ICoRD '15
International Conference
on
**Research into Design**
Indian Institute of Science, Bangalore, 7-9 January, 2015

# Conduplicated Symmetries: Renegotiating the Material Basis Of Prototype Research

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**Abstract:** The role of materiality within prototyping recently received a high degree of attention from HCI and design communities. Existing approaches have solely focussed on the materiality of artifacts produced during prototyping. This focus largely has left the materiality of designers and users unaccounted for. The text illustrates how the Somatic-Marker-Hypothesis and Actor-Network-Theory can be employed in order to illustrate these forgotten dimensions of materiality during prototyping: Not only is material shaped during construction of artefacts. Material modifications also comprise alterations within the material of designers' and users' bodies themselves. In order to facilitate these descriptions, a novel approach towards symmetry had to be developed.

***Keywords****: Prototyping, Somatic-Marker-Theory; Design Thinking, Reasoning of Designers, Actor-Network-Theory, Interdisciplinary Concept*

## 1 Introduction

Most current research positions on prototypes in interaction design are based on a variety of hypotheses that are all symmetrical in construction. While individual arguments are quite distinct we believe there is an underlying theme that we strive to explore. The following article frames a theoretical backdrop which is inspired by Somatic-Marker-Hypothesis (SMH) from Neuroscience and Actor-Network-Theory (ANT) from Philosophy of Technology.

Some of the early key publications on prototyping in interaction design, like [5, 7] attempted to form comprehensive lists of what designers and developers can do with which kind of prototype and what users reflectingly see in those artifacts. Ever since, more elaborate propositions have been made, mainly with the goal to establish languages to describe the material factors of prototypes. Beginning with the fidelity-debate [14] this sometimes led to the bold endeavour to "establish a fundamental definition of prototypes" [12].

However, more sophisticated prototyping techniques are constantly needed for broader application and a wider audience [1]. Most theories to describe prototypes in interaction design are symmetric in style. The following chapter describes three schools of prototyping theories; the subsequent chapter introduces SMH and ANT while the third chapter convolutes those for a more radical theoretical approach.

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## 2 Prototypes In Interaction Design

*2.1 The Fidelity Debate*

One direction of describing prototypes is simple in nature and twisted in reality. The fidelity concept focuses on a variety of continua: low fidelity prototypes are cheap to sketch and help to evolve ideas while high fidelity prototypes are more costly to construct and are used in later process stages to evaluate more elaborated concepts [2]. However, it has been stated quite extensively that the concept of fidelity is broken by design. What if some variables are of low fidelity and others are of high fidelity? Thus the term mixed fidelity has been proposed but is not fit to clearly distinguish different dimensions. Quite similar and in many ways a logic continuation of the fidelity concept is the differentiation of single dimensions as a specification of dimensions in regard to mixed fidelity. Lim [11] and Diefenbach [4] have developed interaction attributes to specify interactions, once again as attribute pairs. The relevance of those attributes have been user tested, implying that those features of prototypes are objectively existing.

*2.2 The Inscription Theory*

A seminal, yet bold landmark seeks to provide a "fundamental definition of what prototypes are" [12]. The proposed vocabulary is once again symmetric in its architecture and proposes two dimensions: filter and manifestation. A filter is one of the five dimensions appearance, data, functionality, interactivity, spatial structure and is exclusively used by the designer who "screens out unnecessary aspects of the design" [12]. The antagonist to filter is manifestation, which forms the perceived embodiment of the designer's goal. Putting aside the positivistic notion that only designers design prototypes, this proposal also suggests that users dependently recognize the very aspects designers are focusing on. We call proposals of similar nature *inscription theories*, because they suggest a clear role allocation where designers deliberately choose a meaning that they inscribe into material. Two fundamental symmetrical propositions are made. First, designers incorporate a meaning into an artifact for users to explore. Second, prototypes have a clear distinction of form and material.

*2.3 The Form-Material Dichotomy*

In line with this argument e.g. Jung et al. [8] define form as intention in design and material as evocation in use. They subsequently elaborate this very dichotomy regarding current evaluation methods. They argue that form and materiality are abstract and always need interpretation while failing in prospect of quantitative oriented methodologies. Form and material are blending, their boundaries are blurring in digital artifacts, thus Jung et al. argue very carefully for a third way: an artifact approach. Accordingly, it is not only form that shapes material it is also the material that influences the form. This symmetric proposition of intention and use – is in line with inscription theories but calls for a consideration of "the complex relations that a certain technology makes with other artifacts" [8] thus suggesting the necessity for considering the artifact as an entity with independent meanings and rich interdependencies.

Those observations are by no means complete, but shall count as a blueprint for a variety of typical views in prototyping research. Before we move to our research position, it is essential to explain the already mentioned bordering theories.

*2.4 The Figure of Symmetry*

During the course of our discussion, we encountered several instances of the notion of *symmetry*. The present paragraph is designed to elucidate both their commonalities as well as respective differences. On the most general level, symmetry denotes a specific strategy of dealing with difference. Symmetry organises elements into a configuration that guarantees invariance regarding one or many transformations. It thus designates a property as remaining *invariant* under a given transformation.

Within the context of inscription theories, it is the meaning/idea/intention that is preserved within the processes of design and use. Additionally, within the discussed example, the processes of filtering and manifestation give rise to a dynamics that can be conceived of as being symmetrical in a literal (geometric) sense: There are two processes, one on each side of the filtering/manifestation division. In a downwards movement, ideas are filtered according to the qualities of the respective prototype. At the same time, an upwards movement is responsible for manifesting filtered ideas. Whereas within form-material theories, a direct relational symmetry can be observed, analogous to symmetry within set-theory: form influences material and vice-versa.

## 3. Metatheoretical Framing

*3.1 Somatic Marker Hypothesis (SMH)*

Human sensory perception is prone to error, intrinsically incomplete and needs to be approximated to be plausibly interpreted. This intuitive, unconscious transcendence of sensory data is key to successful human performance in regard to a complex and ever-changing environment [6]. According to SMH humans embody a cognitive scheme that bonds a certain sensory perception with corresponding somatic markers, thus allowing association of different environmental conditions with specific bodily conditions. Those markers are constantly refined through experience, education and socialisation and are connectors of embodied preferences with exterior factors. They thereby empower better interaction decisions [3]. A somatic marker reliably binds a bodily condition to recurring external situations without the need for logically informed decision making, while improving conscious processes. The cognition of an artifact activates somatic representations, appropriate responses and potential courses of action. A certain system, person or artifact will be rejected or appreciated based on the specific combination of somatic markers it brings about. All those reactions and bondings are inevitably based on the individual's body and perception, constituting the body's individual maps of somatic markers as the main reference point for marking and appraising artifacts [3].

*3.2 Actor Network Theory (ANT)*

Whereas the key elements in SMH are the human body and perception, the role of the artifact hardly crosses that of a passive object. Herein lies one of the main contrasts to ANT. The structure of ANT rises above a general symmetry, which equally includes human and non-human entities. It grasps the social as a circulating entity, as a network of heterogeneous entities connected through a series of transformations. According to this approach agency is not reserved for humans, artifacts can act on their own as well. The main criterion for agency is the capability of modifying a state of affairs by making a difference [9].

Note that within ANT, the notion of symmetry is employed in a distinctive manner. Agency is the property that is preserved while traversing the studied translational network. Whether studying actants that encompass humans or those that do not, the fundamental status of an observed entity does not change. It has to be noted however, that within the context of Latourian theory, the signifier 'symmetry' is employed in a much broader and much more emphatic sense. Not only does it designate the retraction of the allegedly 'pseudo-modern' object-subject dichotomy, it is also employed in order to claim commensurability between science and technology themselves.

In consequence ANT suggests a rethinking of the role of technical artifacts concerning the emergence and maintenance of social connections. ANT brings materiality into focus, as well as relationality – stressing the notion that all entities are produced in relations [10].

## 4. A Radical Twist

Inscription theories depict prototyping as a "platonic" operation: designers shape prototypes from mute material where they solidify ideas for future reference. This leads to the consistent assumption in inscription theories and to a lesser extent in form-material theories, that the idea can be interpreted reciprocally by users. We argue in line with SMH: material is simply too rich and sensory perception bound to individual bodies and also too limited, that the intention may fail to be transported through the artifact. That does not mean inscription theories are wrong, they are just not adequate for describing the rich effects of prototyping. Inscription can succeed – that is what makes great products great: a designer's intention is well executed and users somatically resonate with it. But more often than not inscription fails, because artifacts have such an enormous sensory complexity beyond the designer's control or inscription of intention. Form-material theories advocate a specific role of the material - e.g. its ability to conduplicate other material and its capability to independently bond relationships with other material. However, up until now this is just another consideration for designers to take into account when forming their intentions. Either way suggests that prototypes can be

exhaustively described and to a lesser extent imply that those features exist objectively. We believe both are wrong. In contradiction to prototyping as a platonic operation, and in contradiction to form–material arguments we believe the artifact is neither a mere container, nor does it act on its own. Both theories are by all means useful but not useful to form a persistent meta-theory for subsuming existing theories of prototyping. We rather argue in line with SMH: an artifact is not objectively perceivable, because the only thing that is triggered while perceiving an artifact is the individual map of somatic markers in the individual interpreter. Accordingly there is no objectively existing prototype. There are only compounds of somatic marker configurations that are individually different and that are changing while perceiving.

Whitfield [15] defined aesthetic knowledge as the capability to categorise sensory data and subsequent somatic markers that operates subconsciously and guides our decisions for choosing fitting artifacts. Whitfield's categorical-motivation model is an explanation of whichever somatic marker combination has to be triggered by an artifact to be preferred over other combinations. A slight derivation from a known positive combination is preferred, while confirmed anticipations are equally favoured. Both parameters form the boundaries for somatic conditions. An artifact's configuration has to be recognised as something similar. At the same time this configuration has to be a significant, albeit not immeasurable, derivation from a similar configuration to be considered as sufficiently – but not too much – arousing.

Thus, a prototype is a mere reflection of the designer's somatic marker configuration and that of the interpreting future user. A prototype is more likely to be accepted when its capability of reflecting positive somatic markers is equally symmetric from the designer to the user. This is no simple endeavour. The artifact must infringe current conventions to trigger aesthetic somatic resonance, but must reflect familiar features, habits and traditions to be recognised at all. Great designers seem to inherit somatic marker configurations or at least the capability to simulate such a condition in order to create an artifact that resonates a huge intersomatic overlap, while at the same time triggering enough new marker configurations. Thus prototyping is the art of generating and reflecting as many intersomatic overlaps as possible.

The consequential opposition to platonic prototyping has been proposed as hedonic prototyping [13] constituting the act of collaboratively reflecting somatic markers in the making of a prototype. Hence the artifact is not solely an object to reflect somatic conditions after its creation. Rather the very act of designing-interpreting an artifact is the interwoven reflective practice of individual somatic conditions and as such the necessary condition for designing and interpreting artifacts. In choosing a new mobile phone we may sift through all products on display that look like phones and choosing the one that immediately resonates the most. Depending on previous experience this might be a golden one, the one our work mate uses or the one was the most advertised. However,

deeper somatic reflection will start once we prototype our daily habits with and around the phone. Does it hold on to our aquatic hobbies, the long throw habits of our little ones or the diameter of our forefinger?

**5. Hedonistic Prototyping and ANT**

Possibly, we employ it differently than its makers intended, in a more decontextualised fashion, more as technological artefact than as ontological commitment. We use ANT as an inspiration to propose a framework for describing prototyping practices in regard to SMH. ANT is in many ways a fitting framework for generalizing the multifaceted relations between designers, users and artifacts. It radically assumes that human and nonhuman actors can be treated the same. ANT is deployed as conceptual agent allowing un/blackboxing to be performed, delegation to be described, essentialism to be dissolved, symmetries to be accounted for.

Prototypes reinscribe different configurations of markers into the bodily material of designers. Together with requirements documents and users studies, designers are aggregated into filters. Within this aggregate designers' and users' markers are activated as part of a process that selects ideas from the respectively constituted design space.

We consider a prototype an amalgamation of different material features. The phone might be golden, waterproof and shaped for large fingers. It is as well a black box of black boxes consisting of potentially hazardous materials mined in third world countries, patents granted on another continent and so on. Depending on whether patents, fingers or environmental damage is in the center of someone's attention, the sum of all of the artifact's materials forms an intention that in turn forms a very specific network of material properties that are in turn the specific intention of the artifact. A description of the likability of the specific artifact depends on individual somatic reflections: is concern for the third world sufficiently weaved into my somatic map or does a golden phone somatically reflect wealth or pretentiousness?

Thus, an individual actor-network is a specifically triggered map of reflecting somatic markers. As much as this argument is prone to linguistic fuzziness, an individual actor-network is embedded within an individual human-artifact relation and thus cannot be exhaustively described through language. Somatic mapping is only possible in reflection in prototyping the experience with an artifact, thus forming an actor-network between humans and non-humans in somatic negotiation of user and artifact.

## Reflecting Symmetry

Adopting a stance as outlined above allows for construals of prototyping that demystify both the notion of designer's intuition when creating artefact-forms as well as

that of user acceptance of the forms created. Material is given form during conscious discussions and poietic actions. At the same time material helps to produce forms out of itself by virtue of redistributing somatic markers within its designerly components. Designerly components can redescribe themselves as material within prototyping processes without incurring narcissistic loss. They are not 'mere' material but are those parts without which material-semiotic networks would not produce.

ANT and SMH as agents for changing perspectives in prototyping are by no means new concept. However, the plethora of fragments to describe prototyping practices have often remained isolated from each other and as thus eminently delimited from an overarching concept of human-artifact relations. Our proposition serves as a traversing scheme to subsume the symmetric concepts in prototyping research. It has been shown that those are not necessarily axisymmetrical to each other, but can be described as such with the help of ANT and SMH. This does not mean, that current research has to be condemned in the light of an overarching explication. While concepts like the inscription theories may need to be refuted, esp. form-material dichotomies are helpful assumptions for shaping research in design. Hence, the proposed concept is intended to help shaping design research.

## Acknowledgments

This publication was prepared as a part of the research initiative ValidAX, which is funded by the German Federal Ministry of Education and Research and as a part of the Research Training Group Crossworlds, which is funded by DFG (German Research Foundation). The authors take sole responsibility for the contents of this publication.

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