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A Short Theory of Failure

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Failures are a key concept in design thinking. They are discussed as a resource for learning, whereas fear of failure would be a major block to creative activity. We attempt to clarify the term by reconstructing "failures" as "inconclusive outcomes" in the Dynamic Creativity Framework. This includes a definition of key terms, the specification of hypotheses, a brief consideration of empirical evidence and discussion of practical implications.

Keywords: *Creativity, Creativity Blocks, Design Thinking, Dynamic Creativity Framework, Failure, Failure Theory, Inconclusive Outcome*

1. Introduction

In design thinking, the word „failure" is a key term, embedded in a rich net of assumptions. This paper intends to clarify the concept and central claims involved. It will become evident why failures play a central role in innovation projects, both as a challenge and as a vehicle for creative progress. Furthermore, explicitly formulated hypotheses will help to test beliefs more rigorously and to explore implications for teaching practices.

2. The Concept of Failure in Design Thinking

Writing about *the Gift of Failure*, Roth (2015) prepares his audience for the fact that failures will lie ahead of them. "At the d.school, one of the basic principles is a bias toward action: that is, it is better to start to do something and fail than it is to do nothing and wait for the correct path of action to appear. Failure is part of the result to expect if you have a bias toward action" (p. 121). One reason for discussing the subject of failure is their regular occurrence: They are a normal part of design thinking projects.

Failures also seem to entail considerable opportunities. "If you do something and it works, great! If you do something and it fails, maybe even better. You do, you fail, and you learn. You do again, you fail again, and you learn some more. If you are mindful about what you have done, failure is a teacher" (p. 121). That is, failures can drive creative projects forwards; they can be vehicles for learning.

However, "nobody wants to fail" (p. 121). Negative emotional reactions to real or imagined failures are a much debated subject. Kelley and Kelley (2013) forcefully submit, "while much has been said about fear of failure, it still is the single biggest obstacle people face to creative success" (p. 40).

Design Thinking introduces a broad range of measures to help people overcome fear of failure and to rather flourish from them. "The most liberating way to acknowledge failure is to celebrate it. […] Rolf Faste used to have participants in our workshop take […] [a] *ta-da* bow when they messed up. It did wonders; it made it okay to show one's mistakes" (Roth, 2015, p. 121f.).

Timing is also an importing tool for failure-management. In design thinking education, frontal lectures are short. Instead, there is ample room for teamwork. "We give students a chance to fail as soon as possible, in order to maximize the learning time that follows" (Kelley & Kelley, 2013, p. 44). Along the way, time pressure is often used as an intervention to counter fear. Specifically when teaching novices, a high pace of work and "too short" time slots help participants let go of the expectation that they should deliver perfect work (von Thienen, Royalty & Meinel, 2016).

Next to lowering fear, tools for learning from failure figure prominently in design thinking as well. The most comprehensive approach may be a whole class on how to *Fail Faster* (Hawthorne, 2015). Apart from that, a generic way of helping students handle failure is to offer joint reflections. After teamwork sessions "we follow up in debriefs to reflect on what succeeded – and what can be learned from things that didn't work" (Kelley & Kelley, 2013, p. 44). Examples of more specific tools include the feedback-capture grid (d.school, 2010) or an adapted version of it that specifically encourages the analysis of failed prototypes (von Thienen & Meinel, 2014).

Another key aspect in design thinking education is to convey values and elicit mindset changes in favour of active failure-handling. Corazza (2016a) speaks of an improvement in meta-cognitive control. Students are told that "to learn from failure […] you have to 'own' it" (Kelley & Kelley, 2013, p. 51). "As […] Bob Sutton and […] Diego Rodriguez often say at the d.school, 'Failure sucks, but instructs.'" (p. 43).

Finally, a focus is placed not only on the individual who is educated to embrace failures; the environment too is accorded great importance. "People tend to accept the notion that failure can be productive as an abstraction, yet unsurprisingly, in reality they find it difficult to

accept failure unless they're in an environment that supports this notion" (Roth, 2015, p. 122). Allocating extra resources is one element of preparation. "A creative team must be given the time, the space, and the budget to make mistakes" (Brown & Katz, 2009, p. 71). Another cultural manifestation is the motto "Fail early and often" (Meinel & Weinberg, 2013), which can be found in large print on the walls of many design thinking institutes.

Given all this attention to the subject, unsurprisingly novel reactions to failure – actively addressing them instead of shying away – have also been explored as important outcomes of design thinking education. An *Implicit Association Test* has been prototyped to see whether experienced design thinkers display more positive emotional reactions to failures than novices (von Thienen & Royalty, 2014). Royalty, Oishi & Roth (2014) conducted a survey study with 184 d.school alumni to assess take-aways of design thinking education, sometimes years after the training. Indeed, novel failure-responses figured substantially in self-reports of alumni; they describe "comfort with seemingly negative states […] such as failure" (p. 87).

3. Reconstructing Failures as Inconclusive Outcomes

Failures are a prominent case of "inconclusive outcomes" in the *Dynamic Creativity Framework* (Corazza, 2016a, 2016b), as opposed to creative achievements.

Creative projects often endure over considerable time. Along the way, many attempts can be made to solve a problem or achieve a creativity goal, which are not yet successful (Corazza, 2016b; Roth, 2015). In the *Dynamic Creativity Framework*, the term "inconclusive outcomes" addresses all intermediate ideas or prototypes that are generated in the course of a project without yet realizing a creative breakthrough. According to Corazza's definition "creative inconclusiveness corresponds to insufficient attribution of originality and/or effectiveness to the represented outcomes of a creative process by any estimator at a specific time" (2016b, p. 264).

In design thinking, the most likely situation seems to be that a team works with an idea or a tangible prototype that is not considered novel and useful in the sense of a creative breakthrough. Notably, there is nothing unusual, let alone amiss in working with inconclusive outcomes. Quite to the contrary, it is both a normal and important part of creative work. Sometimes prototypes (i.e. represented outcomes) are not even intended to be novel and useful; they rather serve as communication media to help the team consolidate their understanding of a problem or of the solution space (Rhinow et al., 2013; Meinel & Leifer, 2014). Sometimes, a prototype is simply "work in progress" and the team knows all too well that more needs to be done. Most importantly, however, design thinkers embrace the brainstorming maxim "Go for Quantity" (d.school, 2010), assuming that it is highly beneficial for creative projects to explore solution spaces as comprehensively as possible. This is considered the best approach to finally separate hey from gold, assuming that most ideas are the first rather than the latter. Thus, design thinkers happily work with inconclusive outcomes and not all of them are addressed as failures. This begs the question of what makes one inconclusive outcome a failure, while other outcomes (prototypes in particular) are simply dropped along the way without being treated as such.

4. Clarifying Terms

The term "failure" is sometimes used in a very broad sense. We, however, wish to keep closely in touch with design thinking methodology. Here, the issue of failure comes into play specifically in the second half of the process (model), when teams build prototypes and boldly submit them to user tests. In design thinking courses, participants are encouraged to embrace failing outcomes when they occur, to learn from them and iterate. Prototypes shall rather be given up or changed than defended when users appear unconvinced by their test experience. Attempting to further advance these existing lines of teaching, our definitions shall also focus on prototypes as the typical entities that are treated or not treated as failures.

We submit…

*A prototype is **failing** when it is does not deliver the expected performance in a test.*

In such a case, the team may have actually expected to conclude the project with the existing prototype. However, unexpectedly, the prototype turns out insufficient and creative work needs to continue. Thus, it is not only the prototype that fails, but also the views, the expectations, the domain understanding of the team.[1]

Yet, when test results turn out surprisingly bad, there seem to be different degrees of failure. We suggest making one further distinction.

***Type 1 failures** bear on the question what problem to solve.*

***Type 2 failures** bear on the question how to solve a problem.*

The number of process steps that a team needs to move backwards after the occurrence of a failure could give a rough measure of failure degree. Type 1 failures necessitate moving back to problem framing or even earlier phases, while type 2 failures only necessitate moving back to ideation or prototyping. More generally

[1] Notably, failures thus described have a striking element in common with creatively achieving products: a moment of surprise (Simonton, 2012; Corazza, 2016b). To what extent this could be used methodologically – e.g., by establishing tools to support the move from surprising failure to surprising solution – remains to be explored.

speaking, the degree of failure corresponds to the amount of ambiguity that re-enters a design project and to the number of domain beliefs that become dubious.

However, there can also be failure when no specific beliefs are proven wrong in a test. We suggest saying…

*A prototype is **mini-failing** when it is expected to perform badly in a test, and so it does.*

In the case of a mini-failure, the prototype turns out insufficient. At the same time, the views, expectations and domain understanding of the team are not shattered, because no-one expected a positive outcome in the first place.

To better illuminate education effects, we also introduce the concept of failure-response.

*The **failure-response** of a person encompasses her emotional and behavioural reactions to real or imagined failures.*

The interest in failures is fuelled by their presumed relevance for creative outcomes. Do failures advance or hinder creative work? Thus, we also need to clarify the notion of creative progress and suggest saying…

***Creative progress** means to move from status quo understandings to new understandings that allow for greater creative achievements.*

Here, understandings include problem views, ideas, assumed constraints etcetera. Creative potential refers to the degree of novelty and usefulness that can be achieved by project outcomes (cf. Corazza, 2016b).

Finally, we shall try to clarify the relation of failures to creativity blocks, which both disrupt creative work.

***Creativity blocks** are factors that antagonize creative activity.*

The notion of creativity blocks has a long tradition of investigation (Arnold, 1959/2016; Adams, 1974; von Thienen et al., 2017). Notably, neither blocks nor failures are treated as devastating in the literature. Blocks can be overcome; failures are opportunities to learn. However, there is an emotional difference in how the community addresses the concepts. Failures are discussed in a more favourable tone; they are expected to have a genuinely productive kernel and should enter the process as a resource. By contrast, blocks are factors that abate the agent's resources. There may be a social environment that simply opposes to everything new. The perceptual system of the creative agent may be strongly affected by stereotypes and (s)he has difficulties seeing the problem afresh. In the same vein, unfavourable failure-responses are treated as a severe creativity block. "The fear of making a mistake is a very devastating emotional block to creative activity" (Arnold, 1959/2016, p. 87). People can be so afraid of making a mistake that they rather give up a creative project or settle with less valuable outcomes than seeing a bold suggestion tank.

5. Hypotheses and Attempted Explanations

With thus clarified terms, a number of design thinking beliefs can now be stated more clearly. We shall also attempt to explain them in a theoretically coherent way, building on design thinking, a model of knowledge development as adapted from the *Dynamic Creativity Framework* and by very briefly considering empirical evidence.

H1: Failing prototypes bare a significant potential for creative progress.

To substantiate this claim, we submit that *overcoming failures means to advance key domain knowledge.* Failing prototypes indicate that something in the domain of interest is badly understood and examining failed tests can help to pinpoint insufficient ideas.

As Corazza (2016a) contends, in creative work people likely start off with a standard, non-unique understanding of the subject. The *Dynamic Creativity Framework* (Corazza, 2016a; Corazza et al., 2016) describes this by stating that creative projects start from the *Common Knowledge Domain*, which covers already available views and solutions in the domain of interest. Obviously, people need to move beyond the *Common Knowledge Domain* to achieve a new, creative outcome. Failures indicate that status quo beliefs are deficient in at least one respect. Identifying reasons for failure means to pinpoint deficient views. At the same time, a direction where to explore alternative possibilities crystallizes (see fig. 1).

Moreover, the degree of failure seems to correspond to the creative potential, which a team can add to their project upon utilizing failure observations. The more radical a failure, the more it renders standard beliefs in the *Common Knowledge Domain* questionable. Subsequently, the team can replace old beliefs that now appear dubious with a sensible alternative view. The more ideas they attempt to replace, the more revolutionary are the changes they propose.

In terms of empirical evidence, Wertheimer (1945) has analysed a great variety of empirical studies on creative problem solving and found that re-framing problems is often key to achieve breakthrough solutions. Thus, when a team is ready to use failures as a vehicle to move from bad problem views to better ones, failures should entail a great potential for creative progress.

H2: Failing prototypes bare a greater potential for creative progress than mini-failures.

H3: Mini-failing prototypes bare a greater potential for creative progress than no failures.

Creative progress has been described above as a movement from status quo understandings to new understandings that allow for greater creative achieve-

ments. Mini-failures validate an already existing belief that no viable solution has been found yet. Thus, understandings don't change much, though detail knowledge may be added as to how exactly a prototype fails. By contrast, type 1 or 2 failures that come as a surprise call key domain beliefs into question. Corresponding changes in the *Common Knowledge Domain* may revolutionize the field, both in terms of knowledge and solutions.

Similarly, mini-failures appear to have a greater potential for creative progress than no failures. In an experimental study, Dow and Klemmer (2011) compared the performance of students in an egg-drop test. All participants should build vessels to protect a raw egg from crushing when dropped from increasing heights. In the experimental condition, students should test their vessel prototypes at minutes 5, 10, 15 and 25. In the control condition, only a final test at minute 25 was scheduled. In follow-up interviews, several participants from the experimental condition reported that they felt uncomfortable "having to iterate too early and too frequently" (p. 125). These students likely experienced mini-failures, such as expecting their prototype at minute five to be premature and then, indeed, in the test it probably would not perform too well. However, in the end the average drop height that eggs survived was twice as high in the experimental condition compared to the control condition. It seems that mini-failures were more helpful than no failures along the way.

Finally, a claim shall be discussed that figures prominently in design thinking education.

H4: Failure-response is a key outcome determinant in creative projects.

For this claim, Berns (2010) provides considerable evidence as he investigates the neuroscientific basis that underlies fear of failure. "Like the fear of uncertainty and the fear of public ridicule, the fear of failure wends its way through the brain, distorting perception and inhibiting action" (p. 119). A reduction of risk tolerance and impeded decision making abilities are also pitfalls Berns (2010) relates to fear of failure.

In design thinking education it is considered helpful to actively face failures; shying away is considered detrimental. To prepare further studies on this issue, we might invoke the metaphor of driving. Failures have a power to drive you: They can cause dismay; they can cause a lowering of ambitions or even lead to the abandonment of a project. In that case, failures evoke creativity blocks in the process. Or you can be the driver and use failures to make progress. When teams schedule prototype tests that embrace the possibility of failure and when they actively examine failed tests to understand reasons and improve their domain understanding, teams presumably display favourable ways of failure-handling. In that case, failures are used as a resource.

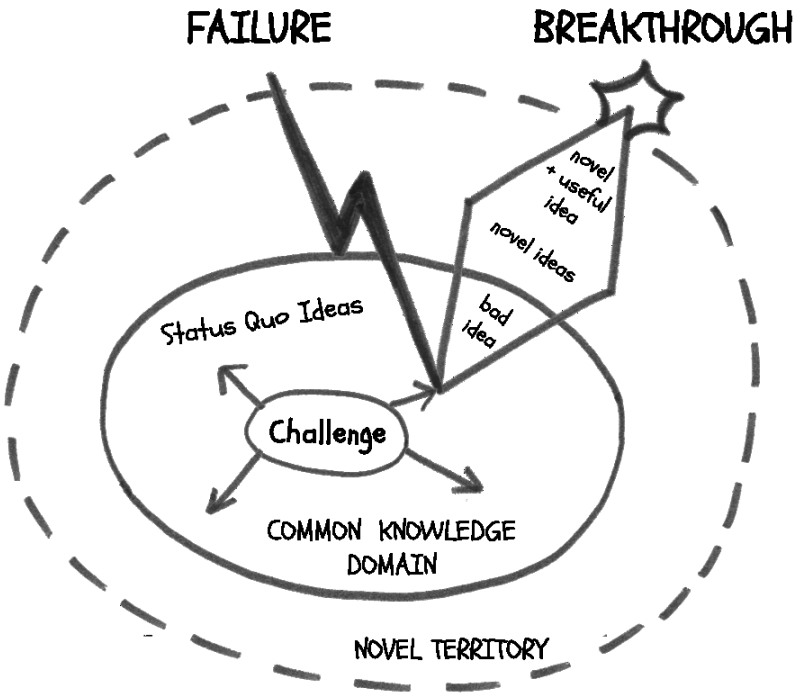

Fig. 1: A failure can be turned into a breakthrough when it is used to identify bad ideas, or questionable beliefs, in the *Common Knowledge Domain*. Then, a divergent search for novel ideas can follow, until the process converges on a novel and useful solution (figure adapted from Corazza, 2016a).

As Kelley and Kelley (2013) contend, "fear of failure […] is the single biggest obstacle people face to creative success" (p. 40). This seems to suggest that education should try to increase the meta-cognitive control of students to help them regulate their fear of failure. Thus trained, it should become easier for students to use failures as a resource in the process to, eventually, achieve greater creative success.

6. CONCLUSIONS

In the design thinking community, failures are prized as highly valuable resources: If only embraced and analyzed with an open mind, failures are expected to aid learning, ultimately in the service of even greater creative achievements. However, failures are painful and therefore hard to face. We have tried to clarify the role and potential of failure by reconstructing the concept in the *Dynamic Creativity Framework*. Here, failures appear as inconclusive outcomes that indicate revisable beliefs in the domain of interest. A search for novel and more useful ideas may then follow, leading to thorough changes in problem and solution space, allowing for revolutionary shifts both in terms of knowledge and practical applications. While this view seems in line with early empirical evidence, next steps need to follow. In particular, methodological tools could be developed to support failure-based learning and applications of Failure Theory may be tried in practice.

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