(1), 18–26.

Amit, R., & Zott, C. (2001). Value creation in E-business. *Strategic Management Journal*, *22*(6–7), 493–520. Baer, M., & Brown, G. (2012). Blind in one eye: How psychological ownership of ideas affects the types of suggestions people adopt. *Organizational Behavior and Human Decision Processes*, *118*(1), 60–71.

Baribeau, S. (2012, October 17). What Is The Pivot? We Asked Intel, Zappos, Instagram, Pandora, Box... Retrieved 18 December 2014, from http://www.fastcompany.com/3002026/what-pivot-we-asked-intel-zappos-instagram-pandora-box

Bilalić, M. & McLeod, P. (2014). Why Good Thoughts Block Better Ones. *Scientific American 310*(3): 74–79.

Bovey, W. H., & Hede, A. (2001). Resistance to organisational change: the role of defence mechanisms. *Journal of Managerial Psychology*, 16(7), 534–548.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101.

Breakwell, G. M. (2006). Interviewing methods. In G. M. Breakwell, S. Hammond, C. Fife-Schaw, & J. A. Smith (Eds.), *Research Methods in Psychology* (3rd ed., pp. 232–253). London, UK: SAGE.

Busenitz, L. W., & Barney, J. B. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing*, *12*(1), 9–30.

Cardon, M. S., Zietsma, C., Saparito, P., Matherne, B. P., & Davis, C. (2005). A tale of passion: New insights into entrepreneurship from a parenthood metaphor. *Journal of Business Venturing*, *20*(1), 23–45.

Cardoso, C., & Badke-Schaub, P. (2011). The influence of different pictorial representations during idea generation. *The Journal of Creative Behavior*, *45*(2), 130–146.

Chakrabarti, A., Sarkar, P., Leelavathamma, B., & Nataraju, B. S. (2005). A functional representation for aiding biomimetic and artificial inspiration of new ideas. *AI EDAM*, *19*(02), 113–132.

Chesbrough, H. (2010). Business Model Innovation: Opportunities and Barriers. *Long Range Planning*, *43*(2–3), 354–363. http://doi.org/10.1016/j.lrp.2009.07.010

Cheong, H., & Shu, L. (2013). Using templates and mapping strategies to support analogical transfer in biomimetic design. *Design Studies, 34*(6), 706–728.

Christensen, C. M., & Raynor, M. E. (2013). *The Innovator's Solution: Creating and Sustaining Successful Growth* (1 edition). Boston, Massachusetts: Harvard Business Review Press.

Constant, E. W. (1980). *The origins of the turbojet revolution*. Baltimore, MD: Johns Hopkins University Press.

Crilly, N. (2010). The Structure of Design Revolutions: Kuhnian Paradigm Shifts in Creative Problem Solving. *Design Issues*, *26*(1), 54–66.

Crilly, N. (2015). Fixation and creativity in concept development: The attitudes and practices of expert designers. *Design Studies*, *38*, 54–91.

Crilly, N., & Cardoso, C. (2017). Where next for research on fixation, inspiration and creativity in design? *Design Studies*, *50*, 1–38.

Croskerry, P. (2003). The importance of cognitive errors in diagnosis and strategies to minimize them. *Academic Medicine*, *78*(8), 775–780.

Csikszentmihalyi, M. (1996). *Creativity: flow and the psychology of discovery and invention*. New York, NY: Harper Perennial.

Deldin, J.-M., & Schuknecht, M. (2013). The AskNature Database: Enabling Solutions in Biomimetic Design. In A. K. Goel, D. A. McAdams, & R. B. Stone (Eds.), *Biologically Inspired Design: Computational Methods and Tools* (pp. 17–27). London, UK: Springer-Verlag.

Dosi, G. (1982). Technological paradigms and technological trajectories: a suggested interpretation of the determinants and directions of technical change. *Research Policy*, *11*(3), 147–162.

Edmondson, A. C., & McManus, S. E. (2007). Methodological fit in management field research. *Academy of Management Review, 32*(4), 1246–1264.

Eisenhardt, K. M. (1989). Building Theories from Case Study Research. The Academy of Management Review, 14(4), 532–550.

Eisenhardt, K. M., & Graebner, M. E. (2007). Theory building from cases: opportunities and challenges. Academy of Management Journal, 50(1), 25–32.

Ellis, J. J., & Reingold, E. M. (2014). The Einstellung effect in anagram problem solving: evidence from eye movements. *Cognition*, *5*, 679.

Evans, J. S. B. T. (2003). In two minds: dual-process accounts of reasoning. *Trends in Cognitive Sciences*, 7(10), 454–459.

Evans, J. S. B. T. (2008). Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition. *Annual Review of Psychology*, 59(1), 255–278.

French, M. J. (1998). Conceptual Design for Engineers (3rd ed). London, UK: Springer.

German, T. P., & Barrett, H. C. (2005). Functional fixedness in a technologically sparse culture. *Psychological Science*, *16*(1), 1–5.

Gilad, B. (1984). Entrepreneurship: the issue of creativity in the market place. The Journal of Creative Behavior, *18*(3), 151–161.

Greenwood, R., & Hinings, C. R. (1993). Understanding strategic change: the contribution of archetypes. *Academy of Management Journal, 36*(5), 1052–1081.

Goddard, W. P. (1976). *Transfer and Einstellung Effects of Examples on Devising Computer Algorithms* (Master of Arts Thesis, Department of Mathematics). The University of British Columbia.

Grimes, M. G. (2012). *To thine own self be true? The process and consequences of "pivoting" during idea-stage entrepreneurship* (PhD Dissertation). Vanderbilt University, Nashville, TN.

Hassard, S. T., Blandford, A., & Cox, A. L. (2009). Analogies in design decision-making. In *Proceedings of the 23rd British HCI group annual conference on people and computers: celebrating people and technology* (pp. 140–148). British Computer Society.

Howard, T. J., Maier, A., Onarheim, B., & Friis-Olivarius, M. (2013). Overcoming design fixation through education and creativity methods. In *19th International Conference on Engineering Design: ICED 13*.

Kahneman, D. (2011). *Thinking fast and slow*, New York, NY: Farrar, Straus & Giroux.

Kassirer, J. P., & Kopelman, R. I. (1989). Cognitive errors in diagnosis: instantiation, classification, and consequences. *The American Journal of Medicine*, *86*(4), 433–441.

Keinz, P., & Prügl, R. (2010). A User Community-Based Approach to Leveraging Technological Competences: An Exploratory Case Study of a Technology Start-Up from MIT. *Creativity and Innovation Management*, *19*(3), 269–289.

Ko, S., & Butler, J. E. (2007). Creativity: A key link to entrepreneurial behavior. *Business Horizons*, *50*(5), 365–372.

Linsey, J. S., Tseng, I., Fu, K., Cagan, J., Wood, K. L., & Schunn, C. (2010). A Study of Design Fixation, Its Mitigation and Perception in Engineering Design Faculty. *Journal of Mechanical Design*, *132*(4), 041003.

Linton, J. D., & Walsh, S. T. (2008). A theory of innovation for process-based innovations such as nanotechnology. *Technological Forecasting and Social Change*, *75*(5), 583–594.

Maine, E. (2013). Scientist-Entrepreneurs as the Catalysts of Nanotechnology Commercialization. *Reviews in Nanoscience and Nanotechnology*, *2*(5), 301–308.

Maine, E., Lubik, S., & Garnsey, E. (2012). Process-based vs. product-based innovation: Value creation by nanotech ventures. *Technovation*, 32(3-4), 179–192.

Maine, E., Soh, P.-H., & Dos Santos, N. (2015). The role of entrepreneurial decision-making in opportunity creation and recognition. *Technovation*, 39-40, 53–72.

Mezias, J., Grinyer, P., & Guth, W. D. (2001). Changing collective cognition: a process model for strategic change. *Long Range Planning*, *34*(1), 71–95.

Moreno, D. P., Hernández, A. A., Yang, M. C., Otto, K. N., Hölttä-Otto, K., Linsey, J. S., … Linden, A. (2014). Fundamental studies in Design-by-Analogy: A focus

on domain-knowledge experts and applications to transactional design problems. *Design Studies*, *35*(3), 232–272.

Mumford, M. D., Connelly, S., & Gaddis, B. (2003). How creative leaders think: Experimental findings and cases. *The Leadership Quarterly*, 14(4-5), 411–432.

Nazar, J. (2013, August 10). 14 Famous Business Pivots. Retrieved 18 December 2014, from http://www.forbes.com/sites/jasonnazar/2013/10/08/14-famous-business-pivots/

O'Connor, C., & Klebahn, P. (2011, February 28). The Strategic Pivot: Rules for Entrepreneurs and Other Innovators. Retrieved 18 December 2014, from https://hbr.org/2011/02/how-and-when-to-pivot-rules-fo

Pierce, J. L., Kostova, T., & Dirks, K. T. (2003). The state of psychological ownership: Integrating and extending a century of research. *Review of General Psychology*, *7*(1), 84–107.

Ries, E. (2009, June 22). Lessons Learned: Pivot, don't jump to a new vision. Retrieved 18 December 2014, from http://www.startuplessonslearned.com/2009/06/pivot-dont-jump-to-new-vision.html

Ries, E. (2011). *The Lean Startup: How Constant Innovation Creates Radically Successful Businesses*. New York, NY: Penguin UK.

Rosenkopf, L., & Nerkar, A. (2001). Beyond local search: boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal*, *22*(4), 287–306.

Rouse, E. (2013). Kill your darlings? Experiencing, maintaining, and changing psychological ownership in creative work (PhD Dissertation). Boston College, Chestnut Hill, MA.

Shane, S., & Nicolaou, N. (2015). Creative personality, opportunity recognition and the tendency to start businesses: A study of their genetic predispositions. *Journal of Business Venturing*, 30(3), 407–419.

Shekerjian, D. (1991). *Uncommon Genius: How Great Ideas are Born*. New York, NY: Penguin Books.

Sio, U. N., Kotovsky, K., & Cagan, J. (2015). Fixation or inspiration? A meta-analytic review of the role of examples on design processes. *Design Studies*, *39*, 70–99.

Solomon, G. T., & Winslow, E. K. (1988). Toward A Descriptive Profile of The Entrepreneur. *The Journal of Creative Behavior*, *22*(3), 162–171.

Solon, O. (2012, April 16). Moonfruit's Wendy Tan White: How to pivot your startup if necessary (Wired UK). Retrieved 18 December 2014, from http://www.wired.co.uk/magazine/archive/2012/05/how-to/how-to-pivot-if-necessary

Stuart, T. E., & Podolny, J. M. (1996). Local search and the evolution of technological capabilities. *Strategic Management Journal*, *17*(S1), 21–38.

Thomas, D. R. (2006). A General Inductive Approach for Analyzing Qualitative Evaluation Data. *American Journal of Evaluation*, *27*(2), 237–246.

Todnem, R. B. (2005). Organisational change management: A critical review. *Journal of Change Management*, 5(4), 369–380.

Töre Yargin, G., & Crilly, N. (2015). Information and interaction requirements for software tools supporting analogical design. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, *29*(02), 203–214.

Tushman, M. L., & Anderson, P. (1986). Technological Discontinuities and Organizational Environments. *Administrative Science Quarterly*, *31*(3), 439–465.

Vasconcelos, L. A., & Crilly, N. (2016). Inspiration and fixation: Questions, methods, findings, and challenges. *Design Studies*, *42*, 1–32.

Vattam, S. S., Helms, M. E., & Goel, A. K. (2010). A content account of creative analogies in biologically inspired design. *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, *24*(Special Issue 04), 467–481.

Viswanathan, V. K., & Linsey, J. S. (2013). Role of Sunk Cost in Engineering Idea Generation: An Experimental Investigation. *Journal of Mechanical Design*, *135*(12), 121002–121002.

Viswanathan, V., Atilola, O., Esposito, N., & Linsey, J. (2014). A study on the role of physical models in the mitigation of design fixation. *Journal of Engineering Design*, *25*(1–3), 25–43.

Ward, T. B. (2004). Cognition, creativity, and entrepreneurship. *Journal of Business Venturing*, *19*(2), 173–188.

Youmans, R. J., & Arciszewski, T. (2014). Design fixation: Classifications and modern methods of prevention. *AI EDAM*, *28*(Special Issue 02), 129–137.

Zhou, J., & Shalley, C. E. (2007). Expanding the Scope and Impact of Organisational Creativity Research. In *Handbook of Organizational Creativity* (pp. 347–368). Taylor & Francis.