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Abstract
This study scrutinizes the paradoxical role of uncertainty for processes of creative collaboration by not only seeing uncertainty as a liability but also as an asset for the creation of novelty. We therefore explore the productive aspects of uncertainty in creative collaboration and scrutinize practices that allow participants not only to lessen uncertainty but also to fruitfully harness it as a resource of creativity. Instead of conceptualizing uncertainty as static or solely of quantitative matter, we apply a qualitative heuristic by differentiating between dimensions of uncertainty regarding participation (who?), procedure (how?), content (what?) and time/space (when?/where?). Based on creative biographies in both arts and sciences encompassing 36 semi-structured qualitative interviews, we identify *embracing*, *ignoring* and *fixing* uncertainty as three distinct, yet interrelated practices. The conjunction of these practices enables participants not only to tolerate uncertainty related to creativity but to harness it and thereby turn uncertainty into an asset for creativity. We further discovered that *shifting* of uncertainty is closely connected to the identified practices of embracing, fixing and ignoring. Shifting uncertainty occurs in situations in which embracing uncertainty is no longer productive and new aspects of uncertainty emerge, previously ignored aspects reemerge or previously fixed aspects are opened up again.

Keywords
Creativity, Innovation, Uncertainty, Collaboration, Pharma, Music

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Introduction

Creative collaboration is ripe with uncertainty. Critical aspects, like the possible outcome, required expertise, the exact procedures or relevant places cannot be known in advance. While some of these factors might be resolved at some point, new sources of uncertainty frequently emerge and former certainties dissolve as actors gain new perspectives during the process. In this paper we seek to make a theoretical contribution on the role of uncertainty in creative collaboration. We do not only see uncertainty as an unavoidable liability that participants have to deal with. Rather, we highlight that uncertainty can be an asset for creativity. In creative collaboration, it is thus not only necessary to find ways of reducing, tolerating, denying, and suspending uncertainty (Möllering & Müller-Seitz, 2018), it also becomes necessary to find practices of inducing or fostering uncertainty.

The ambivalent nature of uncertainty in processes of creative collaboration is not an entirely new topic in the literature on organized creativity. For instance, as Chen argues, creative collaboration needs to balance between under- and over-organizing (Chen, 2012). Others express a similar tension between mitigating and stimulating uncertainty (Brattström, Löfsten, & Richtnér, 2012) or highlight the dialectics of setting constraints while purposefully leaving space for deviation (Ortmann & Sydow, 2017; Rosso, 2014). It is the aim of this paper to further

scrutinize this dualistic nature of uncertainty by highlighting collaborative practices that allow the mobilization, taming and utilization of uncertainty during creative processes.

Uncertainty is extremely difficult to make operational for an empirical analysis. One way of dealing with this difficulty is simply to treat uncertainty primarily as a matter of degree – there can either be high or low levels of uncertainty (e.g. Banerjee & Siebert, 2017). While we do not deny the general idea that the degree of uncertainty can be lower or higher, we argue that this conceptualization is misleading when applied to the analysis of creative processes. It entails a rather static conceptualization of uncertainty that ignores the possibility that uncertainty might also shift in terms of quality throughout the process. In this paper we argue that instead of focusing on the amount of uncertainty prevailing in particular situations, it is more fruitful to focus on different qualities of uncertainty by asking "why particular contexts are uncertain" (Packard, Clark, & Klein, 2017). We therefore propose a multi-faceted conceptualization of uncertainty that encompasses ignorance (= lack of knowledge; Roberts, 2012) and ambiguity (= coexistence of competing interpretations; Weick, 1995) as fundamentally different sources of indeterminacy.

The few existing empirical studies on the temporal dynamics of uncertainty during creative processes seem to suggest a high degree of uncertainty at the beginning of the process, which gradually decreases towards the end of the process (Banerjee & Siebert, 2017). This idea, however, is difficult to bring in line with influential contributions highlighting "incompleteness" (Garud, Jain, & Tuertscher, 2008) as a main feature of creativity that (re-)occurs frequently during creative processes. In order to sustain creativity as a process, it is necessary to engage in an ongoing process of frequently creating new lose ends and discovering new problems. In this paper, we therefore propose that uncertainty persists throughout the whole process but dynamically changes in composition. In order to empirically assess these shifting qualities of uncertainty, we distinguish between *different dimensions* of uncertainty in creative collaboration such as uncertainty about participation (who?), content (what?), time/space (where? when?), and procedure (how?) and explore, which of these facets predominates at what stage of the process.

Our analysis is based on qualitative data across eight "creative biographies", four of music production and four of pharmaceutical development, in which we reconstruct creative processes from idea generation to the creation of a tangible output (recorded albums in music and patents in pharma). After reviewing the literature on uncertainty in relation to creative collaboration in section 2, section 3 describes our research design and methods. In the empirical analysis (section 4) we identify *embracing*, *ignoring* and *fixing* uncertainty as three distinct, yet interrelated practices that enable participants to utilize uncertainty as an asset for creativity. In section 5 we widen the scope from single constellations of practices to the sequential chain of shifts between different constellations of dealing with uncertainty. Repeated shifts between embracing different focal dimensions of uncertainty, we argue, support a cumulative and extended creative process.

Uncertainty and Creativity

The notion of uncertainty has a long and prominent career in economic and organizational theory (Dequech, 2011; Jalonen, 2011). It was introduced into economics while advancing a theory of the firm by Frank Knight (1921) and later built upon by Ronald Coase (1937) and Oliver E. Williamson (1975). Still, the concept of uncertainty is itself highly uncertain (Galbraith, 1997). In general words, "uncertainty means that we cannot predict or foresee what will happen when acting or not acting" (Aspers, 2018: 133). From this general understanding, it becomes possible to sub-divide uncertainty into different types, like weak and strong,

substantive and procedural, *ego*-centric and *alter*-centric, or creative and environmental uncertainty (Dequech, 2011; Packard et al., 2017; Podolny, 2001). These diverse taxonomies give a first impression on the multi-facetted nature of uncertainty suggesting that uncertainty should be assessed in qualitative terms.

Uncertainty occurs in many situations of economic life (Williamson, 1975). Only very recently uncertainty was considered as a crucial factor in the analysis of creative processes (Chen, 2012). With respect to innovation processes, it is argued, uncertainty is high at the outset and gradually diminishes throughout the process (Banerjee & Siebert, 2017). Yet it remains out of scope that uncertainty might also change in terms of quality and composition. In this paper we argue that instead of focusing on the amount of uncertainty prevailing in particular situations, it is more fruitful to focus on the dynamic and qualitative changes of uncertainty throughout the entire process by asking "*why particular contexts are uncertain*" (Packard et al., 2017).

Situating uncertainty: risk, ignorance and ambiguity

According to Knight the concept of uncertainty rests on the assumption that most of the time economic actors have to act under conditions of "partial knowledge" (1921, p. 199). Economic life is embedded into a world that is in constant change and inherently complex. Hence, in most situations, economic actors know something about the future and have some ideas about the consequences of possible actions, but they are far from comprehensive understanding. In other words, they act somewhere in between complete ignorance and perfect information. This is particularly true in cases in which these actors strive towards novelty (Brinks, Ibert, Müller, & Schmidt, 2018).

Against this background, Knight distinguishes between two fundamentally different forms of indeterminacy, measurable and unmeasurable ones. The former, according to Knight, is not uncertainty at all. Rather, he prefers to use the term "risk" to denote measurable indeterminacy. The term "uncertainty", in contrast, should be restricted to cases of the non-quantitative type (Knight, 1921, p. 20): "*It will appear that a measurable uncertainty, or 'risk' proper, as we shall use the term, is so far different from an unmeasurable one that it is not in effect an uncertainty at all.*" Dequech (2011) takes up these ideas by distinguishing between weak and strong uncertainty. In the case of weak uncertainty "*an agent can form – or act as if she formed – a unique, additive and fully reliable probability distribution*" (Dequech, 2011, p. 62). Strong uncertainty, in contrast, is characterized by the impossibility of conducting a probability distribution. In this paper we follow Knight and define uncertainty as distinct from risk.

A second important differentiation when discussing uncertainty focuses on different sources of uncertainty. It can rest upon either *ignorance* or *ambiguity*. Uncertainty based on *ignorance* can be defined as a "*lack of […] information which would be necessary to make decisions with certain outcomes*" (Dosi & Egidi, 1991, p. 145). Uncertainty based on *ambiguity*, in contrast, is not primarily about a lack of knowledge or missing information. Rather, it applies to situations in which "*multiple ... explanations are plausible*" (Weick, 1995, p. 134). Hence, participants might know a lot, yet are confronted with "*an ongoing stream that supports several different meanings at the same time*" (ibid, p. 91). Similarly, Kuhn points out that ambiguity denotes "*a state capable of being interpreted in multiple distinct ways*" (Kuhn, 1997, p. 56).

Uncertainty from *ignorance* can be resolved through the acquisition of new knowledge and information. A state of ignorance invites for exploration and further scrutiny and can be resolved through learning (Brinks, Ibert, Müller, & Schmidt, 2018). However, ignorance is neither a static nor an absolute measure (Roberts, 2012; Gross, 2010) and it has to be specified before it

can be tackled (Merton, 1987). Hence through learning participants acquire new knowledge to resolve a formerly specified ignorance. At the same time new knowledge enables them to shift their perspectives, ask new questions and raise new problems. Even though we might think of learning as an expansion of individual and collective knowledge, it cannot reduce the absolute amount of the unknown but only shift the boundary separating the unlimited spheres of the known and the unknown (Roberts, 2012). This suggests that uncertainty in creative processes cannot be reduced in a quantitative way. However, it is possible to reduce single aspects of uncertainty and to shift perceptions of uncertainty by gaining new perspectives.

In the case of uncertainty from *ambiguity*, "*the problem […] is not that the real world is imperfectly understood and that more information will remedy that. The problem is that information may not resolve misunderstandings*" (Weick, 1995, p. 92). Ambiguity most likely will persists even though participants gather more information and expand their knowledge. If learning cannot remedy ambiguity, it must be approached in other ways, like negotiation or compromise (Drazin, Glynn, & Kazanjian, 1999; Lingo & O'Mahony, 2010).

Creativity as a social process of collaboration

Today, creativity is no longer conceptualized as an ability attributed to individual geniuses, but as socially embedded in teams, organizations, or contexts like communities, networks and fields (Sawyer & DeZutter, 2009). This 'collaborative turn' has been depicted as a culturally dominant form of organization of work in late modernity (Reckwitz, 2016) as exemplified in musical improvisation in jazz ensembles (e.g. Figueroa-Dreher, 2016) or brainstorming in advertising project work (Krämer, 2014). Breakthroughs result typically from complex collaboration (Hargadon, 2003), sometimes related to covert collaboration (Sawyer, 2007) or embeddedness in social contexts (Csikszentmihalyi, 1996). The collaborative nature of new creative products becomes obvious, for example, in closing credits of movies or video games (Becker, 1982, p. 8). As a result, Amabile´s (1988) almost omnipresent definition of creativity as "*the production of novel and valuable ideas*" is not limited to individual effort. Rather on the contrary, it is most typically achieved by social collaboration within diverse teams, groups, (inter-)organizational networks, or communities of practice (Dougherty & Dunne, 2011; Drazin et al., 1999; Page, 2008).

Moreover, creativity research has also moved beyond variance-based perspectives that see creativity as the outcome of structural variables like individual, group and organizational characteristics (Woodman, Sawyer, & Griffin, 1993). Instead, creativity is now considered as complex social processes unfolding over time, including both structure and agency (e.g. Elsbach & Hargadon, 2006; Fortwengel, Schüßler, & Sydow, 2017). By shifting perspectives from static conditions towards dynamic social processes, the negotiations, conflicts, tensions, mechanisms and also failures of creative production come into focus, thereby opening up the 'fuzzy front end' of innovation. Finally, a process-oriented perspective also seems more adequate to analyze uncertainty in the sense of shifting states of ignorance (Brinks, Ibert, Müller, & Schmidt, 2018) and the ways ambiguity is negotiated in different levels of creative collaboration (Drazin et al., 1999; Sundgren, Selart, Ingelgard, & Bengtson, 2005).

Creative collaboration and uncertainty

Organizational studies often refer to uncertainty as a threat to economic and entrepreneurial endeavors that has to be reduced or coped with (Möllering & Müller-Seitz, 2018; Williamson, 1991). So far, findings on the relationship between the seemingly opposing aspects of control

and indeterminacy in organizational creativity are disparate and puzzling. Both aspects are theorized as either beneficial to or as harmful for organizational creativity (Shalley & Gilson, 2017; Styhre & Sundgren, 2011; Sundgren & Styhre, 2003). For example, demand uncertainty can result in fewer creative paths (Tschmuck, 2012) and creativity itself can lead to uncertainty about consequences regarding social acceptance, market development, or reactions of regulatory institutions (Jalonen, 2011). By contrast, other studies acknowledge uncertainty as an important prerequisite for the production of novelty and describe practices of inducing indeterminacy (Hutter & Farías, 2017). Successful creative collaboration might benefit from purposefully releasing constraints or might even be stimulated by purposefully enhancing uncertainty (Brattström et al., 2012). This latter group of contributions point at the possibility that uncertainty is not only a liability but also an asset. Accordingly, participants in creative collaboration might not only be forced to tolerate or reduce uncertainty but also might be tempted to enhance or unleash uncertainty in order to benefit from its productive aspects.

Curvilinear approaches to identify hypothetical "sweet spots" that provide the "right amount" of uncertainty (Baer & Oldham, 2006) point in a similar direction, as they acknowledge the possibility that enhanced uncertainty might have a positive impact on creativity. However, these approaches have to operate on only one predefined plane to assess the amount of uncertainty. They can neither deal adequately with different qualities inherent to uncertainty (ignorance and ambiguity), nor take into consideration the interaction and dynamic change between different dimensions of uncertainty. In our view, it is only possible to disentangle the enigmatic contradictions sketched above by taking seriously the ambivalent nature of different uncertainty dimensions and by scrutinizing the complex interactions between them: what practices are used to utilize uncertainty in creative processes? How do these practices of utilizing uncertainties influence the creative process itself?

Methods

We approached the analysis of these questions with a process as practice view (Fortwengel et al., 2017) using a multi-case study design (Yin, 2014). We selected cases according to the principles of theoretical sampling (Eisenhardt, 1989). Two theoretically important selection criteria were applied.

First, we analyze eight case studies, four respectively representing the spheres of arts and sciences. The music industry was examined as an exemplary case of creativity in the field of arts, while the pharmaceutical industry served as a data basis for the field of science. Arts and sciences represent core societal fields in which collaboration towards creative outputs needs to be organized. Both fields also are prone to far reaching uncertainties and thus offer promising entry points to study the interrelationship between creativity and uncertainty. Yet, both fields represent rather distinct settings for creativity. As with most arts, novelty in the music industry is primarily valued for aesthetic reasons (Reckwitz, 2016). The industry is permanently under pressure to present "fresh" sounds, melodies or experiences. However, new music does not necessarily need be radically novel. Rather, it often variegates existing elements and playfully engages with the audience's expectations and listening habits (Hutter, 2010). Pharmaceutical development, in contrast follows a rather rationalistic approach to novelty. Here, new solutions have to prove a clear added value in comparison to earlier achievements. This has given rise to an innovation dilemma, as in many areas of application existing pharmaceuticals are not easy to outperform. The proverbial challenge is to try to be "better than the Beatles". During the last decades the ratio between r&d output and input has decreased and breakthroughs are hardly achievable.

Second, we control for differences in practices of dealing with uncertainty that reside in the organizational context. For instance, big corporations might differ from small firms in terms of dealing with uncertainty. Similarly, informally collaborating networks might have a different approach than contractually formalized consortia. Therefore, we picked cases that are embedded in different settings of governance. We applied a differentiation introduced by Hagel, Brown, and Davison (2010) between push- & pull-regimes of creative collaboration to make sure that our sample encompasses systematically different organizational settings of collaboration and that the selected cases from music and pharma resemble each other in terms of predominant governance modes. According to Hagel et al. (2010), push-based organizations are found among large corporations defined by hierarchical top-down decision making, mass production and economies of scale. Actors in push-regimes collaborate to concentrate resources in the search for novel products according to predefined rules and evaluative logics and supported by explicit incentives. In a pull-regime, by contrast, actors collaborate to solve emergent problems that confront them in their daily practice, leading to *ad hoc* creation of new rules or evaluative logics. Pull denotes creativity in which collaboration is driven by intrinsic motivation as well as enthusiasm and refers to mobilizing resources that are distributed widely across different actors. Creative production in pull-regimes is strongly embedded in network and community contexts and thereby makes use of loosely coupled networks as well as diverse backgrounds, knowledge and intrinsic motivation of actors.

We identified recorded music albums and patents as cases representing materializations of a creative ideas and its collaborative realization that are comparable across the selected domains. Inspired by the innovation biography approach (Butzin & Widmaier, 2015), we conducted "creative biographies", *ex post* reconstructions of a novel idea that eventually culminate in the completion of a tangible outcome (in our case either a recorded music album or a pharmaceutical patent). We focused our analysis on albums and patents that have received acknowledgements from field representatives, e.g. by receiving creativity awards, being lauded by critics or recommended by field experts. Once we got access to a creative biography, we obtained first-hand information on the creative collaboration from participants in semi-structured interviews. We asked respondents to specify the novelty and usefulness of the album or patent. We asked about phases or stages that structured the creative process, and mapped all collaborations, involved places, perceived uncertainties and handling of these uncertainties.

As not all interviewees took part in every single step of the collaborative production: Initially, central actors of different production phases had to be identified and interviewed. Subsequently, we extended data collection to additional participants, e.g. label owners, producers, biologists, chemists. By comparing several subjective accounts on the process, we generated an intersubjective idea about the course of events. In addition, secondary material (e.g. reports, publications, online content) related to the creative processes, was collected during fieldwork and used to complement interview data. Where applicable we verified information by comparing between interviews or by contrasting interview data with secondary data. Contradictory or divergent accounts required interpretation. In sum, our study encompasses 36 qualitative interviews (19 in music, 17 in pharma) with three to five interviews per case.

All interviews were audio recorded and subsequently transcribed verbatim. Due to the sensitivity of the provided information, we anonymized all references to firms, organizations and participants. For publication purposes, we use aliases.

Table 1. Overview cases

		Push Regime (predominately market and hierarchy governance)		Pull Regime (predominately network and community governance)	
		Strong push	Weak push	Weak pull	Strong pull
Music	Case Name	*PaganRock*	*HabibiRap*	*LeftfieldPop*	*SoulRock*
	Interviews	five	five	five	four
	Label	"Major"-label	"Major"-label	"Independent"-label	Unsigned
	Description	Top 20 folk band that established their own subgenre	Top 20 hip hop artist that established a new linguistic style	Renowned electronic synth-pop artist with genre-spanning approach	Renowned soul & funk artist that started a solo career
Pharmaceutics	Case Name	*BigIndi*	*NatureComp*	*HeartComp*	*CancerStop*
	Interviews	four	five	three	five
	Development at	Pharmaceutical „Giant"	Medium-sized Company Start-Up Public Research	Start-Up Joint Venture Public Research	Public research
	Description	First compound to successfully target a specific lunge disease	Replica of natural substance for targeting heart disease	Compound to help without invasive procedure	Compound to inhibit metastisation of tumors

Source: own data

Data was analyzed using the qualitative content analysis (Mayring, 2015). In line with this approach, dimensions of uncertainty were used as tentative theoretical concepts providing indicators and categories for data analysis. First, all collaborations of actors in the album production or patent application were identified and extracted from interview transcripts. Then, these passages were explicated and structured in order to assign them to particular dimensions of uncertainty.

The dimensions of uncertainty were not assessed by quantity or variance. As an alternative, we employed a heuristic understanding of uncertainty to explore what aspects of a process are (perceived as) uncertain and how such a perception changes dynamically. Long Lingo and O'Mahony (2010) differentiate between aspects of content ('what'), process ('how') and actors ('who'). We suggest adding the aspects of time-space ('where' and 'when') that so far have not been discussed in the literature but complement the existing dimensions (see table 2.).

In creative processes, the outcome or general goal is notoriously underspecified (Austin et al., 2012), meaning it is uncertain *what the content* of the collaboration is or might be. We denote this dimension of uncertainty *content-uncertainty*. Furthermore, the set of participants most likely will change during the process (Vaan, Vedres, & Stark, 2015). While some contributors are known at the outset, it is uncertain *who else will participate* during further development. We denote this dimension *participation-uncertainty*. Other times, participants might be able to specify desired intermediary results, but are uncertain about *how to proceed* to achieve them. We call this dimension *procedural-uncertainty*. Finally, creative processes are often mobile and encompass activities at multiple locations (Ibert & Müller, 2015), making it uncertain *where and when collaboration takes place*. These contingencies related to uncertain locations are defined here as *time-spatial-uncertainty*.

Table 2. Dimensions of uncertainty

Dimension of uncertainty	Content	Participation	Procedure	Time-space
Examples	What do we want to make? What will be the result? What is our goal?	Who can do this for us? Who is an expert in this field?	How can this be accomplished? How do we want to make it?	Where could we do that? When should we start?
Subject	Outcomes and goals	Partners and relationships	Procedures and methods	Locations and timetables

Source: own data

These conceptual dimensions of uncertainty, in line with the approach of starting with tentative theoretical concepts in qualitative content analysis, were carved out before analysis but also had to be modified to consistently include the identified practices regarding uncertainty. Furthermore, patterns of collaborative practices were extracted and linked to uncertainties involved in the creative processes. This iterative process not only included summarizing, explicating and structuring but also visualizing data by mapping practices onto the timeline of the creative process and by reconstructing and abstracting development phases from the order of events.

Embracing Uncertainty in Creative Collaboration through Ignoring and Fixing

In all our case studies, uncertainty emerged as an asset for creativity if it was actively embraced by participants. More specifically, we identified three collaborative practices of *embracing*, *fixing*, and *ignoring* uncertainty. These practices shape the trajectory of the creative process and foster creative outcome in the music as well as in the pharmaceutical industry. Interestingly, we observe that embracing uncertainty with regard to one dimension is supported by complementary practices where actors act with confidence in regard to other dimensions of uncertainty – either by ignoring or fixing them.

Embracing uncertainty

The practice that creative collaborators applied to utilize uncertainty was *embracing uncertainty.* Embracing means that actors adopted an attitude of openness to surprise and unpredictability. They actively delved into the unknown by being playful, explorative, and purposefully engaging in ventures with indeterminate outcome. This is accomplished by venturing into underexplored fields, appreciating unspecific questions and be taking serious unexpected results. It encompasses awareness and acceptance of possible failure, and a general tendency to observing and reacting, rather than planning. By embracing uncertainty, groups of collaborators can discover novel and valuable ideas outside their *cone of expectation* (Austin, Devin, & Sullivan, 2012).

In the music industry, this practice is essential during the phase of collaborative songwriting in all four observed cases. The interviewed participants depict a process of sonic experimentation when working together with other musicians. That means that they actively embrace uncertainty on the dimensions of content (what is the outcome?) and procedure (how will we get there?) in

order to open up the possibility of collaborative creativity. One of the participating musicians of *LeftfieldPop* explains:

> *I guess with this kind of collaboration it feels to me, that being creative or having creativity […] when you're doing a collaboration, you need to be open minded, like you need to embrace what the other person is offering. [musician 2, LeftfieldPop]*

In this example, a musician that usually worked as a solo artist had the idea to make a dedicated collaboration-only album with musicians she had never worked with before, because she aimed at unforeseeable synergies when working with musicians from different backgrounds, various genres and diverse approaches to music production:

> *"Because you meet so many people and musicians […] well, musicians who I like and […] whose music I value and where I say 'Wow, I want to go to the studio with you and just see what happens'. I'm curious about this particular creative process. What is going to happen, when we do that together?" [musician 1, LeftfieldPop]*

Her conceptual approach was to deliberately make no specification about particular content in order to widen the room for indeterminacy. Moreover, this case also illustrates well how where-uncertainty can be embraced. Not only did the musician collaborate with peers she has never collaborated with before, she also travelled to the diverse studios of the respective colleagues. By doing so, she exposed herself to the local idiosyncrasies and technical peculiarities of the unknown studio contexts.

> *„For the most part I actually went to the other persons' studio, because of course I found it exciting, just for myself. I wanted to have a look how they work, in what kind of environment, what instruments they have.. […] And with [collaborating artist] it was like, she had this fantastic piano at her place (1), that was extremely dampened. Something must have been broken. And I sat down at the piano and thought ‚This is fantastic'. And then I just tinkled something and bingo we had an intro." [musician 1, LeftfieldPop]*

In the other music cases prior conceptual decisions were clearer confined by genre constraints and ideas about sonic aesthetics and directions, but nevertheless uncertain regarding procedure and outcome. A beat producer illustrates:

> *"We knew that we wouldn't make house-beats or something like that. It was clear that 'Hey, we are gonna make a rude record, one that's loud and smashing', you know? That was kind of a frame. […] And of course, you are inspired by various things, for sure. […] But this was not an album with a plan or a concept-album or something. We kind of just did it. And I think that is a bit of the key to this record. That we just did it without thinking about it too much and just doing what we want to do, you know?" [beat producer, HabibiRap]*

Another example of embracing uncertainty occurred in *PaganRock*: Two representatives of a record label identified a market niche in mainstream popular music for authentic medieval folk music drawing inspiration from fantasy blockbusters like 'Lord of the Rings' and 'Game of Thrones'. Both expected great business opportunity by launching a first-of-this-kind-band. While in this case there was little initial uncertainty concerning content, they framed this opportunity as an uncertainty with respect to participation: Who would be this envisaged medieval folk band that does not yet exist? By embracing this participation-uncertainty, the two producers started to explore an existing scene of medieval music but also took into consideration the possibility to cast a band of musicians from scratch. Like in the other accounts, embracing uncertainty carried them towards a particular solution. In this case, who-uncertainty was turned into an asset for creativity. The process to acquire new knowledge enabled the participants to move forward into unexplored terrain and to find a solution that was unknown and unattainable to them in advance.

Embracing uncertainty is an essential part of creative collaboration in pharmaceutical development as well. In order to develop novel and valuable compounds scientist cannot just work within the known area of pharmacogenetics. They need to delve into uncertain aspects and relations in adjacent fields like biology, chemistry, and medicine to find something novel of value. Embracing uncertainty is not about asking specific and clear yes-or-no questions (e.g.: Does X do Y? Can person Z do that?), but open-ended questions with unknown and potentially several possible answers (e.g.: Why is X? Who can do that for us?). It is not about confirming or falsifying hypothesis, but about establishing novel ones:

> *„If you talk about exciting, creative research, it happens constantly, that you find something, you did not think of before, because otherwise you do boring research. If you have an experiment in principle, which is certain in such a way, that you know the results already, it has no real creativity, no big innovation, no big risks." [Scientist 1, NatureComp]*

While the result of this process cannot be planned in advance the behavior necessary for embracing uncertainty can be influenced intentionally. For instance, participants assume a disposition to observe unexpected results mindfully and to integrate expertise from outside of their domain openly:

> *„And that is a normal scientific process. That is just how it is, that you cannot plan it like that. What you can actually plan, is the careful observation. To take a thorough look" [Scientist 1, NatureComp].*

In all four pharmaceutical cases development started with scientists embracing uncertainty. As an example, in *NatureComp* a biochemist and group leader working in a public research facility started asking very general questions about the beneficial properties of a certain natural substance. At that point, there were scientific assumptions that the substance has positive impact on human health. Yet, it was unknown why that might be the case. The biochemist and his group embraced this content-uncertainty and approached the substance broadly, without any specific notion of future use or dosage form. As he explains:

> *„Well, beforehand it was absolutely unclear, whether … that is a sustainable idea, right? So the initial idea was not: we want to develop a compound for [indication] for humans, like it is now. Instead, initially there was purely a question: Can we find any reason, why this [substance] has exceptionally good properties?" [Scientist, NatureComp]*

However, while embracing this content-uncertainty, scientific problems arose that were outside the expertise of the involved participants. This happened twice in *NatureComp*, as the then predominant view of biochemists was insufficient to tackle arising challenges in the fields of chemical synthetization as well as pharmacological testing. Thereupon, uncertainty regarding participation emerged and was subsequently embraced. The biochemist put his open questions up for debate on conferences and other scientific meet-ups, without any specific idea on who might help. Eventually, he was approached by a chemist working for another university abroad during an international conference, who made suggestions on how to proceed with the development process. Furthermore, another acquaintance of the biochemist working at his research institute started to contribute to the problem of pharmacological testing. Both of these scientists were enrolled into the group of collaborators, first informally and later more formally. At this point, the collaborating scientists did not yet have a clear notion of therapy in mind, but developed their understanding along the way. By embracing this newly emerging content-related uncertainty, they gained a new perspective on their open question. That way, the biochemist not only found suitable collaborators, but also identified a compound with potentially potent therapeutic characteristics for heart disease.

By embracing uncertainty the chance of failure increases. Embracing uncertainty in pharmaceutical development always includes acceptance of failure, since success cannot be planed. Therefore, not all collaborators agree on the way uncertainty is dealt with. For example, in *BigIndi* management was strongly opposed to embrace content-uncertainty, eventually canceling the project at one point altogether. The only reason the project could further be pursued, was that the laboratory head responsible for the project decided to advance the idea by contacting his peers and discussing his findings with dedicated external experts without asking his superiors for permission to talk openly about topics that are regarded as key assets of the firm.

Fixing uncertainty

The second practice that we found among actors in creative collaborations was *fixing uncertainty*. Fixing uncertainty occurs in situations in which participants are confronted with several alternatives of similar value and viability. The absence of clear priorities give rise to endless negotiations with no clear progress and the process is in danger of being blocked. We understand fixing as assigning a particular result to an uncertain dimension so that attention can rest on another uncertain aspect. The assigned "fix" reaches from a provisional or temporary scaffold that is returned to later and addressed by actors again (hot fix), to ultimate and long lasting decisions. Every fix, however provisional, has implications for subsequent steps in the process as it blocks exploration in a particular direction. More importantly, fixes enable participants to focus effort and attention on other dimensions of uncertainty. Fixes are thus preconditions for sustained and cumulative investments in particular directions. As such, a fix also entails issues of sunk costs and path dependency. The longer provisional fixes persist, the more costly it becomes to question them later on.

A 'hot fix' of an uncertainty occurred for example in music case *SoulRock* when the band was in the process of collaborative songwriting. Here, by playing around and experimenting actors were suddenly confronted with the emergence of different but equally valued alternatives of musical patterns. In this situation, in which equivalent alternatives raised the uncertainty about 'what' to play and 'how' to play it, it was the bandleader who made the decision and thereby fixed the uncertainty and thus made it possible to continue working on other parts and songs. The band leader explains:

> *„And then all of a sudden, you have three alternatives of something or the question ‚How are gonna do the transition from the bridge to the refrain? Are we gonna stop on the four or are we gonna do it with a keyboard sweep or with a drum break?' And all of a sudden you have four alternatives and three people in the room say ‚I like all of them'. Then it's important to have someone say ‚Alright, we are gonna do alternative two'. Because why would you spend more time dealing with it? You can still change it three weeks later." [musician 2, SoulRock]*

The practice of fixing uncertainty is not only important for overcoming situations of blockage. In all four music cases, it also marks the starting point of the creative process. In the initial phase, participants make a number of rather conceptual decisions about what the music album is about. These decisions do not yet determine specific outcomes, but rather serve as a general orientation towards music genres, discourses, stylistic elements or lyrical topics. However, fixing such conceptual frames allows participants to continue with embracing content-uncertainty.

> *„Within the field of medieval music we invented our own genre, which is called ‚pagan-folk'. That means we began integrating topics like spirituality, nature, religion and mythology into the medieval scene… So we really shaped our own thing in this sector of medieval German music. […] That started with being in search for another world and*

> *ended with death and reincarnation from a pagan perspective. Thus, we also had a lot of spiritual (incomprehensible). It was one of the reason for us to start the band in the first place. We wanted to really delve into old literature, provide something to the audience, convey contents.“ [artist1, PaganRock]*

Furthermore, we found that creative processes can also be described in terms of series of decisions about fixing uncertainty. This is not only about ‘hot fixes’ cooling down and turning permanent. Rather, series of fixes can also lead to ultimate solutions, solving a dimension of uncertainty for good. With every fix turned permanent, the scope of possible trajectories narrows down. The creative content becomes less fluid and eventually turns into a concrete and tangible outcome. Especially in the music industry, where decisions are made on the basis of aesthetic reasoning, uncertainties can hardly be objectively solved but are actively decided upon to have a fixed status and thereby framed as finished by participants.

However, in three of the four analyzed music cases uncertainty was repeatedly re-introduced by actors into dimensions that were already framed as fixed before. This happened for example in *PaganRock*, when already recorded songs that were deemed as finished by the band members were opened up again for modification by the record label in order to improve the fit to alleged consumer tastes and demand expectations:

> *„You take the structure apart and say […] for example: ‚We are giving away a hit here.‘ Let’s put it this way. ‚Because we have an awesome hook, but it’s not coming to a point but rather just going along.‘ And then you have to try tighten up the songs’ structure and arrange it so that it remains interesting and that when the song is over, you say: ‚Oh, let’s hear it again, it’s awesome!’ You know, but when it’s too long and you have 30 repetitions then you will finally say: „Ah, I’d rather not listen to it again‘. Thus, you have to fix the structure so that (3) let’s say it’s more adjusted to listening habits“ [producer, PaganRock].*

Fixing an uncertainty does not rely on aesthetic criteria alone. Rather, it is primarily a question of active framing and most typically requires extra-aesthetic justification. Sometimes, time constraints are mobilized to justify a fix (the studio contract runs out in a few days), sometimes hierarchy is required to come to terms (the bandleader takes her responsibility and simply makes a decision). In other cases valuation criteria by external authorities are mobilized like consumer tastes (as the quote above illustrates) or media constraints.

Fixing uncertainty is also prevalent in pharmaceutical development. By fixing uncertainty, participants decide upon methods, actions, and goals of uncertain aspects to advance development. These decisions have to be made based on limited knowledge and incomplete understanding of the subject at hand. However, they are never made randomly, but rather rest on educated guesses of experienced collaborators.

For example, in *CancerStop* a group of bio-information scientists working at a public research institute found a way to inhibit the production of a certain protein within human cells. This was accomplished by embracing content-uncertainty concerning this specific protein. However, the generated knowledge raised new questions, this time about potential areas of therapeutic application. In short, the group discovered a solution but no corresponding problem. The group leader fixed this content-related uncertainty by deciding to focus on cancer therapy even though he was well aware of the fact, that many other areas of therapy might also be promising. He explained his decision in the following way:

> *„I read papers and in the papers it said, that one suggests or that there are suggestions, that the protein, which we inhibit, plays an important part during metastasis of cancer. Hence it was fixed that we want to look thereafter. And then we just said, well okay, why not?” [Bio-informatics, CancerStop]*

Meanwhile, these fixed pathways and solutions often are not ultimately defined, but can be revised again during the development process. In the process of development, participants often realize that earlier fixed solutions might be unfeasible for the advancement of the project. In such cases, previous fixes can be dismantled again to open up already established assumptions and reintroduce uncertainty. Hence, the involved scientists constantly reminded themselves that their approach towards cancer therapy is a revisable hypothesis, not the ultimate conclusion, and that other areas of therapy might turn out as feasible as well. With this mindset, fixes can remain hot over longer periods of time:

> *"And then you say, okay, that is a hypothesis, which I deem, has a certain probability. But that is all I can say at that point. It is a hypothesis. And that you don't believe it to be the truth. That is very, very important." [Scientist, CancerStop]*

Fixing is especially prevalent in pharmaceutical development during clinical testing, since in these very final stages of development processes, regulatory guidelines prohibit the exploratory attitude predominant in embracing uncertainty. The *NatureComp* case in which collaborators found potential therapeutic value for heart disease is a case in point:

> *"There [in clinical studies] you cannot say: we want to somehow develop a molecule and test in the cardiovascular area. Instead you must say perfectly clear, which indication, for example heart attack, and then you must describe in detail, before a heart attack, after a heart attack, should it be tested as a prophylactic or should it be tested acute, when the heart attack happened a minute ago and repetition is impending. All those questions" [NatureComp]*

To be in a position to apply for clinical studies requires a series of previous fixes have to be made. Almost all parameters must be defined and clear yes-or-no questions must be articulated before moving forward with testing. Again, these specifics of development parameters as well as target indications are not chosen with perfect understanding, but are fixed upon limited understanding and uncertainty. Similar to music cases, such decisions are not primarily made by applying scientific standards. Rather, collaborators with a background in management often fix uncertain aspects referring to requirements in business plan development or other strategic planning.

In addition, management needs to fix uncertainty to acquire investments and start clinical trials, both of which are only possible with fixed parameters. During development in *HeartComp*, participants wanted to found a start-up company based on their discovery. Accordingly, they needed access to financial investments to be able to continue development and start first clinical trials. Therefore, the designated CEO, without any real experience, started fixing uncertain aspects concerning the process of development, necessary financing, timeframe, etc. While such a business-plan is necessary to convince investors, he realized the hypothetical and provisionary character of the "fixes" that had to be done:

> *"All that developed later. Of course, you must, when making or writing a businessplan, make certain assumptions. That is possible, if you got some experience – but never in detail. That has developed later." [CEO, HeartComp]*

Ignoring uncertainty

While embracing and fixing aspects of uncertainty, actors remain aware of the fact that other dimensions of uncertainty continue to exist in the further development of the creative process and will most probably resurface later on. It is impossible to address all uncertainties at once, nor can actors anticipate all upcoming uncertainties in advance. In our case studies, we observed that participants often *ignore* these other aspects, acting rather with a general disposition of *confidence* towards upcoming uncertainty, in the sense of "pretending" or acting as if an already

identified uncertainty does not exist. That way, creative development can proceed despite the existence of many dynamically unfolding uncertainties. In this variant of "strategic ignorance" (McGoey, 2012), actors prefer to remain ignorant not primarily for purposes of avoiding responsibility. Rather, here ignorance allows postponing decisions until better ideas emerge during collaboration. Participants free themselves from being dependent on inferior solutions and trust on their confidence that something "better" will come up when the time is coming.

In the music industry, all cases encompassed different sequences of creative work and therefore dealt with constantly shifting uncertainty in the product development process like conceptual planning, finding band members, songwriting & rehearsing, testing with audiences, finding a label, connecting to audiences and so on. Since the outcome of particular sequences was uncertain itself, decisions about how to fix future uncertainty depended on former development and could not be easily decided upon beforehand. This means that even though it was known that for example somebody has to be found to produce and mix the songs or that an album artwork has to be designed or a marketing strategy to be found, these uncertainties on the dimensions of 'who', 'what', 'how' and 'where' were ignored at first and postponed until they became urgent.

Also, uncertainty concerning demand was paramount in all music industry cases. While creating and producing songs, consumer demand is unknown and mostly ignored by actors in order to stay capable of acting. One of the producers in *HabibiRap* explains:

> *„So yeah, uncertainty in the sense of […] ‚Is it cool like this?' Oh fuck, i don't know!' […] This uncertainty was there for sure once in a while, but I somewhat stopped - not somewhat - I definitely stopped thinking about whether people will like it or not. When I think it's cool and the artist I'm working with does so too, then it's enough for me to be satisfied, you know?" [producer, HabibiRap]*

Also, the product manager in *PaganRock* clearly indicates an ignoring of demand uncertainty by acting confidently:

> *„Well, we set the explicit goal that we want to achieve gold with this album: 100.000 units. […] But in the music business that really doesn't mean that it is going to happen. You can never be certain. It's more like going to the movies.. It's inestimable (laughs)." (recordlabel CEO, PaganRock)*

In pharmaceutical development ignoring uncertainty is an everyday occurrence present in every development. The failure rate of pharmaceutical ideas that start development is immense (Scannell, Blanckley, Boldon, & Warrington, 2012). The only way to start and endure this failure rate is by confidently ignoring uncertainty.

The uncertainty of success results from the strict regulations and subsequent development logic within pharmaceutical development. While animal testing is helpful to assess the safety and efficacy of novel compounds, it is ultimately insufficient: Only by testing with sick human patients can developers know for certain if their mode of therapy is effective and safe. However, testing with sick human patients is only allowed deep into the development process, after having spent huge investments of time and resources. And, as a lead scientist and the CEO in *HeartComp* explain, testing with humans is always uncertain:

> *„And then we can directly see, if it helps the patient or not. That, we do not know. In animal testing everyting looks alright. But we do not know if it works right with humans. That we do not know at all." [Scientist 1, HeartComp]*

> *"Well, the main-uncertainty, which we have, is the human. Is our compound functional? With everything we know, from our experiments and pre-studies: yes. But only in one to one-and-a-half years we know, when we apply it for the first time with patients. Everything*

> *else is quite clear. As I said, our molecule does not need to be changed, we know, how it works, we know where it works, we know, what happens with it in the body. But if it is in the end really effective within a sick human, that has to be seen in clinical testing." [CEO, HeartComp]*

Although the developers in *HeartComp* found a promising compound, identified a suitable therapeutic gap, convinced investors, and founded a start-up company, it was still uncertain whether their product will actually help in therapy. They tolerated this uncertainty through sheer confidence in their product and just pretended it will work. That way, development could proceed despite high levels of uncertainty:

> *"**I: How do you deal with that uncertainty in management?***
> *A: Well, everybody is aware. But we work as if it will work. Otherwise we didn´t need to sit here." [CEO, HeartComp]*

Furthermore, ignoring uncertainty is not only a way to proceed with development despite uncertainty, but also to postpone decision for "better ideas". Developers ignore some uncertain aspects about their product until decisions need to be made. By postponing, they can let other contributors with more experience on the subject find answers to these uncertainties. To continue with the example from *HeartComp*, although an investor was found and clinical trials had already begun, the developers still had no clear vision about the form of intake their compound will eventually have on the market (pill, injection, cream, etc.). They deliberately refrained from making this decision and thereby ignored the resulting uncertainty with the confidence that a potential buyer with more experience in the subject will anyway find a better solution then they could:

> „The other translation, whether you eventually take it as a pile or whatever, that will be done by the big pharmaceutical industry, if they want it or are interested. And they have just a lot of experience. Like molecule size, or whatever. Which way is the fastest? When you got experience you advance quickly." [Scientist 2, HeartComp]

Discussion: Organizing creativity as shifting constellations of embracing, fixing and ignoring uncertainties

Looking at the creative processes as a whole, uncertainties in our case studies appear not all at once but rather emerge, unfold, resolve and *shift* over time. When even small developments are indeterminate in advance due to the practices of embracing, uncertainty aspects can change or new uncertain dimensions arise and become prevalent in dependence on decisions made earlier. In situations of several co-existing and equally viable dimensions of uncertainty, the source of uncertainty shifts from ignorance to ambiguity.

For example, in our first music case of *PaganRock* the label initially embraced uncertainty about who to collaborate with and made a first step towards fixing this uncertainty by deciding that an already established medieval folk band deeply embedded in a scene of fans could be more successful due to authenticity superior reputation in the relevant scenes and a closer relation to the audience than a band casted from the scratch. In a second step, this participation uncertainty was embraced further, and the label CEO and the producer visited many medieval festivals in order to gain an overview of existing medieval bands. Eventually, one band turned out to be particularly promising, due to an already existing extended fan base, a predisposition of the band leader to become "more commercial", and a certain celebrity factor of the band members. However, participation-uncertainty was not yet fixed but further embraced because the label CEO and the producer expected the specific band members' composition to be disadvantageous for attracting mainstream media's attention. In order to improve the fit to mainstream market,

they decided to cast another female singer. With all these decisions, participation-uncertainty was fixed eventually when this spectrum of participants had been determined. Subsequently and building upon this, content uncertainty could be embraced collaboratively.

Another example of shifting uncertainty can be found in music case *SoulRock*, where a solo artist had already embraced content uncertainty and had written songs and recorded demos with befriended musicians but still did not reach the point of fixing this uncertainty because she was profoundly uncertain about the songs' quality. Here, embracing uncertainty and thereby gathering knowledge did not subsequently lead to the ability to solve ignorance and thereby fix content uncertainty but resulted in a situation of content *ambiguity* for the main artist:

> *"I was good at writing but then I wasn't really good at finishing a production or at really knowing "Okay, is this the production then? Or is this not? Or am I satisfied with it?" So, I would go from "Uh, this is great" one day, which still happens, "I love this song, I think it's great" and then the next day "It's terrible. What was I thinking?" (laughing) You know, the whole love and hate feel of "Yay" and "Oh, this sucks!" you know. What am I doing?" [Soulrock, main artist]*

Because she was not able to solve this ambiguity by herself, it was shifted into a participation-uncertainty: 'Who has the expertise to help me with this?' A reknown song production team was hired and thereby not only the question of 'who' was fixed, but also as a consequence content-uncertainty was further embraced again, now together with the newly recruited production team. When the main artist heard the results, she was not only overwhelmed but also heavily inspired by what the producers had done with her songs. In hindsight, the aesthetic breakthrough was achieved through the successful shifting between embracing content-related and participation-related uncertainty:

> *„And then they had two songs that they worked on. And it was really interesting because all of a sudden out of those two songs that they worked on, it was a different vibe altogether again. […] Because they brought their production, their producer thing in. And I was like "Oh! Oh, that's kind of cool!" […] And then I went to Portugal with a friend and we started writing in that direction. In the direction of the production that the guys had done." [SoulRock, main artist]*

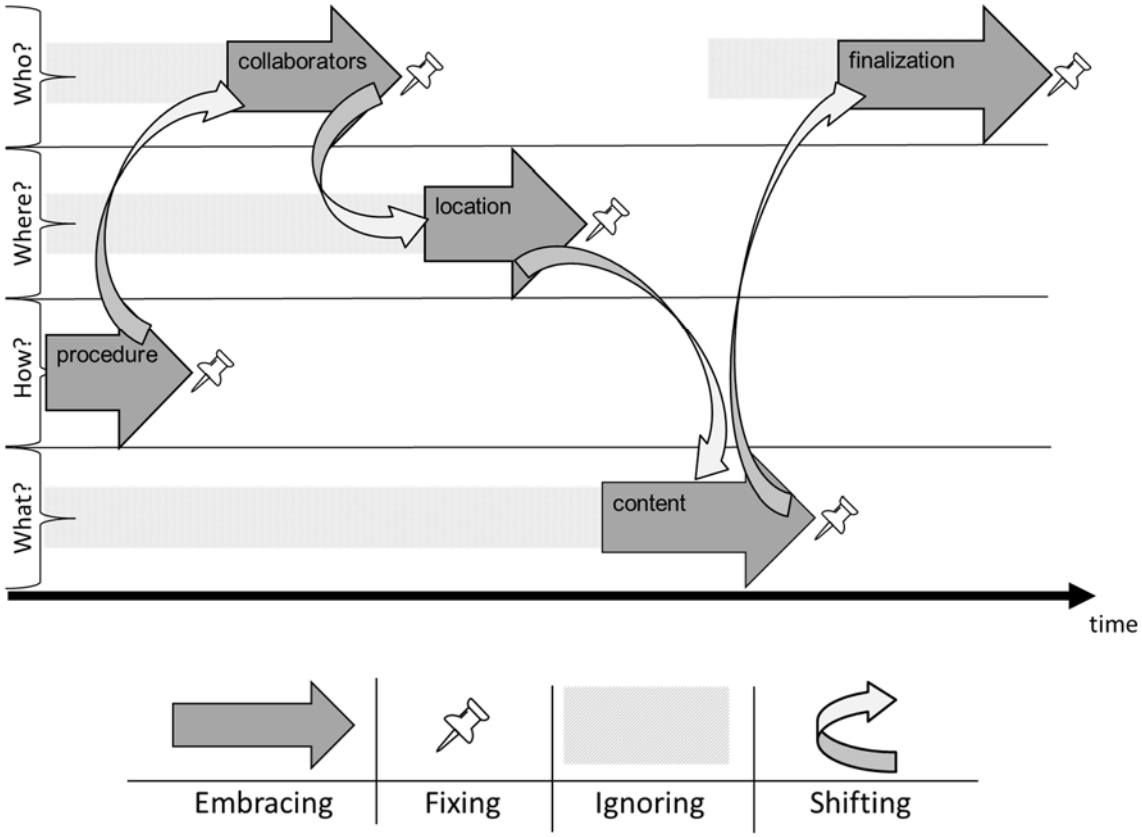
Embracing and fixing of one type of uncertainty leads to new knowledge and it can also reactivate previously ignored aspects of uncertainty or give rise to additional aspects that only become palpable due to the advanced development and decisions made before. The uprising of several aspects of uncertainty can trigger situations of ambiguity in which participants have several options to reorient their endeavor and the whole process becomes highly contingent. For instance, once a band has been casted, is the next step already to start composing a number of songs (content-uncertainty), or, would it be better to first think about new forms of collaboration between band, record label, and producer studios (procedural-uncertainty)?

Our data shows that there is not one specific type or quantity of uncertainty constant in creative development. We did not encounter one specific incarnation of uncertainty before the observed collaborations started, which was addressed by one specific mode of collaboration over time. Rather, multiple and different aspects of development (content, procedure, participants, location, reason, etc.) were uncertain during the entire creative process. Furthermore, these aspects did not all start out uncertain and were unraveled over time. Instead, uncertainty first shifted dynamically in quality and focus of different dimensions during development (See figure 1 for the illustrative music case *LeftfieldPop*). In addition, by acquiring new knowledge due to embracing uncertainty, not only previously specified ignorance diminishes but at the same time formerly unknown and equally viable options can arise. This illustrates that throughout creative

processes, the source of uncertainty can dynamically shift from ignorance to ambiguity. Or, as a lead scientist from case *CancerStop* summarizes:

> *"What I deem important in such a context is that you have a long-term goal in mind, which you want to pursue, but – and that is most important – allow for deviation. It is probably like sailing: if you want to go from A to B, you do not sail straight, because that is not how wind is. Instead you cross and do this and that. So you must try different things in detail, go a detour. Yes, maybe leave a situation indeterminate. Organizing a project from A to B, especially if it is that complex, I don't do out of principle. That would be an engineer's project." [Lead Scientist; CancerStop]*

Figure 1. Uncertainty practices & shifts *LeftfieldPop*

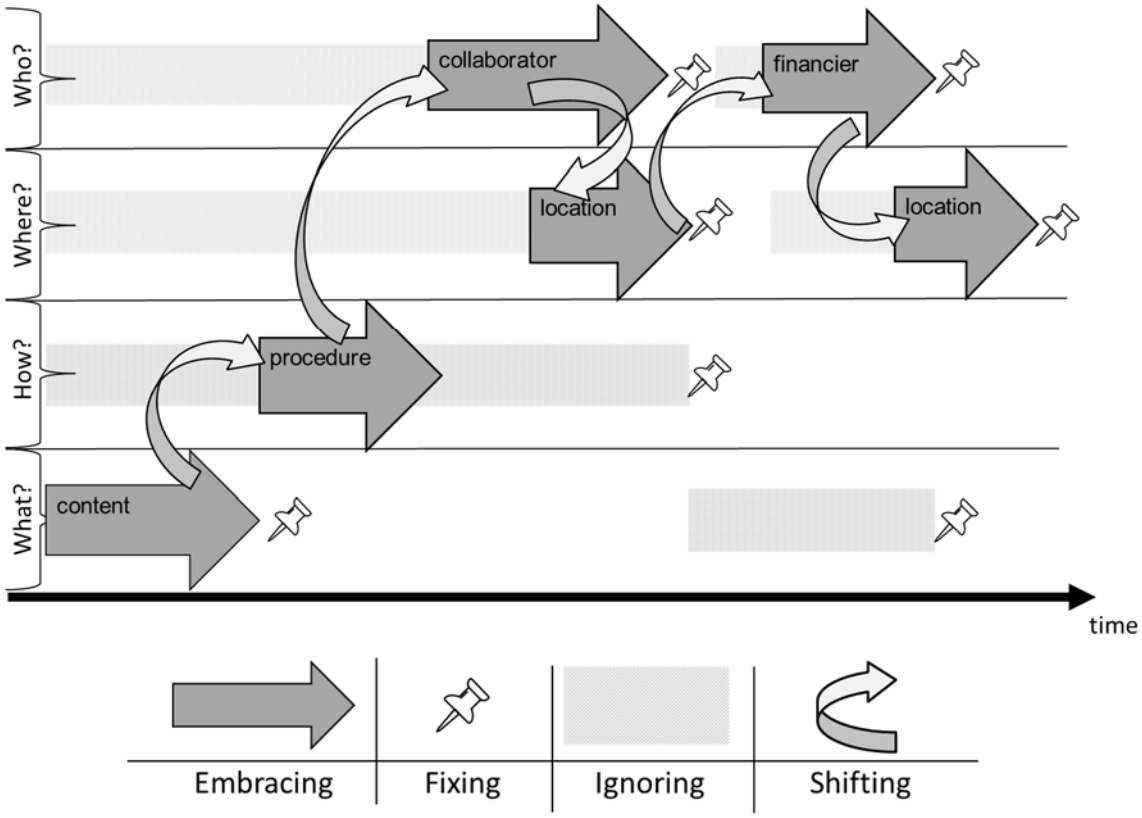


Source: own design

NatureComp can illustrate the constant shift of uncertainty during the creative process (See figure 2): At first, it was uncertain what the scientific team of biochemists wanted to research (content). They embraced this aspect and explored the properties of a specific substance (a fix) that had suggested value for human health. After experimentation, they fixated a specific construct of that substance. Subsequently, participants embraced the procedural dimension of uncertainty by focusing on how to produce this substance synthetically. However, as a result of embracing this aspect of uncertainty, they learned they do not (and probably will never) possess the expertise required to resolve the evolving procedural-uncertainty. Accordingly, uncertainty shifted again, this time to aspects of participation, as the question of who else could fill the procedural-uncertainty of synthetization became urgent. This who-uncertainty was embraced, with the group leader going to different chemistry conferences. In other words, by inducing and embracing where-uncertainty he serendipitously found a chemist who was able to make a useful suggestion for the original question of synthetization. Thereupon, uncertainty shifted again from

who back to how. Eventually, how-uncertatiny was fixed with an approach developed by the newly enrolled chemist. With the aspect of synthetization fixed, first produced compounds emerged. These compounds then needed to be tested in animal studies, shifting the focal uncertainty back to aspects of content, as now it was necessary to identify a target disease in order to be able to launch a series of experimental tests. In a similar way, not only this case but all collaborative processes researched in this paper proceeded until the involved actors could reach points of saturation where embracing uncertainty would not bring much more new knowledge and a degree of concretization basing on a cumulative process of fixing uncertainties.

Figure 2. Uncertainty practices & shifts *NatureComp*



Source: own design

Conclusions

The aim of this paper was to explore the productive aspects of uncertainty in creative collaboration and to scrutinize practices that allow participants to harness uncertainty. Our data from eight creative biographies, four from the domain of music production and four from pharma development, unveiled three related practices – embracing, fixing and ignoring uncertainty – that in conjunction enable participants not only to tolerate uncertainty related to creativity but even to induce uncertainty and to turn uncertainty into an asset for creativity. While embracing uncertainty carries participants towards unchartered shores, fixing and ignoring uncertainty make sure they retain the ability to act in the face of dynamically evolving and multidimensional forms of uncertainty (see table 3).

Table 3 Collaborative practices in dealing with uncertainty

Practice	Description	Impact on creative process
Embracing	• Attitude of openness to unpredictability • Exploring & engaging in ventures with indeterminate outcome	• Gathering of options • Opening up new uncertainty dimensions/aspects
Fixing	• Assigning result to uncertain dimension/aspect	• Changing focus to another uncertainty dimension/aspect
Ignoring	• Acting with confidence towards prevalent and upcoming uncertainties • Postponing decisions	• Proceeding despite unsolved uncertainty or unknown future uncertainty dimension/aspect

Shifting of uncertainty is closely connected to the identified practices of embracing, fixing and ignoring. Shifting enables developers to reorient their efforts from one dimension of uncertainty to another thereby reshuffling the constellation of embracing, fixing and ignoring uncertainty. Shifting uncertainty occurs in situations in which embracing uncertainty is no longer productive and new aspects of uncertainty emerge, previously ignored aspects reemerge or previously fixed aspects are opened up again. The wider theoretical implication of our study is to re-conceptualize uncertainty as an essential asset for creativity, rather than simply as a barrier to organization.

Both, the practices of embracing, fixing and ignoring uncertainty, as well as the time-spatial dynamics of shifting between dimensions of uncertainty could be replicated across different settings of governance (ranging from pull to push regimes of creativity) and across different domains of creativity (music representing artistic creativity and pharma development representing scientific creativity). Hence, despite the limited empirical scope of this study the robustness of findings seems quite high. While our study might be strong in describing the ways how actors harness uncertainty for creative purposes it is still weak in explaining, why these actors are able to perform these practices and even more importantly, what enables them to shift between different dimensions of uncertainty. These limitations raise important questions about the appropriate form of governance for creative collaboration that cannot be discussed in this paper.

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ORGANIZED CREATIVITY

Organized Creativity - Practices for Inducing and Coping with Uncertainty

The aim of this DFG-sponsored Research Unit (FOR 2161) is to examine different dimensions of uncertainty in several practice areas and investigate what role they play in creative processes in different contexts and over time. Therefore four different projects will be conducted in which the dynamics in both the music and pharma industries will be compared. The focus of all these projects will thereby by the creative process both in organizations and in interorganizational networks.

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http://www.wiwiss.fu-berlin.de/forschung/organized-creativity/

Organized Creativity Discussion Paper