Greetings From the Real World! - The Very Meaning of User-Friendliness

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Design vs. science

As designers have to synthesize entire products and/or systems from a vast arsenal of knowledge procured by a variety of diverse scientific disciplines, no designer can be expected to be aware of all the details of current discussion in each of the areas involved.

Moreover, many of the details affecting the design of a product or system have not been explored scientifically, nor will they ever be defined universally by scientific process.

Therefore designers will rather employ a "fuzzy", or intuitive, approach combining the available relevant hard facts with a set of soft assumptions into a more or less holistic working hypothesis, or model, of the circumstances relevant to the task on hand. After all, the job must get done, often with too little time and limited financial resources.

While hardcore scientists frown on this approach as being superficial and unproven, no method has been proposed by them to synthesize the "perfect design" through rigorous scientific procedure.

Even if a designer could take all the available facts (and is there such a things as "permanent" facts?) into consideration, there would still be many factors pertaining to the soft aspects of mood or culture that can only be filled in with the designers' intuitive choices.

The Need for a Working Hypothesis

In the absence of a satisfactory, universally agreed-upon scientific method for an integral synthesis of products or systems, designers rely on their own working hypotheses. Hypotheses exist at various levels of reflection:

37. Designer-Artists reflect little or not at all on scientific content. They create products based on their own moods and feelings; inspiration comes from inside.
38. Designer-Practitioners may have a working hypothesis but rarely ever have the time to sit down and define it in writing; inspirations come from random reading, proprietary research, and occasional conference input.
39. Designer-Theorists will reflect a lot but never get around to test their theories in the real world. They do not design.
40. Designers-Educators occasionally combine theory and professional practice. However, there are few platforms for discourse and development (particularly in Germany where no advanced Master or Doctoral programs exist). Few, if any, working hypotheses are been published, nor is there a suitable platform for cross-disciplinary discussion.

It is the purpose of this contribution, to present a working hypothesis for further discussion and input.

Metaphorical HMI concepts

When computers and processors evolved to allow for complex graphic operations, the Command Line Interface (CLI) quickly disappeared from products other than those developed for highly trained professionals. CLI’s were replaced by metaphorical interface concepts such as desktops, menus, buttons, windows, portals, avatars, or artificial personalities which are all based on the assumption that even a novice user will readily associate specific functionalities with the name of a specific metaphor known to her from the physical world, because the physical world provides the richest source for universally known material and social interactions.

Picture 1: This toddler has already learned that objects separate along a parting line

At a very early age, humans acquire knowledge about the physical world and the objects therein. While playing with objects within reach, a toddler will learn about the object's physical properties. One of the many insights already acquired at a very early age is the fact that two objects separate along a parting line. This enables a person to understand the functionality of doors, drawers, and other moveable objects, such as real buttons and the "buttons" found in graphical user interfaces.

Picture 2: Childhood knowledge about parting lines facilitates the mature user's understanding of graphical objects (such as this simple "button")

There are many more qualities in objects that humans explore as soon as they gain command of the earliest means of motion autonomy. By random playing with objects within reach, humans acquire knowledge about material qualities such as weight and mass and their correlation with the size of an object. Thus they learn how much force to apply when lifting an object thus reaching an optimum of motion and energy economy. Weight and size of objects, together with additional material properties – the looks, the feel, the smell, the taste of an object; the circumstances of the object's first occurrence, the feelings and emotions attached to the event – to form an integral impression in the user's mind. Memories of the total experience will later be produced upon receipt of any singular sensory input anytime in a person's life.

Metaphorical interface concepts will have to respect these early experiences, while designers have to take great pains to avoid perceptual conflicts that would invariably lead to the instinctual rejection of a product or service by any user. Designers (and managers) often underestimate the need for complete holistic concepts of their products and systems. If an object's sound or touch do not coincide with a user's expectation (an expensive-looking toaster whose sounds reveal the cheap metal parts and loose tolerances within), the resulting perceptual conflict will cause an aborted sale, or, at best, reduce the price a person is willing to pay – thus matching the higher risk a person assumes to be taking by her acquisition of a product of lesser quality.

A Universal Real-World Metaphor

Most of our knowledge about the physical world and the objects therein is acquired during early childhood. Very young humans already share this basic ability with birds (and even insects) all of which are capable of constructing mental maps of their environments. Without this ability, any living being capable of autonomous propulsion would be lost in space, never to find their way back to the nest or burrow after foraging for food or escaping from a predator. This basic ability is so deeply engrained in us that we rarely stop to reflect how incredibly powerful it actually is. Consider for a moment the fact that humans have only recently in our history acquired the ability to travel above ground. How come that we are able to construct a mental map of the world as if we had the capacity to fly? How came that maps work? And how come that we are able to look at the map of an unfamiliar town or region, instantly knowing how to reach a desired location? How come we are capable of devising a suitable strategy for finding our way around unfamiliar places even under adverse circumstances, and how, for example, do we intuitively avoid asking the wrong person – e.g. another tourist – for directions, selecting instead an apparent local individual for guidance, without conscientiously reflecting about our selection criteria and method? The answer is, obviously, adaptation. So how does a virtual environment need to be structured for our innate abilities to do their job?

Several of the characteristics of the natural environment shall be listed in the subsequent paragraphs.

Some noteworthy properties of the Real World

- For all practical purposes the world is flat
- The natural environment is continuous
- Regions below or above the surface are harder to reach and require special tools for access (stairs, lights, elevators, wings)
- No two objects occupy the same space
- Objects are characterized by a vast number of multisensory and dynamic qualities

Some noteworthy characteristics of human adaptation to the physical world

- Human cognitive skills evolved as an adaptation to life on a surface
- Tools such as maps allow for representation of surface environments
- Spatial (3D) environments are much harder to envision, to model, and to communicate
- Humans (and many other living beings) are able to predict the future location of a moving object with a high level of probability, if they are allowed to watch the object, and if object motion happens with in a suitable window of speed
- Inanimate objects and living beings are stored in the brain as complex models of multisensory appearance, motion dynamics, and experiential context. These models are retrieved upon the occurrence of any single element of a stored model.
- There is a powerful drive in human beings to explore the physical world and to stretch one’s limits. The driving force is the neurochemical system of endorphines providing sensations that are either desirable (so we ask for more), or they cause pain (so we try to avoid them). We might call these emotions (positive and negative).

Only some of these qualities can be listed here; further reflection and discussion will hopefully turn the designers' (and scientists') attention towards additional research and clarification. The here proposed implementation of an automotive infotainment system is based on these and other qualities. Furthermore, the author postulates that only such experiences can be used in the design of truly universal HMI concepts that were acquired during early childhood when human exploration follows a genetically driven universal program for the child's random experimentation with its physical environment ("play"). From a certain age on, experiences become culture and education driven so that human experience begins to diversify to the point where a universal intuitive concept is no longer possible.

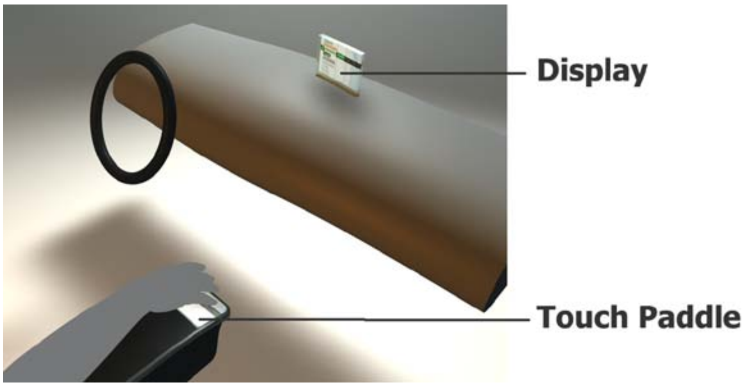
Due to the classification of childhood (and even adult) random experimentation as "play", the structural principles of the physical world and the details of universal human adaptation have long been overlooked and seen as trivial.

Implementation

The concept of an automotive infotainment system as it is shown here is based on the assumption that a Real-World metaphor may provide a meaningful approach to a universal intuitive design.

Hardware

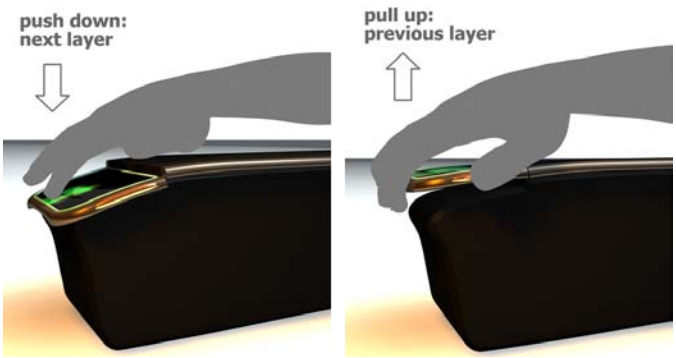
The hardware consists of a semi-tactile multi-touch input device ("touch paddle") that is situated within reach of the driver's hand, and a (pop-up) display device suitably located close to the driver's center line-of-vision.



Picture 3: Hardware components "Touch Paddle" and Pop-up Display

Interactions

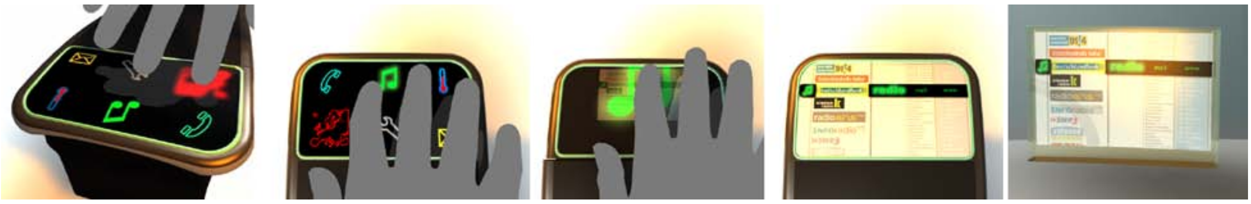
The concept makes use of a zoom interface principle. There are only two layers of hierarchy: "top" and "bottom". If pushing a button or, in this case, the touch panel down, the only sensible reverse action is to pull it up.



Picture 4: Pushing the touch paddle down to make a selection; pulling it up to go back to the top layer

The touch paddle provides for rich acoustic and tactile feedback when changing between layers. Auditory representations are used for touch-pad feedback. A small loudspeaker placed in its vicinity allows for use of the "cocktail party effect", in order to differentiate between interface sounds and the sound coming from the car's sound system.

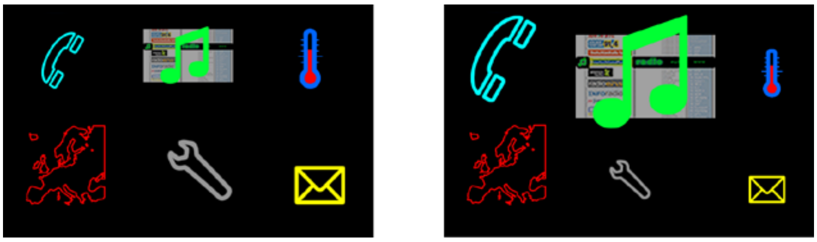
A variant of a zoomable interface presents the user with a consistent representation of the total digital functional universe inside the device. From the top layer view the user enters each of the functional subsections.



Picture 5: Display icons respond with glow and auditory feedback; paddle display and pop-up display (on instrument panel) always show identical content

Obviously, a driver cannot view the touch paddle while driving. Therefore the touch display mainly supports the driver's learning phase. Touch paddle display content is at all times mirrored in the pop-up display.

Last not least, the icons at top level change to reflect the last current interaction with a given function. Upon returning from the, say, MP3 function, the music icon may look like shown here:



Picture 6: Targets will reflect previous use (left) and frequency of use (right)

As the space is limited, details of multi-touch interaction will not be commented. Multi-touch is used at various levels, based on the "weight" of a given task.

Mention needs to be made of the fact that icons vary more dramatically than in conventional interfaces (e.g. iPhone), for an added level of redundancy.

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