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Table manners: The influence of context on gestural meaning

Abstract

We investigated the activation of gesture control for a dining room table lamp. Using video scenarios which show a user interacting with the lamp during a dinner with friends, we carried out an online user test comparing the existing activation through hand gesture with three new alternatives: clapping, finger snapping and voice. Though we had expected users to prefer these alternatives for being more fluid, easier and faster than the existing initiation through hand gesture, the opposite turned out to be true. They were considered intrusive since they disturb through sound, through their connotations and by violating the personal space of others. We argue that the appropriateness of gestures is strongly dependent upon socio-cultural context and should be evaluated in the final use context.

1 Introduction

In this project, we focused on an interaction style called deviceless gesture control. Deviceless gesture control allows users to operate devices from a distance without the need for physical remote controls, body-worn electronics or markers [1], [2].

One of the challenges with deviceless gesture control from a distance is that it is difficult to distinguish between gestures which are intended to control the product and gestures which are not. That is, if gesture control were continuously enabled, users may unintentionally trigger a function. For example, if the brightness of a dining room table lamp were continuously controllable through an up-down gesture, any vertical movement such as picking up a pan would influence the lighting. To prevent such frustrating, unintentional triggering, gesture control should only become active after users have explicitly activated gesture recognition. This activation is called the initiation action.

2 Use Case: A Dining Room Table Lamp

One of our business divisions developed a gesture-controlled prototype version of a Philips Arcitone dining room table fixture (Figure 1). With this suspension light, brightness can be controlled through a vertical hand gesture. Moving the hand upwards increases the fixture's brightness, moving the hand downwards dims it. The advantages of using gesture control for this type of pendant light is that the user need not walk to a wall dimmer, use a remote control nor touch the fixture which would lead to it to sway. This Arcitone pendant was first publicly shown to critical acclaim at Light + Building 2010, a trade fair on architectural lighting [3].

The gesture initiation movement for this pendant requires the user to move a hand horizontally from either end of the lamp to just below the middle, then move this hand downwards vertically, to finally stop and wait for two seconds for the luminaire to confirm its initiation through blinking (Figure 2).

Fig. 1. The Arcitone gesture-controlled pendant.

2.1 The Gesture Control Paradox: The Unnatural Initiation Gesture

The difficulty in deciding upon an initiation procedure based on movement only, is that the movement should not occur in daily ritual as gesture control may then be activated unintentionally, thereby defeating the point of having an initiation gesture.

The paradox then is that while gesture control is often described – as is voice control – as a form of natural interaction, the required initiation is unnatural by definition.

Indeed a user test conducted by the business division concluded that, although the initiation was easily learnable, it was not intuitive. Our team was asked to investigate alternative ways of initiating gesture control.

2.2 Project Scope

When we started our project, the product design and gesture sensor technology for the dining room table fixture had already been frozen. Therefore it was not possible to change the form factor. This blocked the possibility to add use cues to the existing form or to incorporate additional visual guidance through LEDs or displays. Alternative initiation actions would have to work in combination with the existing product design and sensors.

3 Critiquing the Existing Initiation Action

In its strictest definition, intuitive interaction implies that it is immediately clear to the user how to act in order to achieve a certain goal. In other words, users should not need to learn the right action by trial and error, by instruction, or by having to read

the manual. This is difficult to achieve with deviceless gesture control, especially if no changes can be made to the product design. We therefore focused on three aspects in which the initiation gesture clearly fell short: naturalness, repeatability and speed.

3.1 Naturalness

The original, movement-only initiation gesture has a rather mechanical, even robotic expression, as there is no flow to the movement. Due to cost-driven technological choices, the user is required to move orthogonally (first horizontally, then vertically) and then pause (Figure 2). As a result, the initiation action felt like an unlocking procedure and rather contrived.
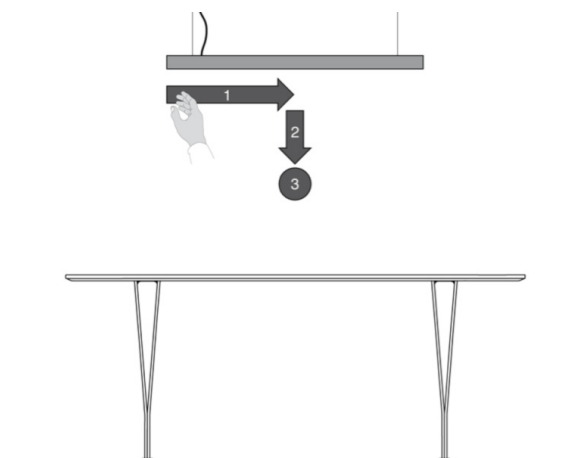

Fig. 2. Diagram showing the dining room table fixture suspended above a table. The original initiation gesture required users to: (1) move their hand horizontally from the side to just below the middle of the lamp, (2) move it vertically downwards, (3) hold it still for two seconds.

3.2 Repeatability

Even experienced users did not always manage to initiate gesture control successfully every time. Initiation would fail if the user moved too quickly or too close to the sensors. So, even though the gesture is easy to remember in broad terms, it can be difficult to execute it exactly correctly. The main reason for this is that users only get feedback after they have completed the initiation movement, not during the movement. Since the interaction lacks real-time feedback, users cannot correct their actions mid-movement. Their only option is to carry out the movement and hope that it will turn out to be correct. If not, they have to start all over again which causes frustration.

3.3 Speed

Because of the change of direction and the pause, the initiation gesture feels long-winded, even though the initiation may only take seconds in absolute terms. The emphasis is more on the initiation gesture than on the functional gesture which changes the brightness.

3.4 Design Brief

Ideally, an initiation action should be accompanied by continuous feedforward and feedback, which makes users understand what is going wrong in case of errors and which allows them to correct their actions [4], [5]. However, with the product design already finished, our options to provide such continuous guidance were limited. We therefore aimed for an initiation action which was short, so that in case of a false negative users could try again without becoming too annoyed. The initiation action should:

• Feel fluid and not be discontinuous in either space or time. The user should be able to continue immediately with the up-down gesture to control the brightness.
• Be sufficiently unusual to score low on false positive (i.e. the product mistakenly flagging an event as an initiation action), yet be simple enough not to result in many false negatives.
• Be easy to get right every time without many false negatives (i.e. the product mistakenly ignoring an intentional initiation action) and without requiring additional guidance.
• Feel instantaneous.

4 Initiation Alternatives

Through bodystorming we explored three initiation alternatives: finger snap, double hand clap and voice. Finger snapping and clapping were already suggested repeatedly by test participants during earlier evaluations of gesture-controlled lamps. All three alternatives are multi-modal, require the recognition of both sound and movement, and allow more fluid, simpler and quicker initiation whilst managing the risk of false positives. Simpler initiation is also interesting from a communication perspective. As it is not self-evident that a product can be controlled through gestures, marketing gesture-controlled products is likely to require an explanation of this new technology and how to interact with these products. There are many touch points at which both brand and user benefit from a simple initiation gesture which can be explained in a split second: in advertising, at point of sale, on the packaging, in the manual etc.

4.1 Finger Snap, Double Clap and Voice

With finger snap initiation, after users have snapped their fingers underneath the luminaire they can immediately change the brightness by moving their hand up-down. The initiation procedure through double clapping is similar, with the only difference being that instead of having to snap their fingers, users have to clap their hands twice underneath the luminaire. With voice initiation, users first say the name of the luminaire to activate gesture control. This is similar to human-human interaction in which we first attract a person by saying their name to get his or her attention before we enter into conversation. The risk of false positives with voice initiation is increased if the word which is used as the voice command does not occur in everyday conversation. As the concept was to be tested in Holland, we chose the name 'Linea', meaning 'line' in Italian, as the name befits the minimalist rectilinear form factor and because the word 'Linea' is not part of the Dutch language. Clearly, this name would not be a good choice in Italy since the word 'linea' occurs commonly in Italian conversation.

4.2 Robustness

The term robustness refers to the ability of the product to withstand adverse, confusing conditions. With sound recognition, various noises may be mistaken for the initiation sound. Though finger snapping has the

Fig. 3a. Initiation by hand movement.

Fig. 3b. Initiation by finger snapping.
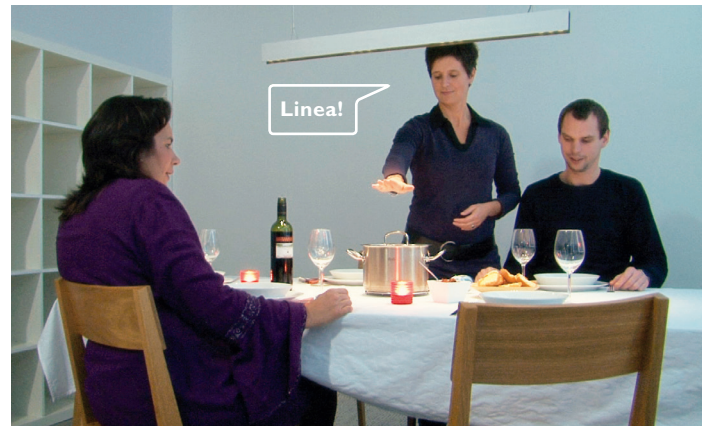

Fig. 3c. Initiation by double clapping.

Fig. 3d. Initiation by voice.

advantage that it can be done one-handedly, double clapping is likely to be more robust than a single finger snap. A single sound spike can result from all sorts of actions (e.g. putting the lid on a pan, throwing a magazine on the table), possibly resulting in false positives, whilst two loud noises in succession are far more unlikely to occur. Whilst clearly it would be possible to analyse the waveform of the sound to determine its origin, this puts higher demands on the processing power of the embedded microcontroller and thus raises the product's complexity and bill of materials.

The robustness of all three initiation methods can be increased by requiring that sound and movement have to be detected simultaneously. That is, the luminaire only initiates if it 'hears' finger snapping, double clapping or voice whilst detecting movement in the active zone. If people make an initiation sound anywhere in the room without movement being detected underneath the lamp, gesture control will not be activated.

5 Online, Video-Based User Tests

To obtain user feedback we shot video scenarios of the initiation options being used during a dinner party (Figures 3a-3d). The resulting video clips were evaluated in an online user test. The original, movement-based initiation was the only method which was technically operational. The other three (finger snap, double clap and voice) were executed using a Wizard-of-Oz set-up. As the actor carried out the gestures, the brightness of the lamp was controlled from behind the scenes.

5.1 Hypothesis

Our hypothesis was that the alternative initiation procedures would be preferred over the original movement-only initiation, as the alternatives were less contrived, less convoluted and faster.

5.2 Experimental Design

Twelve participants (5F, 7M) took part in the evaluation. For the user evaluation AttrakDiff was used [6]. First, the participants watched the four movie clips in randomized, counter-balanced order. Then they watched them one by one, completing a questionnaire after each viewing. They also sent us their comments and critique.
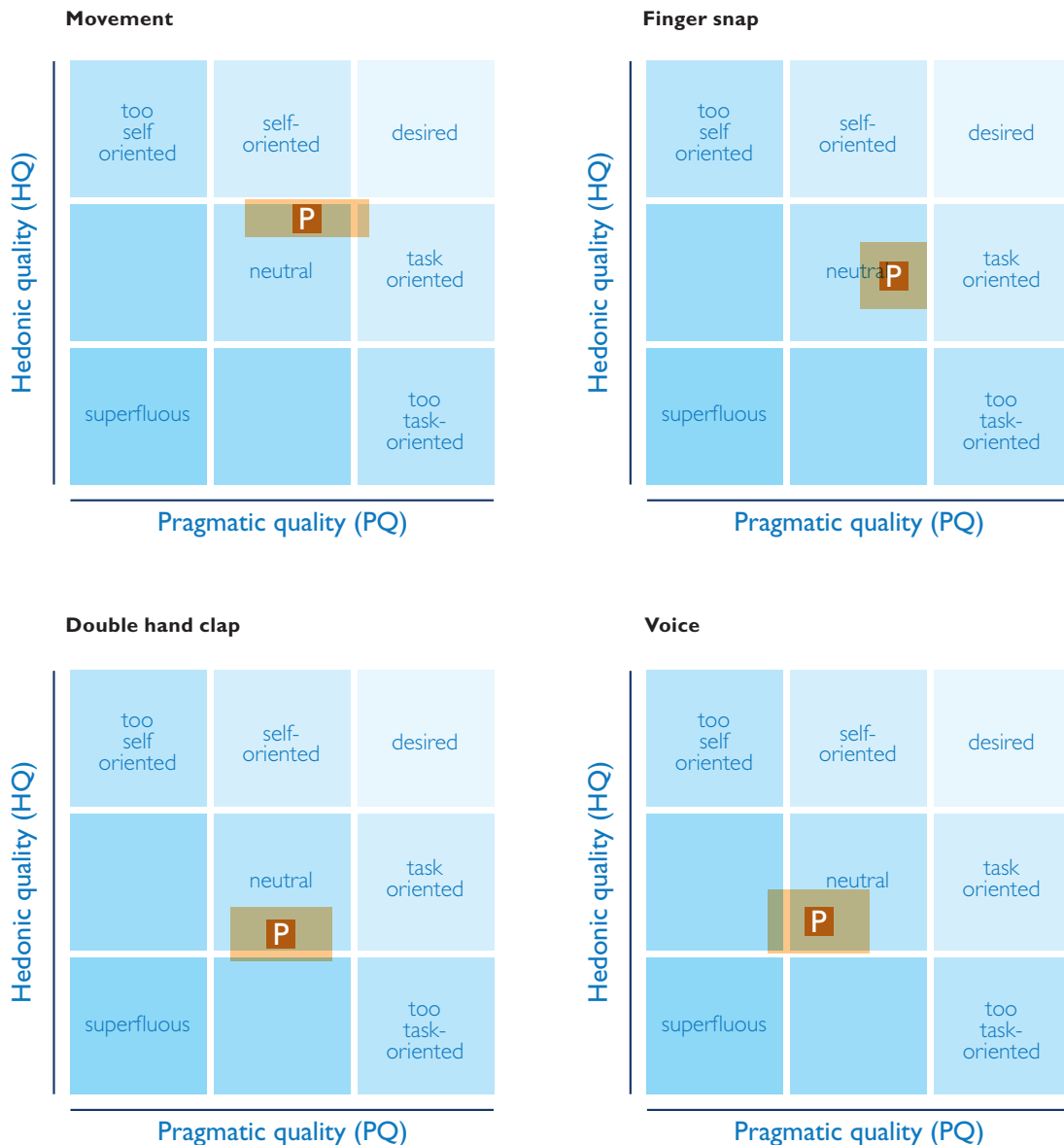
Movement

Finger snap

Double hand clap

Voice

Fig. 4. AttrakDiff test results for the four initiation actions.

5.3 Results

The results are shown in Figure 4. Since the comparison was based on video rather than on interaction with working prototypes, all initiation methods offered apparently perfect recognition: in all four videos the user makes the correct gesture and the product initiates correctly. Once implemented, some methods will have a higher recognition rate than others. Such recognition errors were not taken into account in this test. The pragmatic quality scores are therefore not a realistic reflection of real-world usability, but rather an indication of perceived usability. On the hedonic axis we see that finger snapping, double clapping and voice all score significantly lower than the original movement-based initiation. Hedonically, only finger snapping approaches movement-based initiation.

5.4 Discussion

For an explanation of these results, consider some of the comments provided by our participants.
Finger snap. It's considered impolite to attract attention by snapping your fingers, but may be acceptable to a device. Still, guests at the table may be disturbed.
Voice. Too loud and noisy.
Movement. In my opinion this is the friendliest way to control the lamp, with the least hindrance on what is going on around the table.
Double clap. This is too loud and noisy (e.g. when you're in a conversation), people will be shaken up, conversations might stop and all attention will go to controlling a lamp. / I don't want to clap my hands in front of my guests' noses nor make some funny noises just to activate a dining lamp. / Gesture-controlled

activation seems most logical to me (…once you know how to use it and get used to it). In the movie it still comes over a bit unnatural and complicated to me. The recurring critique appears to be that the alternative initiation methods are too intrusive for three reasons. First, in a dining setting double clapping and finger snapping both have the connotation of attracting attention with an air of superiority (e.g. calling a waiter, reproving children). Second, suddenly speaking to the lamp, the sound of finger snapping and double clapping may interrupt conversation. Third, by making these gestures close to other people's faces, the user is intruding upon their personal space. Considering that a table may only be 100cm wide and that the lamp is suspended above the middle of the table, the user may be finger snapping or double clapping as close a 50cm from the face of a table companion.

In terms of hedonic quality, only finger snapping comes close to movement-based initiation. However, not everyone can snap their fingers sufficiently loudly, resulting in consumers being locked out from using the product.

In this particular use context, the original movement-based initiation therefore remains – at least from a hedonic point of view – the preferred initiation method. The only way we may achieve a simpler initiation is by reconsidering the product design and concurrently designing the product's form and required gestures.

6 Conclusions

Our experiences with the dining room table fixture resulted in the following recommendations for the design of gesture-controlled products:

- Use a holistic approach: product form, interaction and gestures should be designed concurrently as they are strongly interdependent. Premature decisions on form without considering interaction and gestures can result in 'digging yourself a hole' and the loss of design opportunities.
- Provide continuous guidance: the product should guide users during, rather than after, a gesture through feedforward and feedback, thereby allowing users to correct their actions.
- Evaluate in context: gestures should be evaluated with a product's final form factor and in the intended socio-cultural context.

Gestures carry not only functional information but also socio-cultural and even emotional connotations. Therefore, gestures which are simple to execute may still be inappropriate in particular contexts. The three multi-modal initiation actions were both simpler and more robust than the initiation by movement only. Yet users disliked them, as they were considered to be in violation of good table manners.

This case study shows that we need to consider the connotations or feelings that gestures might invoke, something which can only be judged in combination with the use context. Looking back, we did act out the alternative multi-modal initiation actions in the early stages of the project, but only in a meeting room setting with a single user operating a task light. It was not until we tried these initiation actions in a setting with dinner guests and the fixture above the dining room table, that we discovered the negative associations of the gestures.

Acknowledgments

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