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## A rich user interface for a digital camera

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**Abstract** In this design prospectus a digital camera with a rich user interface is presented. Rich interfaces borrow from tangible interaction and the concept of affordances. Next, a working prototype of this camera is presented. Finally, four systematic variations of the interface for this camera are shown.

**Keywords** Rich interface · Tangible interaction · Digital camera

### 1 Introduction

Tangible interaction is a hot issue today. Coined in 1997 by Ishii and Ullmer [1] their term comprises user system interaction by means of physical representations of digital data. The examples commonly given for tangible interaction include computer-supported cooperative work (CSCW) and computer supported tools [2, 3]. Although the first well-known example of tangible interaction, the marble answering machine of Bishop [4], explored an alternative interaction style with a consumer product, the relevance of tangible interaction for consumer products seems to be somewhat forgotten.

At our department of Industrial Design in Eindhoven research is conducted on intelligent products, in particular interactive consumer products. Inspired by the examples of tangible user interfaces we envision those products to have what we call rich user interfaces (RUIs). RUIs borrow from tangible user interfacing techniques and from the concept of affordances [5]. Key to rich interfacing is the notion that form, interaction and function are strongly related to each other and should be designed simultaneously. To demon-



**Fig 1** Camera with a rich user interface

strate our ideas in physical form, a design for a digital camera with a RUI was made, see Fig. 1. First we present the design for the digital camera. Next we present a working prototype of the camera and four interface variations.

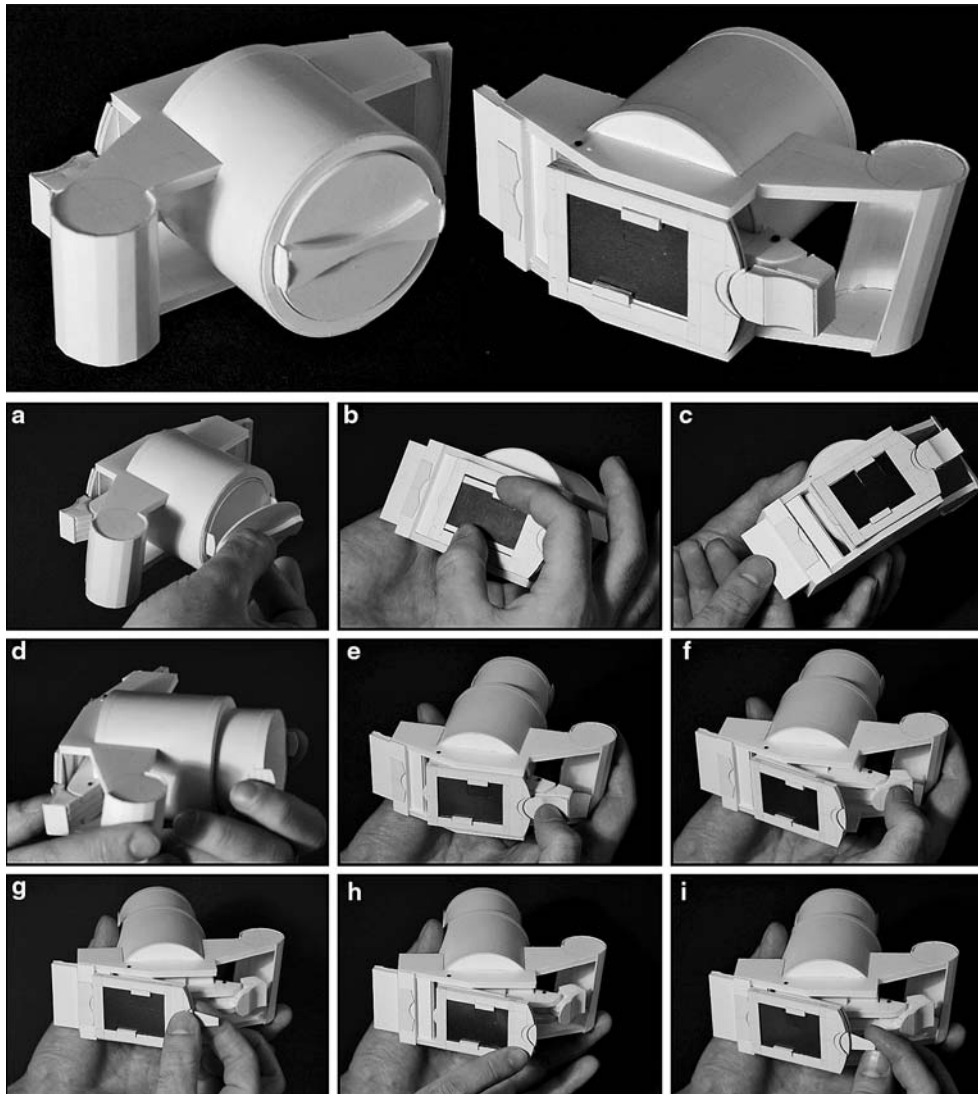
### 2 Design for a digital camera with rich interface

The starting point for the design of the camera was a technical description of the functionality. It was decided to focus on the core functionality of a digital camera. It has the following feature-list.

1. Switch on/off
2. Shoot a photo
3. Reject a photo
4. Store a photo
5. Review/play photos
6. Set size (pixels) of photo
7. Zoom in/zoom out.

The user-actions drove the design. Several pre-models were made to explore form, interaction and

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**Fig 2** Operation of the camera with a rich user interface. When the lens cap (a) is taken off, the camera switches on and displays the image on the screen at the backside of the camera. The pixel size of the photos can be set (e.g. 2,560×1,920 or 1,600×1,200) by changing the size of the screen with physical ‘scalars’ (b). The removable memory card is always visible (c). At the sides of the lens two small handles are placed. When the handles are pulled (d) the lens comes out of the body and one can zoom in on the object of interest. When the composition seems good, the trigger can be pushed (e) to capture the image. The screen will flip away from the lens by means of a spring [screen open position (f)] and one is given the opportunity to review the photo. It now can either be saved or deleted. When the photo is satisfactory it is saved by moving the screen towards the memory card (g). The photo will ‘flow’ from the screen into the card, the screen blanks. The screen is spring loaded and will return to the screen open position when released, it can then be clicked back against the lens and a new picture can be made. If however the photo is not satisfactory the screen is just clicked back (h) against the lens, the image is not saved and disappears, and a new picture can be taken. If the screen is held against the memory card, it clicks into place and it will start to display the images that were stored in the memory card. Those images can be browsed using a small lever (i) that is exposed when the screen is moved towards the memory card

function. Step by step combinations of function and interaction were researched, put into form and tested out. The design process was an iterative process. In testing and changing pre-models the opening of functionality through form and interactivity was assessed. The result of this process was a cardboard mock-up of the camera that offers action possibilities, see Fig. 2. Functionality is expressed solely in the form and in the interaction with the form of the camera, and not in screen based user interface. Although the camera does have a screen it is only used to display pictures and

not to navigate through menus. The controls of the camera not only express what you can do with them, but also express what will happen when you use them [6]. For example, the trigger expresses that it can be pushed. It also shows that it restrains the screen in the closed position. The screen has two possible positions, it can align with the lens and it can align with a trajectory towards the memory card. In this way we try to convey the message that when the trigger is pushed the screen will flip in the other position, thus capturing an image.

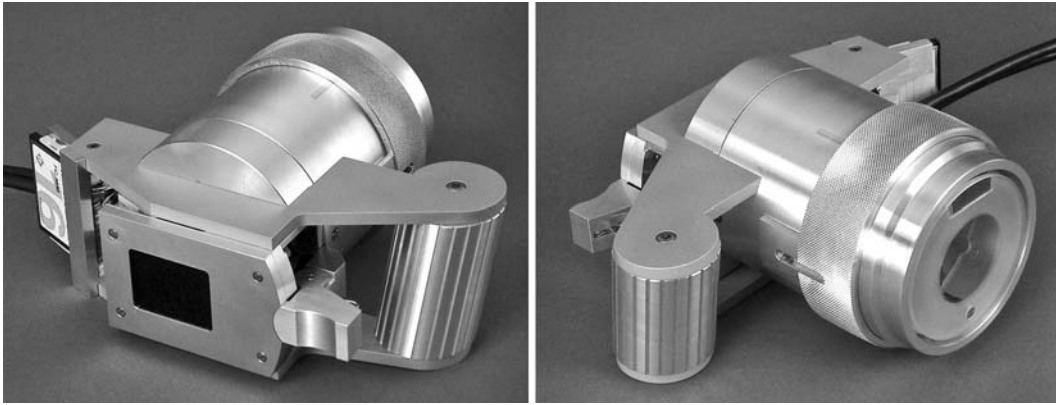


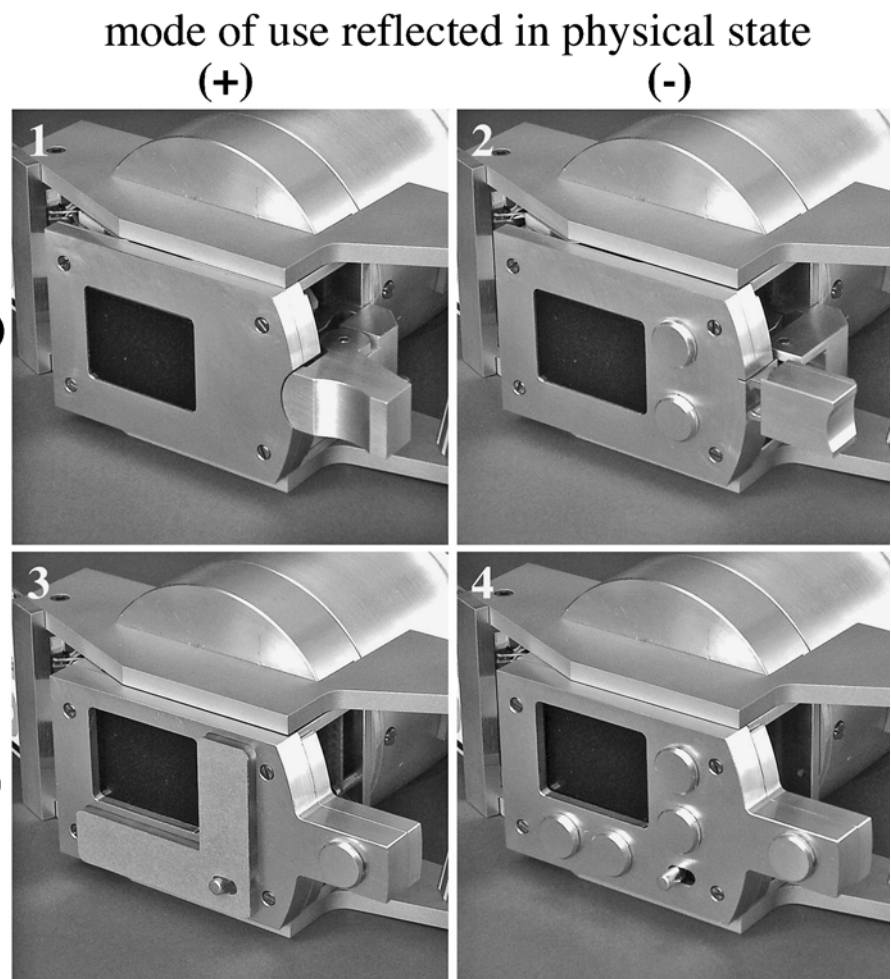
Fig 3 The working prototype of the camera made out of aluminium

### 3 Prototypes

Although the cardboard mock-up of the camera provides action-possibilities it is not reactive. It cannot be experienced. To be able to make qualitative statements on the user experience with the digital camera it was decided to build a working prototype. Moreover, to be able to compare the rich interface to existing interface solutions it was decided to make four systematic varia-

**Fig 4** Four interface variations.  
*Interface variation 1:* This is the original rich user interface. It has mode-relevant action possibilities and it reflects the mode of use in its physical state. *Interface variation 2:* This variation reflects its mode of use in its physical state, but offers all action possibilities always. *Interface variation 3:* This variation does not reflect the user mode in its physical state, it always looks the same. However it has mode-relevant action possibilities. Depending on the mode of use, different controls are shown on the 'L'-shaped area by means of back light. *Interface variation 4:* This variation comes closest to the conventional user interfaces. It does not reflect the user mode in its physical state and it offers all its action possibilities always

mode-relevant action possibilities (+)  
(-)



tions of the interface. First we show the working prototype. Then we elaborate on the interface variations.

#### 3.1 Working prototype of the digital camera

The design of the digital camera was slightly adapted for reasons of modularity and manufacturability. The sliding zoom lens was replaced with a zoom-ring, the ability

to set the pixel-size of pictures was dropped and room was made to fit modular interface units. Also, the design was scaled up 125% to fit the functional parts.

The workings of the digital camera are based on a commercially available camera. The body of the camera was machined out of aluminium, see Fig. 3.

### 3.2 Interface variations

The camera can be fitted with one of the four systematically varied interface modules, see Fig. 4. Those variations were designed based on an evaluation of the original design of the camera. Two variables were found in which the camera differed from most commercially available interface solutions.

1. *Mode relevant action possibilities*: The user of the camera is only offered action-possibilities that are relevant to the user mode the camera is in. If a function is not available to the user in a certain mode, the control for that function is not available either.
2. *User modes reflected in physical state*: The camera shows in its shape the mode of use it is in. For example, the camera has a different shape when it is in camera-mode from what it has when it is in play-mode.

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## 4 Future research

At this moment the camera and the interface variations are ready to be tested. We are working on a comparative user study of the four interface variations. We hope to report on our findings in the near future.

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