

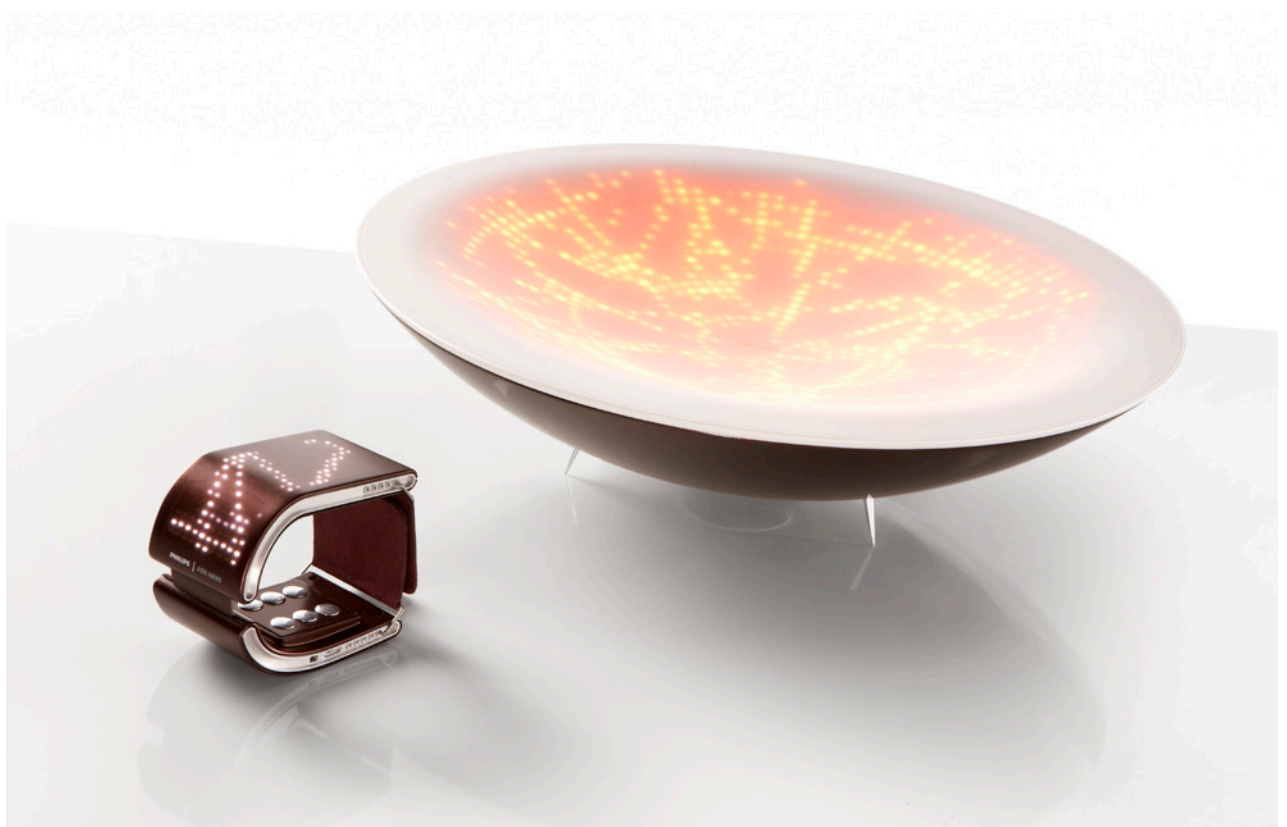
Mirror of Emotions

Rationalizer emotion awareness for online investors

Rationalizer

Emotion Mirror For Online Traders

ABN AMRO and Philips have joined forces in the development of Rationalizer, a concept targeted at serious home investors who trade online. One can think of Rationalizer as a kind of 'emotion mirror' in which the user sees reflected the intensity of his feelings, enabling him to take financial decisions which are less emotionally charged and more rationally founded. Investors are typically driven by two emotions, fear and greed, which can compromise their ability to take an objective, factual stance. Rationalizer alerts them when it may be wise to take a time-out, wind down and re-consider their actions. The system consists of two components: the EmoBracelet and the EmoBowl. The bracelet measures the arousal component of the user's emotion through a galvanic skin response sensor. This arousal level is rendered as a dynamic light pattern on either the EmoBracelet itself or on the EmoBowl. The higher the arousal level, the more intense the dynamic light pattern becomes: the number of elements increases, the speed increases and the colour shifts from a soft yellow via orange to a deep red.

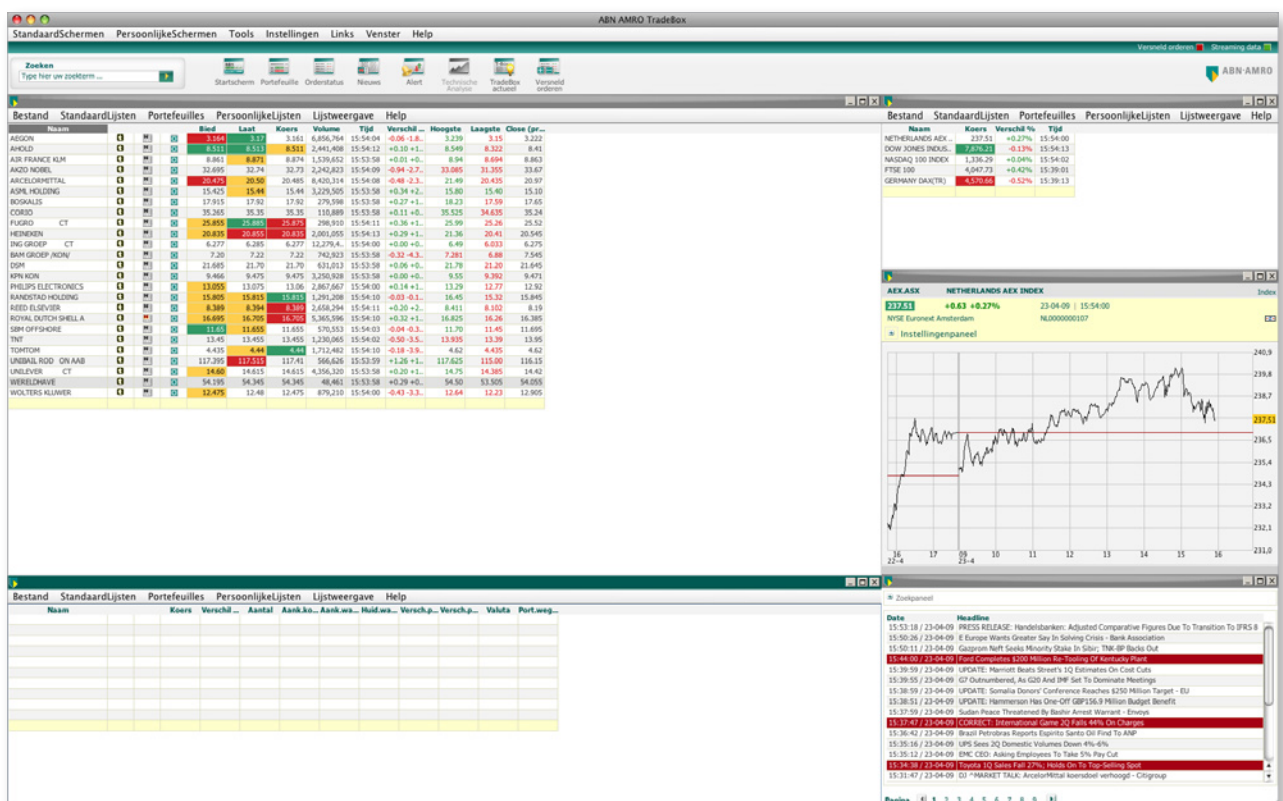


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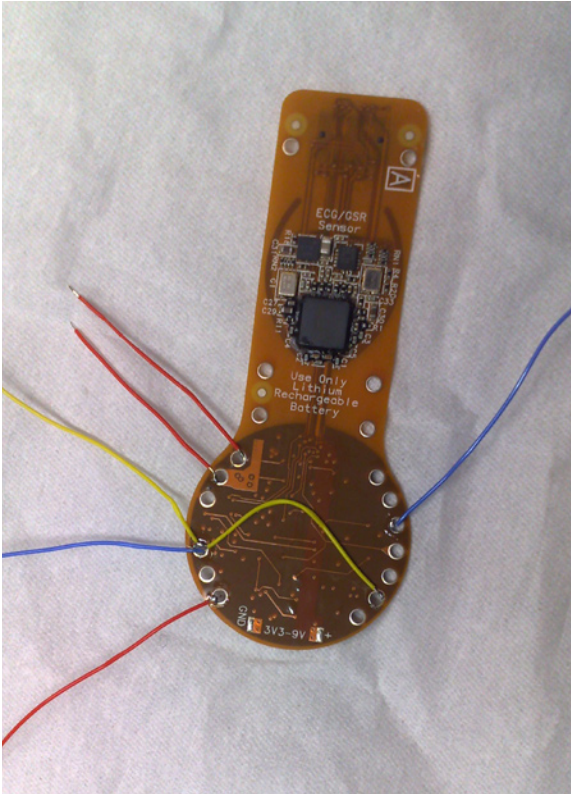
Introduction: investing and emotions

In recent years, more and more non-professional investors have become active in the financial markets and are offered an increasingly complex and wide ranging set of services and instruments. European legislation [1] ensures that non-professional investors receive a higher level of protection from banks than professionals get. A well-known way for a bank to assess the knowledge, experience and personality of a potential investor is establishing the user's investor profile through a questionnaire. This questionnaire consists of two sections. One section, known as the risk profile, relates to the user's investment objective, his preferences regarding risk taking and his financial position. The questions in the other section relate to the user's experience in and knowledge of investment. The questions on risk taking are very much about the personality type of the user and his emotional response to fluctuations in the value of his assets portfolio. When an investor trades via online trading applications without consulting the financial experts of the bank, the investor's profile helps the bank to validate that the intended transaction matches the investor's financial position, his financial objective, his knowledge and experience and the risk he is willing to take. Now that trading through an online applications from the privacy of one's home has become commonplace, decisions are easily and quickly made: the user can commit himself to his decision within seconds. Research shows that investors who switched from traditional

discount brokerage to an online service nearly double their number of trades [2] and experience lower returns caused by poor decisions [3]. The traditional way to help the online investor perform better is education. Similar to other banks and brokers, ABN AMRO has an online trading academy that helps to educate investors. Furthermore, ABN AMRO publicizes online bulletins, email newsletters and market reviews to help online investors gain more knowledge on the stock markets. All these measures are based on the assumption that investors make rational decisions. However, critics state that investors make more often irrational than rational decisions. The sources of these irrationalities are attributed to psychological factors such as fear, greed and other emotional responses to price fluctuations and changes in an investor's wealth [4]. For example, driven by fear, investors may sell too hastily when share prices drop. Driven by greed, they may be overenthusiastic—too 'eager'—buying too many shares at too high a price. Whilst the risk profile may help the user in building a portfolio that is in balance with his emotional response to risk, it provides no protection from emotional decisions made during trading 'in the heat of the moment'. This then leads to the following insight: non-professional investors may benefit—in addition to traditional education and risk protection—from a real-time alert that identifies their emotional response to market fluctuations and helps them to make more rationally founded decisions.



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The arousal component of emotion suffices

What makes the Rationalizer use case interesting from an emotions theory point of view is that measurement of the arousal component of emotion suffices. A clear link can be found between emotional reactivity and trading performance [5]. Investors whose emotional reactions to monetary gain or loss are more intense on both the positive and negative side exhibit significantly worse trading results. This implies a negative correlation between successful trading behavior and emotional reactivity.

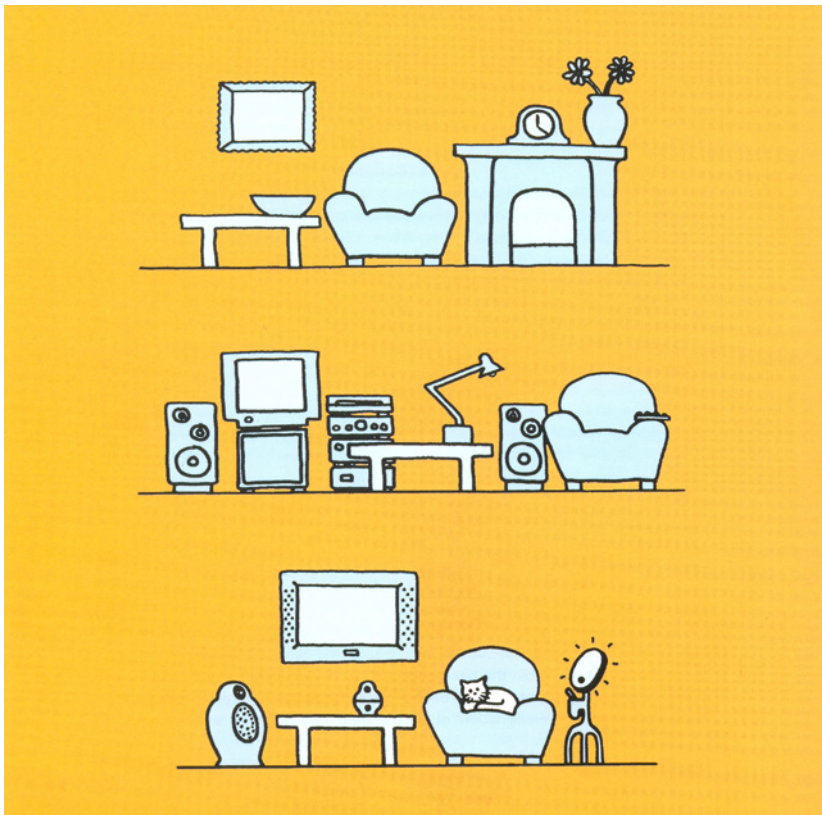
A well-known way of representing emotional response is in the form of a two-dimensional plot, the affect circumplex model [6]. One axis of this model, called 'valence', indicates whether an emotion is experienced as positive or negative; the other axis, called arousal, indicates the intensity of the emotional state.

Typically, using physiological sensing the arousal component of emotion is much easier to determine than valence. Usually, the lack of a valence measurement is considered a serious shortcoming: whether we experience an emotion as positive or negative is such a fundamental aspect of everyday experience that it seems no emotionally aware product could do without it [7]. However, in this use case it does not really matter whether the user is highly negatively or highly positively aroused: both situations may lead to tainted decision making. To put it simply, the online trader should be made aware when entering either extreme state of arousal, be it positive or negative. This means that this application is well suited to the current limitations of emotion sensing technology.

We chose to use galvanic skin response (GSR) sensing technology for Rationalizer, which is a method of measuring the electrical resistance of the skin. GSR only indicates emotional arousal: it reacts to a startle response in the user without considering whether this response is positive or negative. Of the various physiological signals related to emotion, GSR is possibly the easiest to measure as in essence the sensor is an Ohm meter, measuring the electrical resistance between two points. The sensor and signal processing software used in the EmoBracelet have been developed by Philips Research [8].



“Our aim was to create a low-key object which would blend in rather than stand out in a domestic setting.”



Fitting the domestic environment

As Rationalizer is targeted at non-professional rather than professional investors, the main use context is the home. Within the home, we envisage two use situations. The first is the user at a desk in his home office, an increasingly common space within the home for teleworking and doing administrative tasks. The second is using a computer notebook in the living room. The home being our use context, we decided to work with a domestic design language: rather than creating a visually obtrusive hightech gadget or an ‘executive toy’, our aim was to create a low-key object which would blend in rather than stand out in a domestic setting.

Since the appearance of the EmoBracelet and EmoBowl is highly influenced by the dynamic light patterns, we need to consider what domestic means not only for the static appearance but also for the dynamic appearance.

Static appearance

As we were looking for a simple decorative object which would fit naturally in a domestic environment, we came to work on a bowl. The notion of ambient objects—a visually restrained breed of consumer electronics which fits in with the environment rather than shouts out at the user—is a recurring theme within Philips Design. The Philips Design ambition with regard to ambient objects is summarized by the three pictures shown above [9]. The first one is a picture from the early 20th century in which consumer electronics are as yet absent. All other objects are typically domestic objects: a painting on the wall, a clock and a vase on the mantelpiece. The second picture is from the 1970s or 1980s: by this time, the living room had been invaded by a multitude of electronic devices, which all had their own aesthetic and fought for the user’s attention. The third picture shows what a living room of the future may look like: electronic products have taken on a far more restrained aesthetic, inspired by traditional domestic products. The painting has become a flat TV, the loudspeaker and the remote control have become pieces of furniture. In a similar vein, the bowl on the table in the first picture could become an EmoBowl in the last picture: an object which historically fits the domestic context is augmented into an ambient object with behaviour.

Dynamic appearance

Many currently available devices which measure physiological signals show these measurements on LCD displays in the form of graphs and numbers. To improve the fit with the domestic context, we were intent on avoiding the clinical, laboratory connotations of these products and on rendering the user's arousal level in a manner more appropriate to such an intimate subject [10]. Rather than using graphs and figures which require reading and interpretation, we set out to represent the user's arousal level through animated light patterns which are intuitively clear.

Both the EmoBracelet and the EmoBowl have three modes: (i) a fully-off mode, (ii) an ambient mode corresponding to low arousal in which the objects do not draw attention to themselves and (iii) an alert mode corresponding to high arousal in which the objects become the focal point.

Both the EmoBracelet and the EmoBowl are executed as 'dead panel' displays. That is, the translucency of the product housing is such that

in the fully off mode it is invisible that there are display elements underneath. This adds to the objects being perceived as non-electronic in the fully-off mode. Only when the displays are switched on does it become visible that these objects are in fact electronic devices.

Clearly, from a display point of view, the EmoBowl is more sophisticated than the EmoBracelet: it has a higher number of LEDs and its LEDs are of the full colour type rather than monochrome. The animations for both EmoBracelet and EmoBowl are based on a pattern of wavy lines. When shifting from the low arousal to the high arousal mode, four parameters change: the number of lines increases, the number of curves in a line increases, the pattern's speed increases and, in case of the EmoBowl, the colour of the lines shifts from a mild yellow to an intense red. In the case of the EmoBowl, the transition from ambient to alert mode may be compared to breathing life into a fire: when the user's arousal level exceeds a certain threshold the light effects 'flare up'.



“The EmoBowl can be seen as a new type of product which blurs the boundary between luminaires and displays.”

The product is the display

In the Rationalizer project, we have experimented with both single curved and double curved displays. The aim behind our use of curved displays is the blurring of the distinction between product form and display. Current electronic products show a clear separation between form and display, often with the display being stuck onto a product without respecting its formal qualities [11]. Because displays are flat, the possibilities to integrate product form and display are limited. In the EmoBracelet, the display curves with the product's form, if only in one direction. In the EmoBowl, the dish shaped display surface is curved in two directions. Though the current execution of the EmoBowl is still low in resolution, eventually this will lead to products with 'living skins' of which the double curved surface is a display at the same time. (patent pending).

Low-res display or high-res luminaire

Currently, luminaires and displays are separate product categories: luminaires are meant for illumination, displays are for information. The EmoBowl blurs these boundaries. It can be seen as a new type of product which 'hesitates' between being a high-res luminaire and a low-res display and as such may serve multiple purposes.

The EmoBowl as high-res lamp

Since the EmoBowl features almost 1600 LEDs—which collectively

have approximately the same light output as a 100W incandescent bulb—it is far brighter than an LCD display of the same size. This means that it may act as luminaire with display capabilities. As such, it can be seen as a next generation LivingColors lamp [12] which instead of showing one colour at a time can show abstract patterns of animated light. Apart from their decorative effect, such dynamic light patterns could be imbued with meaning. For example, dynamic light effects could be used for non-goal oriented communication [13] (e.g. a particular pattern becomes the light signature of someone thinking of you), for showing the emotional value of communication (e.g. to support e-mail or instant messaging) or as a music visualizer.

The EmoBowl as low-res display

The bowl can also be used as a low-res display showing tickertape-style messages. For the Rationalizer use case, we made the EmoBowl show stock prices. Other applications may be to use the bowl as an additional rendering device for other electronic products. When paired with a DECT phone, it could be used to show incoming SMS messages; when paired with an audio system it could show album title, artist and track information. An interesting aspect of EmoBowl is that it may act as a centerpiece on a dining or coffee table to share information in a group setting. As the tickertape information is displayed at a slant and travels in a circle around the bowl, it will eventually be readable to everyone gathered around the table.



The project

The Rationalizer concept is the result of a joint exploration project by the ABN AMRO Dialogues Incubator and Philips Design. It clearly shows what great results can be achieved when two large companies create a stimulating environment for cooperation and open innovation. During the project other crucial parties were involved such as potential end-users, Philips Research and the VU University Amsterdam. This cooperation has led to various propositions of which the Rationalizer concept is a first concrete manifestation. In a few years from now you might recognize some of the elements of the Rationalizer in products and services we will market by then.

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