Interaction Design Feedback and Feed Forward Framework: Making the Interaction Frogger Tangible

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ABSTRACT

In this paper, we present a tangible version of the design framework Interaction Frogger [4]. First, all terms used in the framework are explained using examples. Then, we present how the framework can be used to analyze products, compare products and improve interaction in products using examples from a workshop. Finally, we discuss how the tangible framework can show new possibilities for (improving) design on a more concrete level.

Keywords

Interaction Design, Feedback, Feed Forward, Tangibility, Framework

1. INTRODUCTION

To analyze human-product interaction, the Interaction Frogger (IF) was created by studying theory as well as design practice, "to analyze person-product interaction in terms of the couplings between the person's action and the product's function through the use of inherent and augmented information, i.e., feedback and feedforward."[4, p1] The framework itself is reduced to a theoretical application and graphical representation of human-product interaction and requires theoretical background knowledge before designers can start to use it, which adds difficulty to directly apply it to the design practice limiting its use to design research [3]. Our contribution to the Interaction Frogger is to provide a Tangible Interaction Frogger (TIF) which offers freedom of interaction to designers by making theory physical and social [1].

2. UNDERSTANDING THE FRAMEWORK

Analyzing interaction of human product interaction is an abstract process while the interaction itself is often non abstract. By making the IF tangible we attempt to present the information about interaction in a less abstract way.

2.1 Four Phases

As stated by Wensveen[4], in analyzing interaction we run through 4 states: Action, Inherent Information, Augmented Information and Functional information. The three kinds of information contain both feed forward and feedback. To understand how these four phases are related to each other we use the example of turning on a television using a remote control and the definitions by Wensveen [4: p.3-4].

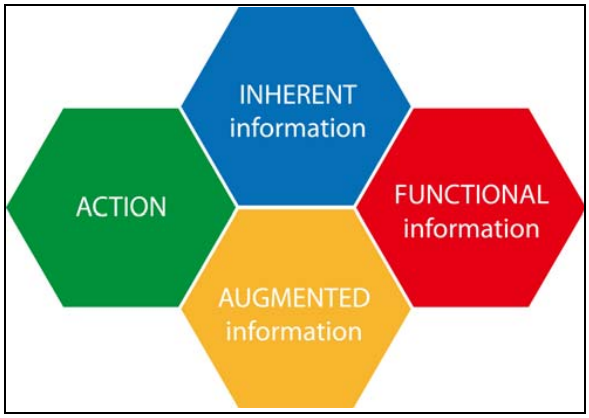

Figure 1. Four states (Action, Inherent, Augmented, Function)

The action in this example is pushing the button of the remote control.

Inherent Feed Forward: The information that communicates what kind of action is possible and how the action can be carried out.

Inherent Feedback: The information returned from the action itself, in physical terms.

Inherent feed forward is given by the button itself: the button looks like it can be pushed. (Instead of moved, turned, etc) While pushing the button, the button provides feedback, the user can actually feel the state of the button is changing, it is giving physical feedback to the user. (For example, while moving in front of a Kinect, the user does not get any physical feedback from the product confirming that the action is received).

Augmented Feed Forward: The information received from an additional source about the action possibilities or the purpose of the action possibilities.

Augmented Feedback: The information received from an additional source once the action has been performed and not related to the action.

Figure 2. Remote control

In the example the icon on the on/off button of the remote control is providing augmented feed forward, as well as the red color of the button (see figure 2); the icon and color tell the user's cognitive skills this button is probably for turning the television on and off. After pressing the button an indication LED on the television will light up, providing augmented feedback that the system received the user's action.

Functional Feed Forward: The information about the general purpose of a product and its features.

Functional Feedback: The information received about the actual purpose of the action.

The television is providing functional feed forward by the fact it has speakers and a screen that provide information about its visual and auditory functionality. After the action is performed the television gives functional feedback by showing an image on the screen and playing the corresponding sound. The user knows the function (s)he wants to achieve is accomplished.

Inherent and/or augmented information connect the action and functional information, like represented in figure 1.

2.2 Six Aspects

How action, inherent, augmented, functional information are coupled can be described using the six aspects of natural coupling. "There are six aspects taken from the physical world which describe characteristics of both the action and the reaction. A unification of action and reaction on each of these aspects makes the interaction intuitive" [6]. We represent them with symbols and make use of questions to describe their meaning; they will be explained by using the television and piano examples.

Time: Does product's reaction and user action coincide in time?

The action and the inherent information is coupled through time, the button is moving at the same moment the action is performed. However, the functional information (the television turns on) is received later on, there is a delay and thus there is not a coupling in time.

Location: Does the reaction of the product and action of the user occur in the same location?

The location of the action is coupled with the inherent information, the button itself is providing this information. However, it is not coupled to the functional information that comes from the television as the location is different, which is good in this example because that is why it is a remote control.

Direction: Is the direction of the product's reaction the same as the user's action?

The action is coupled in direction with the inherent information. While pressing the button, it moves in the same direction as the action is performed. As well, the button is spring-loaded which gives forced feedback in that direction.

Dynamics: Are the dynamics of the reaction (position, speed, acceleration) coupled to the dynamics of the action?

Dynamics can be explained by the example of playing a piano. The dynamics (the speed and acceleration) that is put in pressing the keys can be heard in the sound (functional information) from the piano.

Modality: Are the sensory modalities of the product's reaction in harmony with the user's action? (Sound, light, etc) It refers to the richness of the feedback in relation to human senses.

The action of playing a piano is coupled on modality as well: the user can hear the sound, see and feel that the keys are moving.

Expression: Is the expression of the reaction a representation of the expression in the action?

The expression that is put into the action performed by the user can be heard in the functional information (the melody) of the piano.

2.3 Representing the Six Aspects by Sliders

In the tangible model sliders represent the couplings between action, inherent information, augmented information and functional information. By using the sliders, users of the framework can grade the quality of the couplings and add meaning to it making the couplings more dynamic (See figure 3). Users of the TIF can go through the questions defined in the previous paragraph and draw the couplings.

Figure 3. Couplings in the tangible framework

3. USES OF THE FRAMEWORK

To test the TIF a workshop was set up with two interaction designers from Novo Nordisk [2], a PHD student of Syddansk Universitet and Stephan Wensveen himself. Two of the authors were facilitators while the others were present during the session. The workshop contained four activities, the first one 'understanding the framework', through a 20 minutes presentation in which the four elements, the six aspects and their possible coupling were introduced to our participants using the previously mentioned examples of a television and a melodica.

To make the participants familiar with the IF we run a sense-making activity in which two products were analyzed; a hammer

and an egg timer; in order to show the difference between mechanical and digital products. The facilitators guided them to analyze the hammer first, afterwards they were separated into two groups to analyze the timer and compared and discussed the results later on in an opened conversation.

After building understanding about the theory of the IF and how to apply it in the TIF, the participants analyzed one of the Novo Nordisk's insulin pens. During the analysis, we discovered how the participants acquired a deeper understanding of their product interaction.

The goal of the workshop was to discover if the TIF helps designers to understand the theory used to develop the Interaction Frogger and use the tangible version to analyze products.

From the results of the workshop we want to address three different directions of use for the TIF.

3.1 Analyze Products

Once a certain level of understanding of the framework has been reached, designers can use the TIF to analyze products, they do that by moving the sliders of those aspects that are coupled to show the connections.

In the workshop the participants were given the task to analyze a product from their own company, they draw the couplings by moving the aspect sliders of the four elements, starting from action and going through inherent and/or augmented information to functional information. They did not only show the couplings but the quality of them as well. So they discussed about the quality of interaction in their products. By doing this they discovered why certain interactions with their products are good: it was because there is coupling on many aspects between inherent and augmented information (see figure 4); the user can hardly distinguish whether the feedback is inherent or augmented which makes the feedback rich.

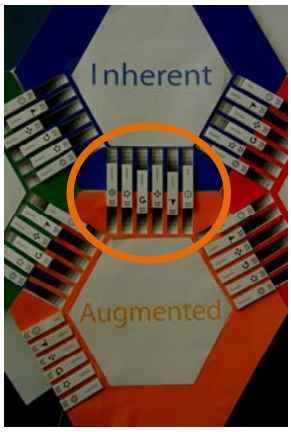

Figure 4. Strong coupling between inherent and augmented information

3.1.1 Choosing Different Paths

An important aspect of filling out the framework is as well freedom of interaction.[5] In the workshop, the participants started with the action that is performed and then go through functional information via inherent and/or augmented information. However, the TIF allows designers as well to start by defining the functional, inherent or augmented information at first and then look how it is coupled to the other aspects (see figure 5), thus helping them to change the focus of the analysis and allowing for new perspectives. When the analysis is made starting from the action the existing interaction with the product leads the path, in contrast when the analysis starts from the functional information, it leads to different insights closely related to the function of the product.

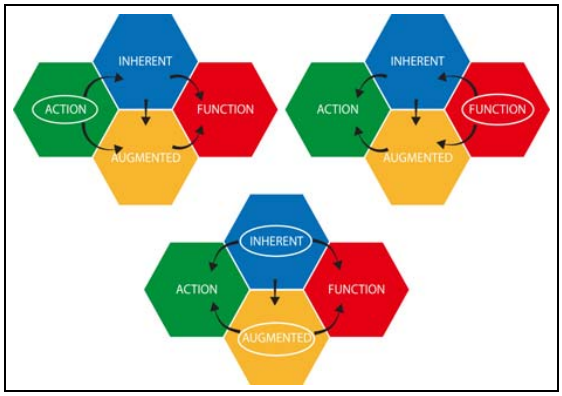

Figure 5. Possible connections in the framework

3.2 Combine Analyzes in a Tangible Way

The TIF can also be used to compare different products or the different analyses of the same product.

For example, in the workshop 2 groups analyzed an egg timer, both groups draw their own framework. While comparing both analyses, participants saw similarities as well as differences (see figure 6).

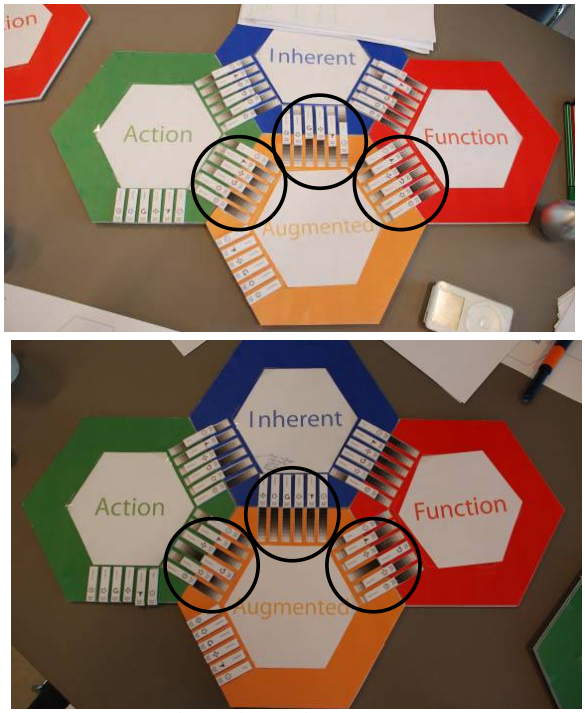

Figure 6. Egg timer analyses

While discussing the results the participants realized that they were not always talking about 'the same aspects'. For example, a good coupling between action and inherent information on the aspect of location could mean the inherent feedback on location is

really good or the inherent feed forward on location is really good. Ideally the slider is a representation of both, but while moving the sliders and discussing within design teams, participants realized that some of them focus more on feedback while others focus more on feed forward.

The value of comparing multiple analyses is on the one hand to get a better understanding of the terms used within the framework and on the other hand to build common ground within the design team. They can for example ask themselves questions like: What do we mean with feedback and feed forward within human-product interaction in our products, what is most important? Which of the six coupling aspects are important for the individual members and which ones are important for everyone? Do we, in providing feedback and feed forward, want to focus on inherent, augmented or functional information or a combination of those?

3.3 Possibilities for New Designs

Finally, the tangible framework can also be used to come up with improvements for a design or opportunities for a new design.

For example, when the participants were analyzing the egg timer, they noticed that the inherent information is not strongly coupled to the functional information, meaning that the physical state of the product does not provide the user with any information about the function, setting a time, (see figure 7).

Figure 7. Egg timer

Because the framework shows this missing coupling, the design team can now discuss on if they want to fill in this coupling and if so on which aspects they want to make this coupling stronger. Overall, the framework helps designers at first to take a look at their products like they did not do before, and also show them new design possibilities. It is however to the design team if they want to use this possibilities or not and judge if these possibilities are improvements for their products.

4. CONCLUSION

By making the Interaction Frogger tangible we noticed that designers can quickly start to use the TIF and get to understand the four elements and six aspects of natural coupling of the IF while exploring the possibilities of the Tangible Interaction Frogger. By doing this we connect design theory used in the academic world to a practical design tool that can be used by designers in as well the academic world as in the industry.[3]

5. FUTURE

TIF allows analyzing quality of interaction. The position of the sliders says however something about the quality of the coupling and not about the quality of design, it is an observation, not a justification. Can we modify the framework in such a way couplings can say something about the quality of design? This is of course difficult since ‘good’ and ‘bad’ design is hard to define, although the framework seems to give opportunities for that purpose as well.

Part of our future considerations regarding the development of the tangible framework address the need of the framework of being a tool that can be used to rate the quality of the interaction with a product instead of the quality of the aspects of coupling. In short, making it more concrete and therefore easier to use within companies to assess the interaction of their products.

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