# **Embodied Technology: Unraveling Bodily Action with Normative Types**

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## Abstract

Interactive artifacts are normative, as they materialize the norms of their designers in order to guide human action in a use-context. A better understanding of how interactive artifacts transmit norms can support designers and users to critically reflect about appropriate human and designed artificial behavior in context. In this paper we introduce 'normative types', which are artifacts that disable, guide, or empower people's bodily actions, in order to deliberately address and explore what is normative physical action in context. We present four design explorations of normative types, named 'Petal Table', 'Toilet Companion', 'Keep-Up-With-Me Table', and the 'Ring Fork'. Based on initial field trials we suggest that socially (in)appropriate bodily action can be imposed, exposed, juxtaposed, or opposed by normative types. We suggest that these modes of intention can aid designers in developing a critical self-reflective and contextually informed design approach.

### **Author Keywords**

HCI; Interaction Design; Industrial Design; Design Ethnography; Normative Types.

## **ACM Classification Keywords**

H.5.2 [Information interfaces and presentation]: User Interfaces. Interaction Styles, Prototyping.



## Figure 1: Our explorations of Normative Types

- A) 'Keep-Up-With-Me Table'
- B) 'Petal Table'
- C) 'Toilet Companion'
- D) 'Ring Fork'



**Figure 2**: 'Table Manners' in use during a field trial

#### Introduction

Interactive artifacts aspire to support human action to access a computational function in an efficient, effective, beautiful, or satisfactory manner. These artifacts cannot be neutral [8]. Firstly, this is because they will elicit emotions from people, and secondly, because they embody the norms and beliefs of their development teams, as a developer's sense of what is logical, sufficient, appropriate, or beautiful is scripted in the form of, and interaction with, the artifact [6, 14]. However, a designer's understanding of what a normative action is in a given situation, might not comply with actual norms at the moment of use [1, 10]. An artifact's behavior, whether autonomous or in response to human action, might conflict with people's notions about expected or appropriate behavior. A challenge for developers of interactive products is thus to understand *how* an artifact's embodied norms and beliefs fit a given practice or social context. For example, the use of mobile phones in public space might cause inappropriate or undesired social behavior, depending on how the device is used in situ [11].

This exploration is part of a larger project on *Embodied Technology*, where we are interested in the role of technology in relation to bodily action in space. To highlight how interactive artifacts can embody, set, and transmit norms surrounding physical actions, we present what we term 'normative types': artifacts that disable, guide, or empower people's bodily actions, in order to explore what is socially normative in a given context or practice.

#### **Mundane Artifacts**

Our focus is on everyday furniture and utensils in our explorations of normative types (Figure 1), as these

sort of artifacts are inherently perceived as 'normal' – i.e. both the words 'normal' and 'normative' etymologically derive from 'norm' – being a standard, a pattern, or a model. Mundane 'industrial' artifacts can exert influence on human action in various ways, for example in their forcefulness (a strong or weak influence) or salience (a hidden or apparent influence) [13]. Similarly, *interactive* artifacts could be designed to exert normative bodily action in various ways.

Inspired by designerly adaptations of breaching experiments [9] and critical and speculative design attitudes [7], our approach to address the normative is to 'defamiliarize' the familiar use of mundane everyday objects [4]. In such an approach it is important to maintain a 'perceptual bridge' [2], i.e. a means for the viewer to connect their perception of the world with the estranging element of the concept. A slight strangeness can be enough for an artifact to not become too weird and be dismissed, but also to not stay too familiar and be absorbed into reality as it is [2, 3, 6]. As we are interested in the appropriateness of bodily actions in context, the static form of most of our mundane artifacts was changed as little as possible. This means that the static form would remain close to people's expectations of everyday objects. However, the temporal form and dynamic behavior of the chosen mundane artifacts were designed to potentially appear slightly strange. This would enable us to better understand actual bodily actions and interactions around the normative type. In the following we present our initial findings of how normative physical action was imposed, juxtaposed, exposed, or opposed by a set of normative types that were developed during a 'User Experience Design' course and an ongoing PhD project at the University of Southern Denmark.



**Figure 3**: The 'Toilet Companion' moving its handle between its outer positions

## Imposing Normative Bodily Action with the 'Petal Table'

A table is a supportive artifact to a wide range of human activities. These activities typically require people to spend some dedicated time at the table, be it out of protocol, politeness or manners. For many uses of a table, serenity and calmness is required. However, transitions from a prior activity into this calm state can happen in undesirable ways, for example when rapid paced physical movements disturb a state of concentration.

The 'Petal Table' (Figure 2) aimed to address this issue by creating an imposition upon people to approach the table in a calm way. A number of ultrasonic sensors in the table's foot detect the direction and speed by which the table is approached. The top of the table consists of three petal-shaped surfaces that can each independently move from each other. These surfaces react to the pace in which the table is approached: if the table is approached in a calm way, the table stays in its idle state. If the table is approached rapidly, the surfaces retract into the opposite direction of the person who approaches it, *disabling the table's basic functionality*. After a few moments, the surfaces then slowly return to the idle state.

#### Initial responses

'Petal Table' was field tested with engineering students during three informal evaluations at our university. In one test a student was asked to study at the table for a period of an hour, in a second test people were asked to have a drink at the table, and in a third test the table was placed among other tables in a canteen environment. The table was most active in its movements during the third test, as many people passed rapidly to find an available table for lunch. This evoked curiosity as people stopped and further inspected the table. During the first two tests, participants expressed a slight pressure and anxiousness while sitting at the table, as the table would move quite abruptly. This resulted in participants verbally and non-verbally 'forcing' each other and bystanders to act in a calm way. In line with the table's design intention, participants expressed that a calm environment was highly desirable during a coffee break or while studying; but the uncertainty of when the table would retract was clearly uncomfortable. Overall, the table imposed participants to act upon its exerted normative intention, though it was counter-effective in actually achieving a calm local atmosphere.

## Exposing Normative Bodily Action with the 'Toilet Companion'

A toilet room is typically a solitary private space. However, this room is also part of a larger social place, which is reflected in its diverse uses. Besides the usual sanitation activities, other non-toilet-specific actions might include doing make-up, reading, writing or playing computer games. This blend of interaction qualities that simultaneously bring together private and social, utilitarian and hedonistic activities, prompted an exploration about the feeling of connectedness in toilet rooms, and how to deliberately design for this context with social connectedness in mind.



**Figure 4**: 'Keep-Up-With-Me Table' in use during a university exhibition

The 'Toilet Companion' (Figure 3) is an augmented toilet brush that aims to provide moments of joy on the toilet, yet also encourages usage of the brush when it is likely to be necessary [5]. The brush detects the amount of time a user sits upon the toilet seat, and initially starts to gently move its handle to draw attention to its presence. Over several minutes, these movements become increasingly conspicuous through gradual acceleration of the handle's rotations. As time passes further, the brush draws attention through small up and downward rapid movements, to encourage the toilet-goer to pick up the brush for usage. In use, the toilet brush generates beeps in response to human handling. These beeps were intended to provide a sense of reward and accompanying pleasure.

#### Initial responses

Field trials with eight students in a unisex university toilet room showed that the brush was not considered to be a companion. Instead, it was seen as an object that challenged the boundaries of the otherwise private context of the restroom. This could mainly be attributed to the unexpected side effect of the sounds produced by the toilet brush: not only did the brush produce sounds during cleaning, but its embedded motors also made a loud crunching sound during the movements of the handle. The intensity of the sound (from unexpected crunches to designed sounds) would directly indicate the duration of toilet usage to people outside the toilet room. Further, as one participant reported in reply to the designed beeps: 'For me its more about the others. I don't want the others to know that I'm doing that. Then they know that I've been *doing business'*. The sounds turned private activities

into a more publicly perceivable event. The 'Toilet Companion' as such revealed normative bodily action, by exposing bodily (in)action during private events. This suggests that normative types may be mobilized to serve as a design ethnographic artifact to deliberately breach intimate spaces.

## Juxtaposing Normative Bodily Action with the 'Keep-Up-With-Me Table'

Sharing a mealtime brings a sense of belonging and social connectedness. However, these moments might be disrupted when the eating pace of participants is not aligned. For instance, the person who is the first to finish the food on their plate might be considered impolite, or might not enjoy watching others eat. However, the person who is last to finish their food may suffer the discomfort of being watched by their dining companions.

The 'Keep-Up-With-Me Table' (Figure 4) aimed at synchronizing the relative pace of eating between meal sharers, to guide diners in keeping pace with each other [12]. This table incorporates a mechanism to gauge the relative weight of food on the dishes of dining partners. Actuators gradually raise the dish of a slower eating partner, and lower the dish of a faster eater by a corresponding amount. This results in the dish of the slower eater to be gradually positioned in closer proximity to their mouth, while the dish of the faster eater gradually moves lower below the surface of the table. These discrete signals aimed at bringing the eating pace of dining companions iteratively back into mutual alignment.



**Figure 5**: The 'Ring Fork' in first encounters and use

#### Initial responses

The table was deployed at a public exhibition in our university. Ten visitors ate a bowlful of soup at the table. In these informal tests, we observed three patterns in responses and behavior: firstly, the speed of eating became a lighthearted topic of conversation amongst participants, playfully making eating pace 'accountable' and not rude or impolite to discuss. Secondly, if their bowl became lower than the surface of the table, some participants paused their eating. This in turn increased attention for the other participant and decreased the focus on eating. Thirdly, as the platforms moved very subtly, the change in height was not always noticed during eating, which created moments of wonder at the times that the height of pl plate was noticed. Overall, the short trial with the table suggested that the normative became negotiated across participants by juxtaposing their bodily actions over a dining time.

## **Opposing Normative Bodily Action with the** 'Ring Fork'

Dining equipment such as plates, utensils and glasses play a pivotal role in consuming food. These objects are often 'seen but unnoticed'. This invisible normative role could potentially be better understood by estranging them, to observe how participants appropriate and relearn the objects in a dining context.

The 'Ring Fork' (Figure 5) is a modified fork, that instead of having a handle that can be held to control the fork, has a ring that can be put on a finger. In contrast to the previous normative types, the Ring fork is not interactive. However, we anticipated that the static form would appear familiar and become 'slightly strange' in actual use. As the size of fingers varies between people, the Ring Fork requires each user to find an appropriate position for the ring on their own finger, and secondly requires them to adjust their bodily movements according to where on the finger they chose to "wear" the utensil.

#### Initial responses

Initial field trials with the 'Ring Fork' were held in a family home and in our university canteen. These cases showed how users explored various ways of holding the Ring Fork, how these effected the movements emerging from that particular "holding-style", and ways to deal with the particular kind of food they were eating. The utensil was generally usable but was also a prompt to explore alternative ways of moving: in some instances these explorations emerged from difficulties to control and manipulate the fork, as when the ring would be too big, or too small to be worn in a particular way. At other times explorations were carried out in a playful way. Wearing the 'ring-fork' induced almost all participants to eat in a variety of ways that opposed normative dining manners. For instance, by making disproportionately sized movements to move food towards the mouth (Figure 5, top), or make actions judged as "aggressive" or impolite (Figure 5, bottom). During use, the fork could thus be seen as breaking prevalent bodily patterns and habits related to eating practice. This resulted in bodily action that was opposing the normative action that is expected of consuming food with a utensil.

### Discussion

We have introduced normative types as a means to unravel socially appropriate bodily actions in a given situation. Initial trials with four normative types suggested that (in)appropriate action can be imposed, exposed, juxtaposed, or opposed. By bringing unarticulated norms to the foreground in these various ways, we hope to support designers and users to critically reflect about appropriate human and designed behavior in context. This might support developers to better understand how their norms are materialized in their designs, and to aid a contextually informed design approach. However, other than small scale informal testing within our own university, we have conducted little testing of our artifacts. We will soon more rigorously evaluate these design examples 'in the wild'. Additionally, we will need to further populate the design space of normative types to explore other ways of addressing bodily normative action in temporal form of mundane artifacts. This is intended to lead to a better understanding of how norms are transmitted and can be exerted in interactive artifacts.

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