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# Interactive Demo Of An Experimental Payment Terminal

**Lukas Van Campenhout**

University of Antwerp  
Prinsstraat 13  
2000 Antwerp  
Belgium  
lukas.vancampenhout  
@uantwerpen.be

**Joep Frens**

Eindhoven University of  
Technology  
Den Dolech 2  
5612 AZ Eindhoven  
The Netherlands  
j.w.frens@tue.nl

**Caroline Hummels**

Eindhoven University of  
Technology  
Den Dolech 2  
5612 AZ Eindhoven  
The Netherlands  
c.c.m.hummels@tue.nl

**Achiel Standaert**

University of Antwerp  
Prinsstraat 13  
2000 Antwerp  
Belgium  
achiel.standaert@uantwerpen.be

**Herbert Peremans**

University of Antwerp  
Prinsstraat 13  
2000 Antwerp  
Belgium  
herbert.peremans@uantwerpen.be

**Abstract**

In this demo we present an experimental payment terminal, which we designed in order to explore and articulate our design approach, the third way. This third way is a possible answer to the question how dematerialization can be guided by industrial design. We start with the definition of dematerialization, and its benefits and pitfalls. Next, we distinguish two design approaches with respect to it, and position our own approach, the third way, in between them. Finally we give a description of our payment terminal, and discuss our future research.

**Author Keywords**

Dematerialization; Rich Interaction; Tangible Interaction.

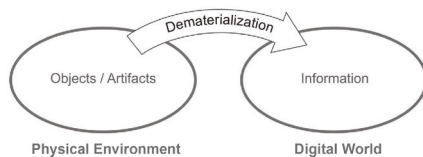
**ACM Classification Keywords**

H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces: User-centered design.

**Introduction**

We humans live in the physical world, surrounded by other humans, animals, objects and artifacts. In the last decade, we have seen a thorough change in this pattern: artifacts that populated the physical world, are disappearing. Coins and bills, music albums and books are dematerializing, and the information that was

carried by them, is transferred to this other realm, that is growing ever faster, the digital world. This raises some fundamental questions. How does one interact with an object that is not physically present? Do we have to undergo this process of dematerialization, or is there some way to consider and guide it? If so, who holds the key to this guidance? Philosophers, cognitive psychologists or computer scientists? We think that in dematerialized products many fields of research meet. In our view, design has always been a field that integrates knowledge from these different fields and therefore we are interested to see how the concept of dematerialization changes when guided by design. We want to open up the discussion from our own background in industrial design, and seek to provide handles to lead dematerialization in a predefined direction. That is not to say that we are aiming to define formal guidelines or even a recipe for dematerialization. Instead we seek alternative, designed examples of how we feel dematerialization could be. Following a research-through-design approach [7], we have designed a payment terminal in order to bring to the surface what these handles are, and where this direction aims at. In what follows we provide a theoretical starting point on dematerialization after which we present our payment terminal. We finalize this work-in-progress paper with a discussion of our future research.



**Figure 1.** The process of dematerialization.

### Dematerialization

In a previous publication [12], we coined the term dematerialization, and defined its characteristics. We described it as a process where information carrying objects dissolve and disappear. The information that was associated with these physical carriers, their content, is digitized and flows from one digital device to

another. Dematerialization denotes a move from the physical towards the digital world, causing the first to shrink, and the latter to grow (Figure 1). Examples of dematerialization are numerous and include: (a) music albums that are now digital files on our computers, phones and MP3 players [6], (b) books, newspapers and magazines which are viewed on e-readers [2, 10], (c) money that is no longer handled through coins and bills but through smart cards or even phones [11]. With the advent of the smart phone and the tablet [5], a whole range of single-purpose products is replaced by a digital application: agendas, calendars, board games, but also digital devices like portable navigation devices, digital cameras, remote controls [2].

This process of dematerialization happens for a reason. By dematerializing, these carriers and products get rid of their physical limitations, and obtain characteristics of the digital world. The interaction with them demands less physical effort, and they become limitlessly flexible and available. Without dematerialization, we could not go for a walk outdoors with our music and literature collection and our finances in our pocket [11].

Yet, the current wave of dematerialization comes with pitfalls. These pitfalls can be brought back to the loss of physical richness. LPs, CDs, cash money and books have their iconic physical shape, dimensions and material properties. With these physical characteristics come affordances [3, 8] and a dedicated interaction process, which appeals for a great deal to our perceptual-motor skills [1]. Getting an LP out of its cover, positioning it carefully on the pick-up, and placing the needle on it demanded a ritual of specific bodily skills, which, once assimilated, posed little cognitive effort on the user. The interaction with

today's MP3 player is limited to button-pushing and multi-touch actions. It does not differ substantially from the interaction with a smart phone, a hifi installation or a television set. It is a standardized interaction with a high level of abstraction, which appeals to our cognitive skills, rather than to our body.

### **Our viewpoint: the third way.**

We currently distinguish two ways that deal with dematerialization. As an illustration, we apply them on the payment interaction. Additionally, we present our own third way.



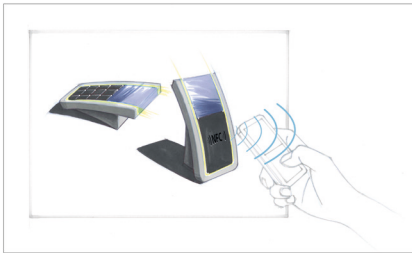
**Figure 2.** The payment interaction of the first way.

#### *The first way*

This is the approach that emphasizes the physical world and its characteristics. The aforementioned information carriers (CDs, LPs, coins and bills, books) are exponents of this approach. The physical world with all of its rich action-potentials and affordances is taken as the basic measure. The payment interaction of the first way is the cash exchange ritual between two persons (Figure 2). It is a physically rich, intuitive and meaningful interaction, but it poses the burden of constantly carrying cash money in our pocket.

#### *The second way*

The second way emphasizes the digital world and its unique features. Its basic principle is: the more digital and dematerialized, the better. A payment interaction of the second way is mobile payment (Figure 3), where the customer waves his smart phone in front of a sensor. The limitless availability of digital money is a huge benefit, but the payment interaction itself is standardized and generic.



**Figure 3.** Mobile payment as the payment interaction of the second way.

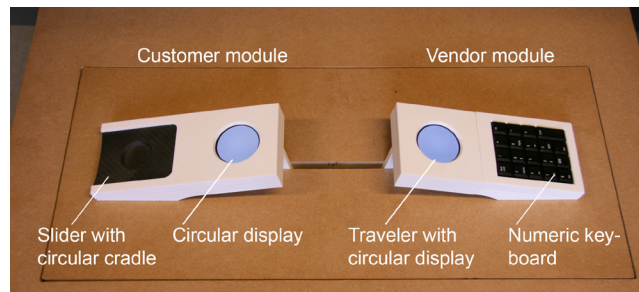
#### *The third way*

We think that both the first and the second way are limited. Dematerialization offers such huge benefits, that we should not limit its progression. On the other hand, we feel that dematerialization should not proliferate freely as it does now. Industrial design should guide it by adopting a perspective that we defined as the third way. The third way finds its place in between the first and the second way. We advocate a conscious guidance of dematerialization and a design of products that capitalize on the benefits of both the physical and the digital world, while avoiding their respective pitfalls. In the case of money, this means that we want to build on the tangible and persistent character of physical coins and bills, while avoiding their physical limitations, the burden of having to carry them around. We welcome the flexibility and availability that digitized money brings, but we question the loss of specific interaction rituals, and the resulting move towards abstraction and cognition. The third way advocates the design of single-purpose products, since they permit to be designed and optimized around one specific functionality [9], opening the gate to expressive physical shapes and affordances. In order to explore this third way and further define it through an example, we designed a digital payment terminal.

Hurtienne and Israel [4] establish a similar distinction between "Physicality and Digitality". In their PIBA-DIBA lists (Physical Is Better At – Digital Is Better At), they exhaustively describe the unique features of both realms. They advocate "designing for blended interaction", an approach to interaction design that seeks to mix physical and digital features, and feels connected to what we call the third way.

### Our experimental payment terminal

The payment terminal is integrated in the desktop counter. When not active, it consists of two similar modules: the customer module and the vendor module (Figure 4). The customer module contains a circular display and a slider. This slider has a circular cradle for the customer's money-token that contains his account details. When inserted in the cradle, the token is used for payment. The vendor module contains two parts: a part with a numeric keyboard, and a part with a circular display. We call the latter the 'traveler', since it can move from the vendor module to the customer module.

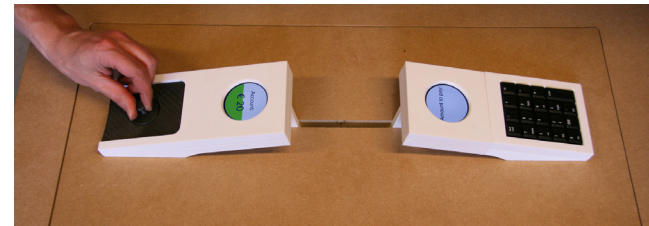


**Figure 4.** The payment terminal and its main components.

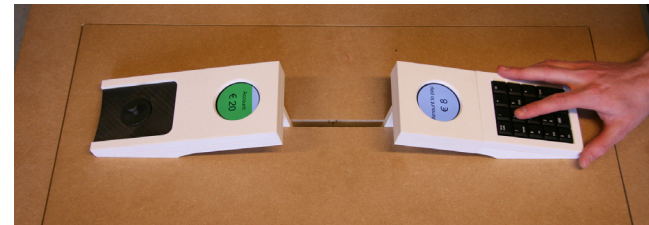
#### *Description of the interaction*

Consider the following scenario: a customer enters a wine boutique and wishes to acquire a bottle of wine for 8 euro. When the choice is made the vendor and the customer move to the payment terminal and the payment procedure starts. They find the terminal in rest, both displays showing a plain white color (figure 4). The terminal is designed such that there are natural sides for the vendor and the customer to take with the counter in between them. The whole setting is symmetrical and well balanced.

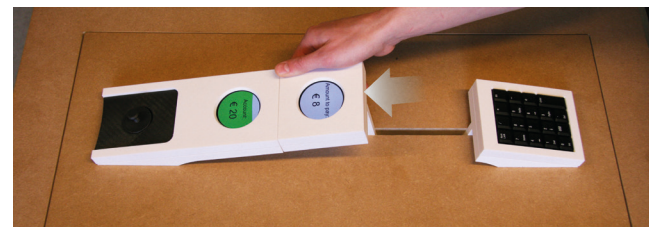
The customer places his token in the cradle of the customer module (Figure 5) whose display then shows a green 'liquid' rising from the token, indicating the amount of money in the customer's account. The vendor enters the price of the bottle by typing it on the keypad of the vendor module (Figure 6). The display on the traveler shows this amount.



**Figure 5.** The token is placed in the module which then shows the money in the account.



**Figure 6.** The vendor types the payment amount on the keypad.

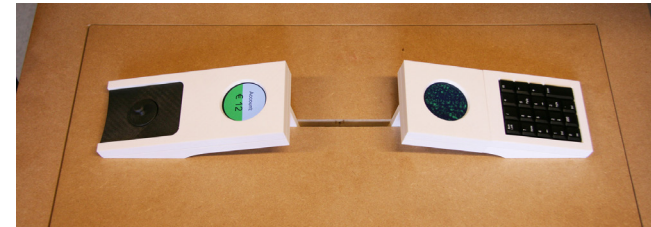


**Figure 7.** The vendor moves the traveler to the customer side.

The vendor mentions this amount to the customer and moves the traveler with his hand towards the customer module (Figure 7). While moving, the payment amount turns around, to become readable for the customer. Once the traveler has arrived at the customer module, it stays there (Figure 7). The customer module now seems to have become larger, while the vendor module has shrunk. The visual balance that was established in start mode, is clearly broken. The customer now sees two displays: the display with his account, represented by the green liquid, and the display with the payment amount. To execute the payment transaction, the customer pushes the slider with the token in the direction of the vendor (Figure 8). The slider slides in, seems to appear on the customer display, and moves the green liquid into the traveler display with the payment amount. A few seconds later, the traveler automatically moves back to its original place, at the vendor module. The money literally moves towards the vendor. At the end of the transaction, the two similar shapes are restored, and so is the visual balance of the whole setting. The customer display shows a lower liquid level, and a new account status (Figure 9).



**Figure 8.** The vendor pushes the slider with the token inserted towards the screen.



**Figure 9.** The payment terminal is back in balance.

## Discussion

The interaction in our terminal is divided by the two traveler movements: the movement from the vendor towards the customer (Figure 7), conveying the payment amount to the latter, and the reverse movement (Figure 8), where the money is transferred. Both movements have a direction and a measurable distance, which can be compared to the dimensions of the user's body. The idea of transferring matter from one person to another, forms the basic concept of our terminal. This concept appeals rather to our perceptual-motor skills than to our cognitive skills [1].

The position of the traveler indicates whose turn it is to take action: the vendor or the customer. This way, our device instigates a choreography between the two actors. This opens the gate to a spontaneous and intuitive interaction. The physical movements of both the device and the two actors resonate with the on-screen movements on both displays.

Our terminal makes use of two displays. These displays carry information, textual feedback and feedforward [1]. Next to that, they also carry matter. The dematerialized money gets a tangible shape within the context of the payment terminal and its displays. It temporarily materializes as the green liquid, which is

poured in the customer display and then flows in the traveler display. This leads to an interaction that is visually rich, engaging and rewarding.

By reflecting on the design of our payment terminal, a designer of dematerialized products will understand that dematerialization does not necessarily lead to generic interactions and more abstraction. By exploiting the single-purpose character of dematerialized products, the designer will discover a way to design a new, specific interaction ritual that combines the physical richness of the former information carriers with the flexibility and versatility of the digital world.

### Future research

In further research, our payment terminal will be submitted to a user test in a closed environment, and compared with an existing terminal, the latter being an exponent of the second way. First, we will test if our terminal, and therefore our third way, does provide a particular, preferably positive user experience. Second, we will determine how it does that, and which mechanism lies behind it. With the results of this user test, we seek to further define our third way, provide evidence for its validity, and transform it into a fully fledged design perspective.

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