

# HARD CASH IN A DEMATERIALIZED WORLD

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## ABSTRACT

Dematerialization is an ongoing process in today's generation of intelligent, digital products. Content becomes disengaged from fixed carriers, and flows freely through networks and devices. We already witnessed how music albums and cash money were replaced by MP3 files and digital payment. Now dematerialization has entered the world of books.

Dematerialization of these artifacts enhances their flexibility and availability, but our interaction with them loses its physical richness and becomes mainly cognitive and abstract. Since we believe that digital products should appeal to cognitive and perceptual-motor skills, we consider this move towards cognition as a pitfall.

In this paper, we illustrate how we educate our Industrial Design students at University of Antwerp to deal with dematerialization. We discuss a design project that forced the students to at first, design the interaction. Here, the emphasis was on movement and not the artefact. Only after that, the students were asked to design the product. The results of this project show that this way of working leads to solutions that otherwise would remain unexplored.

*Keywords: Dematerialization, digital payment, interaction design*

## 1 INTRODUCTION

This paper discusses a design project that we organized for the 3rd year bachelor students Industrial Design at University of Antwerp. This project was conceived starting from the principle of dematerialization, as it was formulated at our university [1].

First we will lay out some theoretical background. We discuss the concept of dematerialization, and explain our vision on the position of the industrial designer in this matter.

Second, we focus on the guidelines and setup of the design project. We sketch the technological evolutions that drove it: Near Field Communication and mobile payment. We explain our cooperation with Atos Worldline, specialist in data transactions, and we discuss the project assignment itself.

Third, we come full circle as we discuss the results of the design project, and provide feedback to our concept of dematerialization.

## 2 DEMATERIALIZATION

We distinguish two parallel worlds. On the one hand, there is the physical environment. This is the real habitat in which we, humans and animals live [2]. On the other hand, there is the digital world, the world of bits and bytes [3]. Both worlds are parallel in the sense that we interact with the digital world by interacting in and with the physical environment, through mediation. They are disjoint, since they have opposite characteristics. Artifacts in the physical environment can be manipulated directly, they are graspable. Information in the digital world needs to be mediated, for example on a display, before it can be manipulated. Artifacts have their shape and physical properties that guide us on how to interact with them. Information in itself does not have these physical assets. It appeals to our cognitive skills rather than to our perceptual-motor skills [4, 18].

Dematerialization occurs when an artifact makes a move from the physical environment to the digital world (Figure 1). It gets rid of its physical shape and limitations and its liberated content is added to

the digital world. Examples of this phenomenon are manifold: music albums, photos and photo albums, maps, books and cash money are dematerializing.

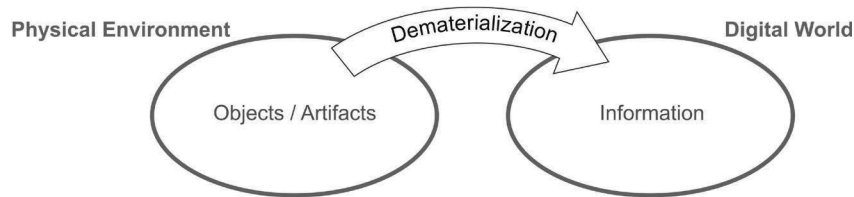


Figure 1. The process of dematerialization

Dematerialization happens for a reason. By dematerializing, artifacts are cut loose from their physical constraints and become intangible. Their content reaches virtually unlimited flexibility and availability [5]. The walkman allowed us to go for a walk with ten music albums (cassettes) in our pocket. An MP3 player does the same, but with 10.000 music albums.

On the other hand, we notice some pitfalls. Dematerialization causes artifacts to disappear. At the same time, the rich physical interaction that came with them, vanishes. Physical affordances, inherent feedback and feedforward cease to guide our interaction [6, 7]. As a consequence, the interaction process becomes less intuitive and more computer-like. The process of digital payment might be fast and accurate, it is also more abstract and less tangible than paying with coins and bills. We argue that dematerialization increases the cognitive character of our interaction with the products that surround us today. Since we believe that humans are not merely cognitive, but also action-driven beings [8, 9, 10, 17], we think that dematerialization may not proliferate freely. It should be guided by design [1].

### 3 DESIGN PROJECT: HARD CASH IN A DEMATERIALIZED WORLD

#### 3.1 Description of the project

The aim of this design project was to reintroduce physical design to products that had dematerialized. Its context was digital payment and two technologies formed the basis in this assignment: Near Field Communication (NFC) [11] and mobile payment [12].

The students were asked to design a payment interaction between two persons, the vendor and the customer. To support the interaction, both had their own device:

- The customer had a smartphone with a payment application.
- The vendor had a payment terminal.

Both products, smartphone and payment terminal, were to be designed by the students.

The twist of the assignment was in the way it took off. The students were asked to design a payment interaction, but without the idea of a product [13, 14, 15]. They had to capture these movements on film (later on referred to as “exploration movies”), and use them as an inspiration to design a set of products through which this interaction sequence was to be externalized. The central question was: how do you pay with money that is not physically there?

Since the focus was primarily on the interaction, we let the students act out their designs. Instead of merely sketching and CAD modelling, the students were asked to continuously realize and test their findings through real-live cardboard models, and this from the initial phase on.

#### 3.2 Atos Worldline

Atos Worldline [16] is a European leader in hi-tech transactional services and is specialized in electronic payment. The engineers and designers of the technologies and products division were charmed by the starting point of our assignment. They granted us their cooperation. Together with our staff, they coached the students during the whole course of the project.

#### 3.3 Results

##### 3.3.1 Exploration movies

###### 3.3.1.1. Lio De Winde – Ornella Poponcini (Figure 2)

1. The vendor knocks on the door, which is opened by the customer.
2. The vendor hands over the bag with the goods.

3. The vendor shows her right wrist, around which she carries several red bracelets. She slides two of them forward, as an indication of the payment amount. At the same time she extends her right hand towards the customer, as to greet her.
4. The customer shakes hands with the vendor. She wears black bracelets around her arm. When the two hands meet, she uses them as a bridge to slide two black bracelets on the arm of the vendor.
5. The money transaction is completed. Vendor and customer separate.



Figure 2. Exploration movie *Lio De Winde* – Ornella Poponcini

### 3.3.1.2 *Davy Habiyaremye* – Philippe Van Aerde (Figure 3)

1. The vendor hands over the purchased good.
2. The vendor shows an empty, orange balloon.
3. The customer brings out a blown-up, green balloon, and attaches it to the empty one by means of a connection piece.
4. Air flows from one balloon into the other, until the latter reaches a size that satisfies the vendor.
5. Both balloons are separated, as the transaction is completed.



Figure 3. Exploration movie *Davy Habiyaremye* – Philippe Van Aerde

### 3.3.1.3 Discussion

Through acting out the payment interaction, the students encountered its different aspects, and reflected on them. We briefly discuss some of these aspects.

1. Spatial layout: As the payment transaction was to take place between two physically present persons, the virtual change in location of the money could be physicalized in a real movement from the customer towards the vendor. This movement has a direction, a distance and a pace. It defines the positions of both customer and vendor, and forms the baseline for the choreography of their mutual actions. In the first exploration movie, a bodily bridge is created over which the “money” can be transported. This bridge refers to the classical handshake, and was experienced

by both actors as a friendly gesture. The moment of transaction is captivating and dramatic since the process takes time and physical effort. It ends up in a clear and logical result as the black bracelets changed owner.

2. Transparency: How is the payment amount communicated? What is the status of the customer's account before and after the transaction? The students explored other ways of communicating virtual data. They designed payment interactions that are clearer and more transparent than those we use today. The second exploration movie is appealing since it enhances the expressiveness of the money flow. The idea of using air as a metaphor for money results in a three dimensional volume that shrinks in favour of a second volume that grows.
3. Time: Current payment processes are driven by efficiency, and thus are designed to demand very little time. Our students discovered that, once they got rid of this time-efficiency, richer interaction rituals could be addressed. Some students even considered time as a variable parameter. The larger the payment amount, the longer it would take the system to process it. In both exploration movies, the interaction takes some time to be completed. This enhances its illustrative presence.

### 3.3.2 Resulting concepts

The project resulted in two products for each student group: a smartphone with a payment application and a payment terminal. We show two results.

#### 3.3.2.1 Gertjan Brienen – Collin Van Hest (Figure 4)

1. The customer orders a beer. (The input of the payment amount fell out of the scope of this assignment.)
2. The vendor tilts the payment terminal towards the customer. Thus, the payment terminal is set in reception mode, and clearly displays the payment amount to the customer.
3. The customer takes his smartphone. This smartphone consists of two square elements (displays) and a metal shaft. One element is fixed on the shaft, and the other can rotate and translate on it. The customer rotates the latter element and slides it over the shaft next to the first element. The smartphone is transformed into a key or pipette. It is now in payment mode.
4. The customer inserts his smartphone into a hole in the payment terminal, and tilts the terminal back to vertical position by pushing his smartphone.
5. Once in vertical position, the smartphone's display shows a flow of light towards the payment terminal. The money is delivered.
6. The customer takes out his smartphone, and transforms it back into phone mode.

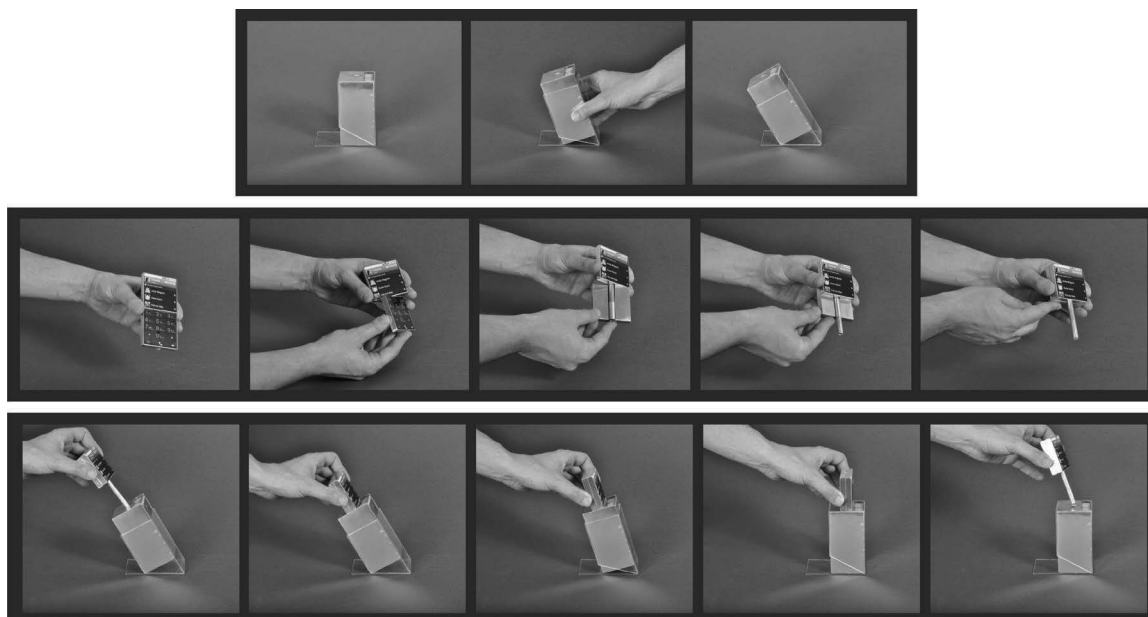


Figure 4. Concept Gertjan Brienen – Collin Van Hest

### 3.3.2.2 Wessel den Adel – Mark van der Schoot (Figure 5)

1. The customer orders a beer.
2. The customer takes his smartphone, and slides out a drawer. On the drawer is a display, which shows the status of his account. He folds the drawer downwards. His smartphone is now in payment mode.
3. The vendor enters the order in the payment terminal. He pushes a button which causes the display of the payment terminal to tilt towards the customer. The payment terminal gets an overall shape of a hook. It is in reception mode.
4. The customer hooks his smartphone behind the display of the payment terminal and pulls it towards him. The display rotates back to horizontal position, and reveals the reduced amount on his bank account. The money is pulled out of the smartphone and the transaction is completed.
5. Both actors bring their devices back in neutral mode.

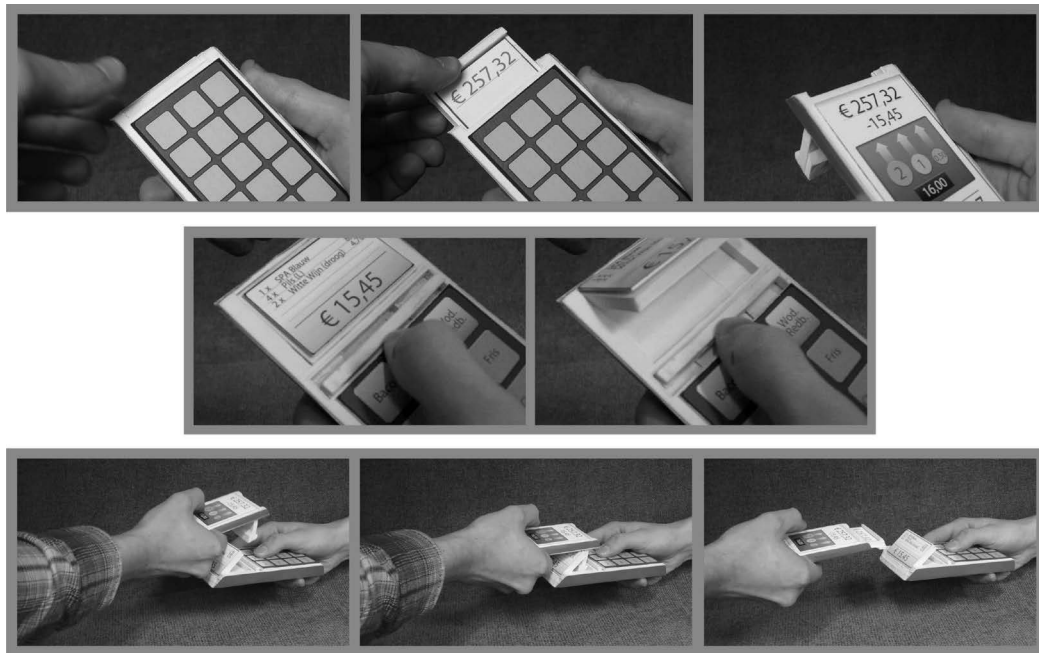


Figure 5. Concept Wessel den Adel – Mark van der Schoot

### 3.3.2.3 Discussion

The three topics we described in 3.3.1.3 were elaborated further and resulted in acceptable product concepts. How do these concepts cope with the pitfalls of dematerialization?

1. From cognition to action

The previously discussed spatial layout and the emphasis on rich physical movements offers a new payment process with a reduced cognitive character, and an enhanced perceptual-motor character [17]. The movements from actors and products contribute to illustrate a flow of matter from customer to vendor, and grant the process a higher level of intuitiveness.

Both devices are physically transformed to get in payment and reception mode. The transfer of the money asks for a precise cooperation between vendor and customer. Since they are urged to focus on it, both will experience the process more consciously.

2. Tangibility

The first concept makes use of displays, not only as carriers of information (feedback and feedforward [6]), but also as carriers of matter. In the first concept, the dematerialized money gets a tangible shape within the context of the smartphone. It temporarily materializes. Once the smartphone is inserted in the terminal, the money flows out of it, into the terminal. This flow is guided by meaningful user actions: inserting the smartphone in the payment terminal, tilting the terminal to let the money flow.

3. Designing for interaction

By approaching the payment interaction first as a physically rich process, and then designing the product to realize this process, we can prevent an impoverishment of interaction rituals due to

dematerialization. Moreover, this approach results in products tailored to the human body instead of products tailored to technology. This fits in our vision on design as a transformative force. We want to educate students to transform our world by designing products, instead of designing products for a transforming world [18].

#### 4 CONCLUSION

We established the framework in which the design project was situated. It was formed by the concept of dematerialization, its benefits and pitfalls, and the crucial role that we assign to design in this matter. The project itself was situated in the world of digital payment, where coins and bills had dematerialized.

In this project, the students had to, first, design an interaction, and only after that, design the products to realize this interaction. Being liberated from material constraints in the first phase, the students were able to come up with new kinds of payment behaviour. This behaviour was based on interaction principles, rather than on technology. These principles included spatial layout, tangibility, expressiveness and the action possibilities of the human body. The payment interaction sequences were translated fluently in innovative product concepts.

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