PROBLEMS AND POTENTIALS IN THE CREATION OF NEW OBJECTS

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ABSTRACT
In this paper we explore the creation of new objects in two very different contexts: painting and fluid-mechanical engineering. Based on two case studies, we treat creativity as an empirical phenomenon constituted by actor-context relations that enclose perceptions of problems. Context, here, is both a stabilizing structure that is difficult to escape from and the condition upon which to create something. This duality appears to be a critical and necessary condition for the creation of something new. Through different social theories we will argue for the importance of problems in change-making processes. We will emphasize how processes of creative thinking and innovation proceed through steps, and how the end result reflects what these steps have brought in terms of problem perception and new knowledge. Inspired by Bruno Latour, we suggest a framework by which to understand how change is performed through systematic steps of materialization of problems, to gain the necessary support and acceptance to carry through innovation.

Keywords: Creative thinking and innovation, creation of new objects, materialization of ideas, circulating reference

INTRODUCTION
During the last three decades, research on creativity has developed from being mostly directed towards inner determinants like creative thinking, to a more comprehensive focus on social context and environmental factors [1]. There is a profound interest in creativity and how it can be perceived, improved, and utilized, e.g., as support tools within software and user interfaces [2]. In recent years much research has been put into understanding creativity, producing a great diversity of views (see [3], [4], and [5]). Paradoxically many views express creativity as either art or craftsmanship [6], as an individual [7] or collective [8] matter, and as building either from nothing or upon something. In the literature, creativity is described as novelty [9] with appropriateness [10], and is often said to be linked with cognitive processes [11], and personal capabilities such as intelligence and wisdom [12]. It is even proposed that psychosis causes creativity [13] or just that there is a relationship between madness and openness [14]. A fascination with famous thinkers, artists, and inventors is likely to have inspired ideas about these having unique cognitive capabilities. These positions seem difficult to substantiate, however, especially as great discoveries have been explained by socio-material practices and technological development rather than strokes of genius [15]. Some researchers look for structural settings and conditions in their attempt to clarify how creativity is fostered within innovation research (see [16], [17], [18], and [19]). In his work, Shneiderman recognizes three perspectives on creativity: *inspirationalism*, *structuralism*, and *situationalism* [20]. Though different they all focus on influencing factors rather than the substance of creativity. While we recognize that there are many meaningful and useful ways to describe creativity, we question the deeper meaning of existing positions, which focus primarily on sources and causes fostering creativity.

Very little research seems to address *how* creativity is *realized*. The word creativity comes from the Latin term `to create, make´ [21], hence creativity is to be understood as a verb, rather than an adjective. In this line of thinking any deeper understanding is bound to an exploration of acts leading to, and creating, something. Instead of looking for more or less `creative´ ways of thinking or organizing, we believe there is a need to look at the practices that lead to new things, which could easily could be taken for granted as a black boxes [22] from the simplified perspective of an outsider to the specific practice. Opening these practices and seeking ways to make sense of them is therefore a prerequisite for attaining a deeper and more comprehensive understanding of how new objects are created. As people create things every day, but rarely succeed in commercializing them, hence

obtaining a broader appreciation of the new, we focus on the difficult and rare act of doing so. In context of design engineering and innovation our conception of new things are not just the making of, but also achieving recognition and appreciation of the new, hence realizing innovation. In this article we approach creativity and creative thinking as a practice of creating novelty through a series of acts building on each other, ultimately being recognized as innovations.

By comparing two cases of creative action, in very different contexts by people of diverse backgrounds, this article explores how `creativity´ can be understood as a socio-material phenomenon that brings something new to the world. Inspired by Actor-Network Theory [23], we seek to find traceable relations and effects that can be linked to what can be perceived as `creativity´ in both cases.

Structure of article

We begin with some methodological considerations behind the empirical and analytical approach in this article. The empirical basis of the article is thereafter introduced through the two cases. Then the analysis will take its departure in a Bourdieu-inspired perspective [24] to address the tension and difficulties bound to the contextual settings within which new objects emerge. This perspective is then challenged through a Foucault-inspired view [25] of problems as drivers of novelty. To further stretch this perception, a Callon-inspired use of ANT [23] is applied to approach the micro-process level of creating new objects. By drawing on Latour´s concept of circulating reference [26], we finally propose a new conception of the micro-process level of the creation of new objects, and relate this to an overarching process of building relations between the new and the context it emerges within and where it must gain acceptance.

Methodology

The data this article is based on has been gathered through ethnographic fieldwork. The two field studies had the common objective of studying how professionals manage to create new objects in their respective fields. The first case, referred to as Case I, is originally part of an empirical exploration, made for Gylling's master thesis in Sociology, University of Copenhagen 2008 [27]. The aim for the thesis was to describe conditions for creative processes that aimed for innovation in artistic fields. The focus was on the circumstances supporting the work being done, and the elements functioning as catalysts when human creativity was used to drive innovation. The empirical exploration was based on fieldwork among active artists whose livelihood is creative processes. The choice of field area was made on the assumption that the conditions for creative processes are related to each other across industries and businesses. In particular the conditions for destruction of already existing knowledge during creation are important openings to the perception of non-knowledge. This is a necessary act to concretize the new invention [28]. Fieldwork was chosen as a method for this research because we wanted to explore conditions for creative work from a practical point of view.

The first case clearly highlights the relevance of problems as possible gates to the new during the process of creation. This is because problems like resistance will emerge in the process of creating new objects as novelty confuses the accepted sense of reality. That makes problems essential for the destruction of already existing knowledge during creation [29]. Exactly this point is also present in the case of engineering creativity, which is the methodological rationale supporting the applicability of two such different cases for this paper. The perspective of diversity finalizes, whether it is plausible that 'creativity' can be understood as a general socio-material phenomenon in both worlds. This diversity is reached by selecting cases from an artistic-, and an engineering- field, which in their respective creating practices, acts very differently. In essence the diversity of the two cases in terms of social and material conditions, applied methods and applications of the new objects, also serves to ensure a greater degree of generality regarding our findings on creativity. As these realizations are to be recognized across both worlds, local phenomena in each case have to be acknowledged in an overarching analytical scheme assuring their generality.

The second case, referred to as Case II, is derived from the empirical material, collected in an explorative ethnographic field study [30], as part of Juhl and Rosenqvist´s master's thesis in engineering on front-end innovation processes, DTU 2009 [31]. The field study was conducted at the industrial company Alfa Laval during 2009, and covered the processes leading to four innovations, one being the content of Case II, called Power Plates. In total, 13 semi-structured qualitative

interviews [32] were conducted with 9 engineers appointed among the staff of the Product Center Decanter; they were selected according to their affiliation with the four innovations. These interviews were carried through in the same surroundings where the innovations under exploration emerged, and the potential for conducting contextual interviews [33] were utilized when possible to follow the practices of the informants. The conducted interviews were audio recorded, and notes and observation studies were made during the dialog based interviews in the field, to document the accounts of the informants. To assure verification among the staff, a total of four workshops were conducted to discuss the reported findings directly with the employees, dealing with product development.

The data gathering for the first case study is fully based on fieldwork, and consists of both observation studies and qualitative interviews performed in the field. With this choice of method, the aim was to seek into the world of radical creation practiced among professional artists, [34] and [35]. This ethnographic journey procured rich opportunities to notice the practical side of creative work. The methodological agenda on this research can be classified as a journey of discovery, in the field of art creation [36]. On this journey of discovery, the aim was to notice practical and common circumstances for the process of innovation. The field work took place among ten different artists in their individual working localities [37]. The case chosen for this paper is representative of the ten performed case studies, and elucidates the creative process of the artist, who has been given the alias Alpha.

Data material from ethnographic work is a reliable and useful source, using observation studies as a source during the interview. These kinds of impressions can guide a semi-structured and explorative interview-guide, as there can be taken advantage of the interview person's reactions, like pauses in answers, gestures, face-work, etc. during the interview [38]. This kind of information has been a guideline in each research project, to seek for more nuanced perspectives, which in relation to the subject of this article came forth as different angles from to talk about creativity as a socio-material phenomenon.

CASE I: HOW AN ARTIST DEALS WITH PROBLEMS IN THE PROCESS OF CHANGE-MAKING

In Case I, we found it remarkable that the painter Alpha[1] dealt with problems in processes of creating new pieces of arts. Problems became the potential for something new to happen. In the process of change-making, Alpha did not see problems, failures, or transformation of an object as hindrance, but rather as a trail in the search for the new.

"We frequently cope with our own mistakes or own goal as declaration of bankruptcy. It is actually opposite. It actually means that your consciousness is telling you that something exists which is higher and bigger than you could imagine at the moment. Actually it is your brain which is disappointing you and once aging, offering you another chance. I think this is the point where a lot of people go down. So this is where you can draw a clear line between winners and losers. If you go down because of your failures, you have not discovered that the process is not ended. This is for me the moment of the acknowledgment: "You are not as big as you thought you were". (…) This is the moment of changing path, this is where it starts to progress, this is where the real game starts. It is at this point you will start changing your own tail again" [39].

In general, Alpha emphasises the importance of how he deals with problems in a creative process. Explicitly problems, because the way one deals with the creation of something, will push in a direction that confuses one's sense of reality. This is where problems start. Dealing with an object and problems will move one's recognition in another direction. Through his observations, Alpha seems to

[1] Alpha is a cover name chosen for the real painters name. We have decided to keep his name coved because cover names were a part of the methodological considerations for the empirical research of master thesis [M1]. Alpha is a Danish painter and environmental artist, courageous to defy concepts and definition. His work is world known for testing the viewers' desire to recognize objects and things. In a young age Alpha has been acknowledged with numerous of prices and his art has been presented in many of the Worlds most celebrated museums and galleries.

emphasise, that the process of creation (re-creation) is a dialectic movement between the actor and the object. This dialectic movement is propelled by the dynamics of dealing with problems and confusions throughout the process. This attitude is apparent when he talks about a painting as an old and confused medium:

"I think it´s my greatest friend, that I don´t take a painting for granted. (...) I am actually referring to them as mediums of paintings. Something old and confused. Confused for good reasons. Because maybe you once in a while will create a good context, which is perfect, and therefore not confused any more. (...) Somehow the painting is held together by the friendliness of the audience. (...) Old confused soldiers in the woods. (...).(Painting) is about creating a chance, an opportunity for this old and confused medium called painting" [40].

We like his statement of the media as *confused for good reasons*. We will get back to this point later in the paper.

CASE II: A SHORT STORY ABOUT CREATIVITY IN ENGINEERING

-The becoming of Power Plates; a simple energy and cost reducing yet creative idea.

This case is about a professional engineer who is called upon to fix a specific problem for a customer, but instead ends up developing an idea with great potential although it has little to do with the initial problem. Engineers are often looked upon as reasonable, logical, and organized professional problem solvers, but this story reveals an alternative perception of engineering as an act of creativity in a not straightforward, logical, but highly specialized attentive way.

Power Plates is an `add-on´ product to improve energy efficiency and also often the quality of the decantation process in decanters. Decanters are large rotating industrial machines for continual separation of solids from liquids, which work by using centripetal forces to sediment matter of higher mass from liquids under high pressures. The simplicity of Power Plates is staggering; it is basically a small metal nozzle that diverts the outgoing stream of liquids in the opposite direction of the rotation of the decanter.

According to Klaus, who is the inventor of Power Plates, Power Plates emerged from an attempt to deal with the problem of large quantities of water being spilled on the floor by a decanter in a customer's facility. The operators contacted Alfa Laval who had developed and supplied the decanter that was causing the problem. In order to maintain a good customer-relationship, Alfa Laval sent Klaus, a highly skilled engineer who was their specialist in decantation-process optimization. When Klaus arrived at the factory hall and through his own wet feet experienced the problem, he not only considered the decanter, the customer, the water on the floor, but also Alfa Laval and their customer policy which he was representing. In context of this narrow description, Klaus needed a solution to the problem defined by the costumer. In this way, he would have represented Alfa Laval as a responsible supplier of decanters who cares and supports their customers. But something else caught Klaus´ attention.

In Klaus´s perception, the predefined problem, the water on the floor, was not a stable and settled entity. To understand the nature of the problem, it is necessary to take a look at how decanters work. The general working principle of decanters is to build up great internal pressures as they rotate the decanter body as well as the fluids they contain, hence causing up to 3000G pressure against the inside of the body. This separates the fluids according to their respective densities and sediment solids. These pressures when released as the decanted fluids leave the decanter, translates into a high velocity stream of fluids being sprayed out. This is often a messy affair, and considered to be a working premise when dealing with decanters. So, in addition to being a problem (the cause of water on the floor), Klaus also saw the decanter as representing a process calling for optimization. In order to understand Klaus's subsequent actions, we must also look at his relation to Alfa Laval and, particularly, him being the process engineer in the Product Center Decanter department, which deals with the technological product development.

At the time Klaus encountered the problematic decanter spilling too much water on the floor, Alfa Laval was in the process of internal change with the declared goal of creating a more innovative organization that develops more energy-efficient decanters. Initiated in the factory hall with the floor soaked in water eager to interest Klaus, the announced problematisation by Alfa Laval of creating

more energy efficient decanters together with Klaus´s expertise within decanter-process optimization, appeared to be more successful in attracting his attention. Instead of dealing directly with the water problem on the floor, he became curious about the excess water in a way he had not been before. To support and develop his new curiosity in the time following the visit, Klaus began to sketch ways of perceiving the excess fluids as a part of the decantation process. After Klaus encountered the wet factory hall, his view on decantation-exhaust of fluids was thereby gradually transformed. From just being a disposal of processed liquid it became a sign of entities like liquid flow, velocity, mass, and pressure drop. What in retrospect might seem like a logical and straight forward solution, by connecting these relations to create the potential for a new product, was at that time a rather radical move done by Klaus. He did not just deviate from the predefined problematisation concerning water on the floor, he also deviated from the established consensus of what matters in decantation. By initiating another problematisation concerning decanter-process optimization, and later its energy saving potential, Klaus took the first step in developing an idea that later became the success known as Power Plates.

This process did not, of course, happen all at once or all by itself. Klaus´s actions slowly shaped the initial curiosity: passing from an interest in dealing with excess water into design drawings that construed the excess fluid as part of the decantation process. This materialization of his idea in the shape of sketches and drawings were of great importance to get feedback and gain support from his closest colleagues. By working out a calculation based on these drawings the argument for the potential of utilizing the excess water in the idea, was further strengthened as it was now also quantified. The way the idea was quantified was also important as it was by expressing the potential reduction in power consumption, directly related the idea of Alfa Laval´s declared vision of developing 30% more energy efficient decanters. By allying with this declared vision of energy efficiency and backing the idea´s energy saving potential with a calculation, the necessary *interessement* were was established as formal support from the organization. This enabled the idea to gain enough momentum within Alfa Laval, to make prototypes and do tests, which became crucial proof of concept in mobilizing the commercialization of the product Power Plates.

So what are we getting at? Klaus did not solve the problem, which he was sent to explore. The problem instead piqued his curiosity for the excess water in a new and unexpected way. Developing this curiosity through sketches and calculations, he saw things differently and developed a new attentiveness to how fluids leave the decanters. At that time this aspect of the decantation process was punctualized as a blackbox considered trivial and insignificant. Deviating from this established consensus was crucial for Klaus to develop the idea, but also difficult as he had to mobilize many allies during the process to achieve acceptance of his idea.

The point is that Klaus had to disassociate himself from the established consensus, and fight for his uncontroversial proposal to be recognized among his colleagues and in the organization. He acted creatively in the sense that he refused to reproduce the established consensus and instead chose to challenge it, by developing his controversial proposal through materialization and feedback. In this perspective the creativity involved could be understood as the actions enabling a reframing process, and thereby organizing potential for the mobilization of new futures, in terms of what ultimately became Power Plates. So by creative reframing of the problem, Klaus enabled the potential for change, in this case, leading to a new product.

COMPARING THE TWO CASES

What brings these two cases, which are otherwise so different (engineering and art), together? Well in our view they are both about the creation of new objects, though very different objects, and in very different fields. In both cases, something new to the world is taking form, both despite of, and as an effect of, the existing socio-material hybrid world [41], which serves as the *context*. These structural settings capture a duality in being both a stabilizing structure that is difficult to deviate from and the foundational conditions that are necessary for the creation of something new.

If the painting were not invented as a medium, Alpha would not have been able to leverage confusion and opportunity the way he did. There would be no reason for Klaus to divert his attention to the outlet of liquids on decanters, if decanters were not materialized in a way that drew his attention. On the other hand, both cases also illustrate the context as something to enable change, while at the same time preventing and limiting it. As Alpha puts it: *"Somehow, the painting is held together by the friendliness of the audience"* as in the case of Power Plates, where it is crucial to gain support initially

among the organizational "audience". This implies a close relationship with the continual act of creation, and the context in which it is done and the duality appears to be a critical and necessary condition for the creation of something new. In our cases, there are strong implications in this duality for the ability of the actors to kick-start *a leap* in another direction, escaping from what was functioning as a structure, of a certain order, in their fields. Inspired from different theoretical perspectives we will now explore this leap: the act released due to, and in spite of, the duality of the context. Starting with Pierre Bourdieu, we will emphasize why change-making is such a difficult act in the existing socio-material hybrid world we call the context.

Bourdieu and empirical break against doxa?

If we look at this leap in the perspective of Bourdieu's concept of *habitus*, it makes perfect sense that Klaus and Alpha talk about *problems* in relation to their process of creating new objects. It does create problems when actor's deep-seated, enduring, and transposable dispositions derived from previous socialization and rational hypotheses, do not fit in a certain social order any more [24]. The problem is then caused by the actor´s *habitus* that wants to make a dialectic relation between the objective reality, and its expectations of what to achieve through positioning in a social field. In Bourdieu´s conception, *habitus* exceeds the limits of the individual, and that is exactly what our two actors transcend. This transcendence generates resistance in terms of ontological and epistemological problems between the actor, his creation, and the social field he is embedded in. But this transcendence also enables the possibility of change and the creation of something new. What emerge as problems are momentary states of mind of the individual – a break against *doxa*, what is taken for granted and common sense [24].

This becomes clear when Alpha talks about our "own goals": *"We frequently cope with our own mistakes or our own goals as a declaration of bankruptcy. It is actually opposite"*. This is a movement against *doxa*, a tough counter-action against his habitus, which he further explains as*: "…This is the moment of changing path, this is where it starts to progress, this is where the real game starts. It is at this point you will start chasing your own tail again"*. This dialectical movement between the actor, his creation, and the context will move the actor's recognition in another direction than his *habitus* suggests. This also reflects the struggles in engineering that Klaus chose to endure to reframe the established consensus of what is important in decanter construction. His colleagues naturally rejected his proposition at first, as they emphasised the experience and knowledge derived from over 30 years of reproducing a certain perception in their field [31]. Bourdieu's implication of *actor's habitus* and predispositions due to the established doxa´s in social as well as professional fields, emphasize the difficulties that actors face, when attempting to get something new accepted in their existing contexts [24]. Being this stabilizing and reproducing structure, simultaneously serving as a necessary foundation for any creation, the double role of context and the significance of the actor-context interplay in change making, is very apparent.

Since Bourdieu's constructivist structuralism treats these sociological aspects in such an anchored matrix in terms of his conception of fields, classes, and forms of capital, we find it difficult to elucidate keys or potentials for change-making with outset in his theoretical framework. His theoretical conceptualisation is also criticized for neglecting resistance- and change- mechanisms due to his emphasis on power and reproduction in society [42]. In other words, the perspective offered by Bourdieu, provides a picture of why change is such a hard thing to bring about, hence also the extent of the struggles bound to change-making. We will therefore now turn our attention elsewhere, to assess the generative potential for change inherent into the structurality of the context.

The dispositive as a drive towards change

To capture the potential for change, yet still acknowledging the influence of structural conditions, we find Foucault´s theoretical framework with its descriptive method, useful to illuminate the potential for change in a structural perspective. By viewing our cases as examples of structural change in historical processes where new *epistemes* are formed out of existing ones, we seek to recognize and describe the dispositives driving the structural change.

"By dispositive I understand a kind of, shall we say, formation, the primary function of which, at any given historical point in time, has been to respond to a certain urgency (urgence). Thus, the dispositive has, above all else, a strategic function." [43]

As formations with the primary function to respond to urgent problems, dispositives thereby drive the structural change. The interesting aspect of Foucault´s descriptive method is how it enables us to look at the making of new objects, as consequences of what he frames as dispositives, which are the resulting forces of current discourses. Foucault´s dipositive also seems to bear many similarities with basic concepts of ANT, as he describes how the dispositive mediates different entities including other dispositives, as a development in correlation with its structural settings [44]. This perspective contributes to our conception of the context as a dynamic and constantly negotiated structure in change making. What seems to be a characteristic of Foucault´s ontology is that he implies that the dispositive is the tendency that relates entities in certain ways to form new structures. In this manner the dispositives as the drive towards change in either the case of the painting, or the case of decanter engineering, mediates other dispositives, and the structural practices in the current relevant *epistémé* of arts, and the current epistémé of decanter engineering.
With a Foucault inspired perspective, the painting which Alpha works on and the idea that later became Power Plates, are both important parts of dynamic dispositives exchanging other entities, and performing passage-links for other dispositives. Due to their distinctive relational order, the dispositives affect developments in certain ways. In this sense Foucault would address the direction of developments to the dispositives at play, as they mediate Alpha and his painting to unfold towards a certain outcome. By including the disposivites of the audience, and the context within which the painting is confused, a relational picture arises where each dispositive acts and together shapes the development of the painting. What in this view becomes interesting in both cases is that some dispositives seem to determine the future of others.

This is what happens with the audience of the painting, and Klaus´s colleagues at Alfa Laval, as they end up supporting the new logic presented through the developing approach in painting, and the developing idea of Power Plates. This leads to the question of why the audience and the colleagues in fact do change their perception of the new. Adopting the perception that it is due to the characteristic channels of dispositives, the case of Power Plates tells us that the colleagues, who at first did not accept the idea of possible gains in altering the liquid outlet, was not a homogeneous mass. Instead they acted as a heterogenic mass, as some were persuaded of the idea before others.

What becomes a bit difficult to grasp with the dispositive perspective is the complex interplay between creator and creation, attracting some of the audience before others. To grasp these micro-processes, Alpha and his developing painting as well as Klaus and his slowly materializing idea, have as dispositives, the function to digest certain problem complexes [44]. The painting and the idea are in this perspective thought of as necessities, for certain problems in specific historical contexts. These are the traditional form of painting, which has become “old and confused”, and a growing awareness of the need to reduce power consumption. So what can we learn from the dispositive analysis? The resulting dispositive of creator and creation in a specific context needs to hold, or develop mediating power, strong enough to influence the existing audience. This is done slowly by increasing the combined effect of the dispositive on the audience, until the new object has become the reality digesting the problem that justifies it. Hence it becomes a part of the new structure, and thereby loses its novelty. Though the conceptual idea of the dispositive implies inherent qualities, that characterize its potential for change, it also draws attention to the need for changes in its current context, which is essential if new objects are to be accepted. We will therefore examine how the problems that justify the new objects in the two case studies are dealt with on a micro-process level.

A relational perspective on change-making

In order to capture the essence of problems as indicative of tendencies or drives, which is experienced in both cases, we draw upon Callon´s description of change and, in particular, his perspective on the change-related ANT term: translation. Callon proposes translation to be composed of four characteristic `moments´ of translation*: problematisation, interessement, enrolment*, and *mobilisation* [23] and [45]. What seems to capture an important part of the work performed by Klaus and Alpha is the way they see problems, and thereby enable potential in a continual interplay between defining the problem, and the ability of the problem to draw interest in the context. In this sense, materialization (through media such as the painting) and calculation are ways to relate idea with audience, and test whether and how the problem can create interest. In this perception, the problem becomes the initiator of opportunities to create new futures. The gradual development of the problematisation through

materializations, and interessement attempts, will in this perspective be crucial for how an idea evolves, either turning into a new object or slowly fading away.

With inspiration from Latour´s science studies, we will attempt to unpack the cases within the framework of Circulating Reference (see Figure 1 and 2), which can be seen as a break with a classical conception of ontology and epistemology such as Descartes' material separation of the mind and the world [26].

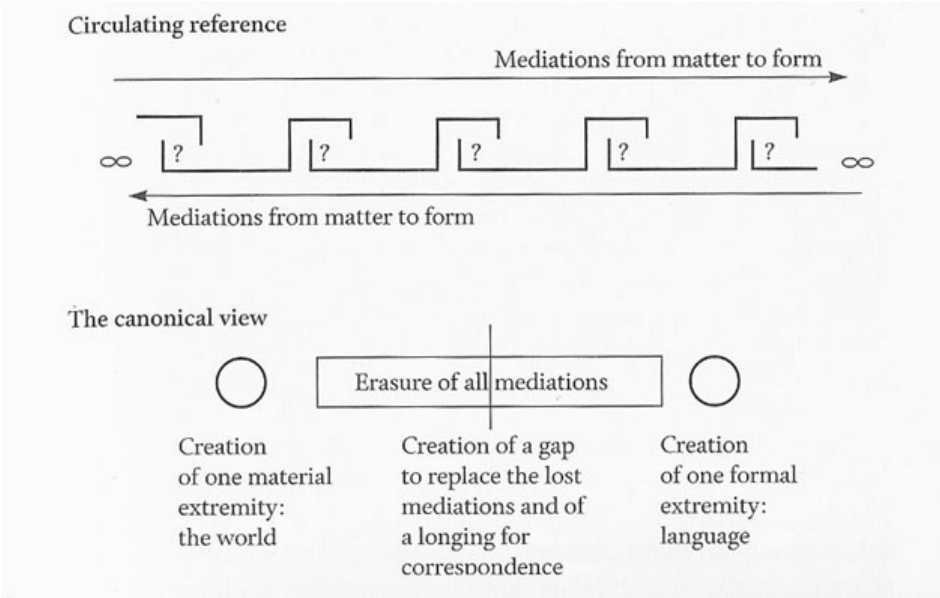

Figure1: Circulating Reference opposed to Descartes´ canonical view as illustrated by Latour in Pandoras Hope 1999. Circulating Reference show concrete steps of mediations from matter to form, building long cascades of references whereas the canonical view erases the mediations and leave a gap between the material world and the mind.

With a pragmatic view on the practice, by which scientific facts are constructed, through steps of inscribing matter into form (see Figure 1), Latour provides an explanation of how complex reality is reduced, and then amplified as immutable and combinable mobiles [15]. These are then turned into textual accounts which, if accepted by scientific communities, build validation into being recognized as "scientific" [46]. In this way, Latour creates a framework, by which scientific practice can be understood as constructing facts, through systematically representing the local and particular matter through form, thus adding to its relative universality by an amplifying representation. Thereby, material complexity is slowly decreased, by representing it with purified descriptions. These can be made compatible with other representations, now driving an escalating scientific knowledge production. In this way, Latour provides a framing of science, as a mapping of relations, in order to construct facts, by connecting the complex material confusing "reality" at one end, to the reduced, purified, compatible, and mobile representation, at the other end (see Figure 2).

At each step of the process, the materialization plays an important role as a media relating creator with creation, and creation with its audience, which provides essential feedback for future steps. If Klaus did not represent the *material* and confusing outlet of fluids, through a certain form of math, he would not have mobilised a better understanding of the possible gains of altering the direction of the outlet. This mathematical representation of the fluid-mechanical system in Klaus´ idea was crucial at that time, and helped him to gain further support and concretization of the idea. One of the important parameters was that the fluid-mechanical calculation was spoken and framed in an accepted form, being the language of math, which among Klaus´s colleagues at Alfa Laval, greatly improved its ability to interest and gain acceptance. In line with this, Alpha refers to his paintings *as "old and confused"* but also *"confused for good reasons"*, as he sees this confusion as something that relates him and the painting to the context. *"Because maybe you once in a while will create a good context which is perfect and therefore not confused any more. (...)"*

In this way the confusion that Alpha speaks of, and the struggles Klaus responds to in order to gain acceptance of his idea, are important and generative drives in their respective processes of creating new objects. Though our cases are not samples of scientific practice, they are about dealing with perceptions of problems and achieving recognition of the new. In the case of Power Plates,

crucial steps were taken to represent the problem through math, and later to build and test a prototype, in order to gain the necessary acceptance, to proceed and commercialize the idea into a product. Alpha speaks of his paintings as mediums of paintings, which confusion drives him to paint, in order to create contexts that are perfect for the paintings. Hence he also materializes his work step by step, to assess the problems and his perception of them.

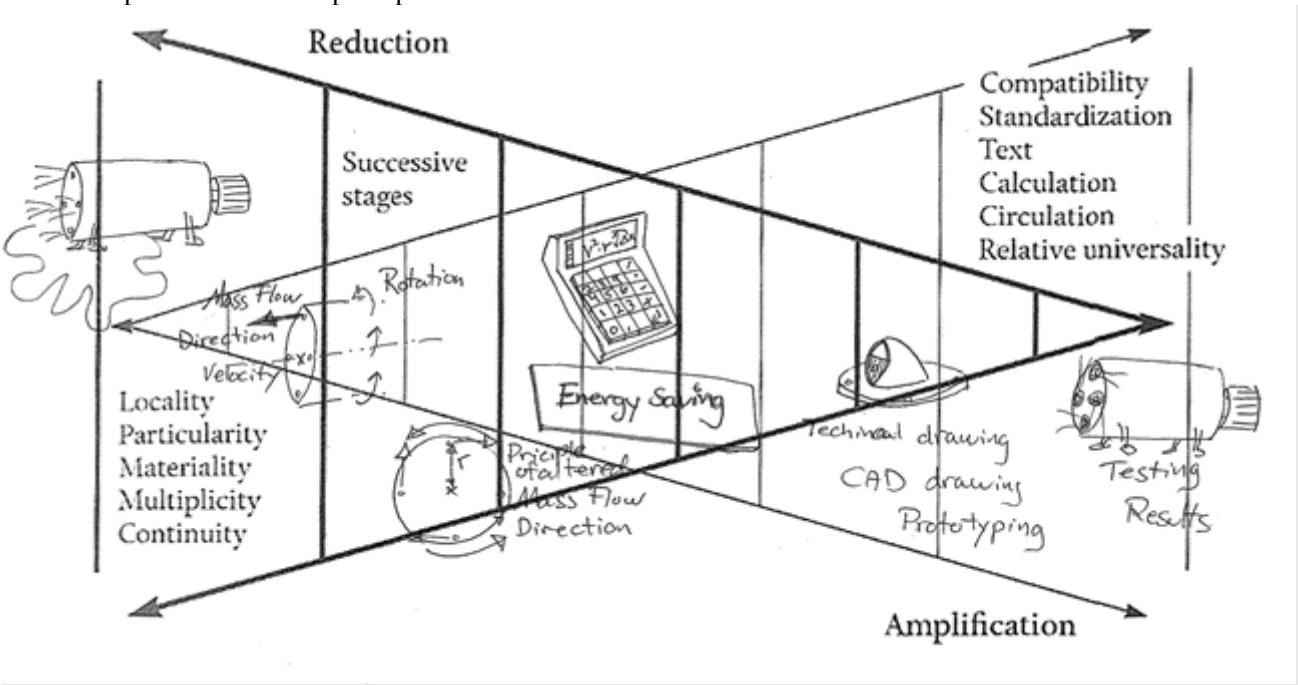

Figure2: Latour´s Circulating Reference diagram from Pandora´s Hope 1999 applied to frame the stepwise materialisations of Power Plates in a systematic order. The Circulating Reference diagram illustrates the increasing effects of the long chains of matter to form illustrated in Figure 1, as reducing and amplifying the complex materiality on the left side into standardized, circulating, and compatible re-presentations on the right side. This is exemplified by the developing process of Power Plates moving from curiosity to realisation and circulation, from left to right.

What might be hidden in different ways, in both cases, is the hard work that needs to be invested to create something new, as these steps of materialization seems to be necessary and decisive for further development and its later potential for success. Both cases show that creating something new in the world is done in steps. The end result reflects what these steps have brought in terms of problem understanding and definition and new knowledge. Even though these crucial steps also serve to attract the audience and gain acceptance, they are seldom mentioned. It is seldom mentioned that Picasso sometimes did more than 200 alterations to get a picture right [47], as the focus on Picasso´s end results leaves his process in the shadow. What we propose is to turn the focus towards the process of innovators, as far less can be learned from the end results alone. In this sense the epistemic journey of the creators has nothing to do with them being especially gifted or endowed with unique mental capabilities. It has to do with hard work performed systematically through incremental steps of exploration, and anchoring of fruitful ways, to perceive what they are working with. The emphasis on hard systematic work, as opposed to unique mental capabilities in creating novelty is also expressed by Steen Nepper Larsen, in his researches of *mind and thinking* [48]. In relation to the papers point of view, Nepper Larsen is arguing that creative capabilities in relation to development of a new product has nothing to do with creativity as a special kind of cognitive capital. A source derived as a result of individual discipline, mindful control and self-development captured through organizational control. It is through these many iterations of systematic and hard work that both Alpha and Klaus have shaped their ideas through the problems that justifies them and, over time, been able to materialize them in the world as new objects or what is perceived as innovations.

CONCLUSION

By assessing the creation of new objects in the world, with the empirical background in our case studies of the painter Alpha, and the engineer Klaus, we found that the way they dealt with problems was central to their process of change-making in their respective contexts. In the larger scope, equipped with Bourdieu's concept of *habitus*, these contexts also appeared to play an important part as the structural settings contributing to the problems. Following Foucault, problems also seemed to provide the means for change, as an essential relation ties problems and new objects, seen as change of *epistemes*, by justifying them as dispositives. On the micro-process level, Callon showed how problems were made to interact with their contexts by *problematisation* and *interessement*. This was developed in relation to Latour´s perspective on the scientific practice of constructing facts and led us to the acknowledgement of the essential importance of assessing change through continuous steps. Each stage of the development is related, step-by-step, with the context, to justify and create acceptance of the new.

On this basis, we propose a new perception of creativity, one of systematic exploration of problems and ideas through dialectic actions with material and social settings. Through transforming and translating problems, ideas, and socio-material networks are sought to be destabilized and mobilized to gain support of the new. In contrast to the idea of cognitive capital, we thus propose creativity to consist in skillful acts of systematic exploration, and a building of relations between problems, materials, ideas and audience.

As authors of this paper, we hope to have been able to follow the same procedures described in this paper. We have tried to approach our subject as interesting *problematisations* through traceable and transparent stepwise mappings and representations, to create the necessary relation with the reader and our scientific contexts. If we have succeeded, we may achieve acceptance of our findings, getting one step closer to creating something new, to establishing a fact.

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For inspiration: http://www.youtube.com/watch?v=NugRZGDbPFU

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