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The eye of the use

- The influence of movement on users' visual attention

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Abstract

To explore and experiment with the communicative potentials of movement in interface design, six principles for applying movement on web sites were developed. The movement principles were grouped under the following functions: catching the eye, getting attention and avoiding distraction.

Letting the principles act as design guidelines a prototype was developed embedding dynamic visualizations of movement. The assumption was that the movements will help direct users' visual focus and perception – without causing irritation and distraction. A pilot test of the prototype was conducted, at the same time exploring two techniques: eye-recording technique and mind tape interviews.

Taking the results of our investigations as indications, we argue that use of movement - though further experiment and investigation are necessary - holds so much promising potential as a communicative tool IN INTERFACE DESIGN

Keywords:, animation, attention, design principles, distraction, eye-catcher, eye recording, graphics, motion, mindtape, movement, user testing, web design.

1. Introduction

The focus of the paper is the use of movement in interface design and how users experience it. The background for the paper is web designers' seemingly uncritical use of movements on web sites, where even small animations may lead to chaotic, disturbing and ugly communication. The classical example is a continuously spinning company logo. This kind of movement may become distracting to the extent that users become exasperated. Prolonged Flash animations without interactivity are other examples of movements, which often leave the user irritated – and passive. The unrestrained use of movement has caused web experts to recommend that movements only be used with great caution, or not at all (Perfetti Christine and Klee Matthew, 2000; Nielsen Jakob, 2000).

Rejecting the use of movement on the web, however, is not the solution. "It is here to stay" (as Mae West said about something entirely else). We argue that movements have significant communicative potential, which has been largely unexplored in web design. Yet, it may enrich user experience significantly. Just think of how movements in e.g. ballet may convey emotions. Ballet is an art form, which uses movements as the main artistic effect to create and enhance the emotional content of the characters and the

plot (Vaughan, Leslie Carlson, 1997). Movement also has unique communicative properties when conveying or describing events or processes that unfolds in time or space (Perfetti and Klee 2001). However more than anything, movement has the ability to catch the eye.

This is well known from television commercials and has also found its way into e.g. design of e-commerce sites where movements are used to direct users attention to different products. However, use of movement is not restricted to these applications, it goes much further. Movement can be used to influence the path within which a user reads and interacts with a web site. For a medical consultancy site it may be essential that users carefully read, click, watch and follow instructions from A to Z when treating e.g. burns. Movements may be designed to enhance this process by introducing each step one at the time, and using lines, and animations to control users' path and direct their attention. Even on a static web page layout, shapes and lines will affect the path the users eyes follow while scanning through the web site.

Again, this is not a particular novel idea. It draws on the traditions of instructive sketch like drawings with lines and numbers organized in a stepwise approach, which tell the user where to read and observe. Most of us have experienced this when installing a video recorder, or assembling furniture piece by piece by following the cartoon like instructions.

However, use of movement on web sites to attract users´ attention, may reduce usability significantly and prevent the user from getting their task done, or may even result in the user leaving a site. Therefore, it is important that we start investigating and exploring the communicative potential of movements. Especially how movements may enhance the ability of the design to capture user's eyes and maintain visual attention without excessively disturbing or causing disruption in the interaction.

2. Aim and Conceptual Frame

With the aim of exploring and contributing to an understanding of the use of movements - and at the same time exploring techniques to study the user interaction - we developed an actual web prototype and conducted a pilot test study. The intention was to design movements that would be able to catch the eye of the user, direct users' attention and provide an aesthetic experience – without compromising usability.

With this in mind, we identified two objectives. The first was to investigate how different patterns of movement communicate and instill different emotions in the user. To obtain this we designed movements with the aim of providing a rich and aesthetic experience[1]. The second objective was to ensure that these movements did not compromise usability in a way that would irritate, distract or in any other way prevent users from decoding the relevant information on the page. In this paper, we report on the second objective: designing movements, which catch and direct users' visual focus without compromising usability[2].

'Movement' in this paper must be understood in very broad terms as graphical objects, which shift location, transform shape or change texture. In film production the term primary movements cover people, animals or artifacts moving; secondary movement is camera movements by panning, tilting, zooming etc. and tertiary movement is cuts between different scenes (Zettl Herbert, 1973). Web movements encompass a wide range of dynamic elements of a web interface, which covers three types: moving objects, screen motion and moves between web pages. Drawing on the terminology from movie production the following classifications have been developed for web design: *Moving objects* comprise rotating elements, dynamic typography, interactive animations, unfolding drop-down menus, fading objects,

rollovers. *Screen motion* covers scrolling and zooming on a web page. *Moves between pages* represent jumps to a new web page and windows that open and close. These three types of movement are specified further into automatic movements and user initiated movements. *Automatic movements* are the 'inherent' or 'built in' movements over which users have no control. The start of these movements is defined by the programming of the site. *User initiated movements* are triggered by users' physical interaction with the web site - typically by mouse click. Users control this kind of movement. It should be noted that any of the specified types of movement contribute to the overall aesthetic feeling of the site. At the same time the movements constitute the sites 'functionality' in the sense that the movements combine the different information chunks, which the user will be exposed to and navigate between.

The empirical study presented in this paper we report on two of the above types of web movement: One is automatic movement of an object (primary), and the second is a user initiated move between pages (tertiary) followed by object movement (primary).

3. Principles for Movement on the Web

Research on screen motion in television commercials has been comprehensively documented (Reeves Byron and Nass Clifford, 1996)[4]. Drawing extensively on these findings and combining them with theory about visual perception (Mullet Kevin and Darrell Sano 1995) and findings from user evaluations of websites with movements (Nielsen Jakob, 2000; Spool Jared, Scanlon Tara, Schroeder Will, Snyder Carolyn and Terry DeAngelo, 1999) six principles for movement was identified. Together with the analysis of our studies of movement as an emotional aesthetic element, the six principles served as basis for developing a prototype. In the following these principles are presented and their underlying rationale described.

3.1 Catching the Eye

Gestalt laws are used to describe the connection between human perception and specific properties in graphical representation . A web page may be seen, basically, as a group of graphical components. In principle, by drawing on these laws, a desired user perceptual experience may be designed.

One of the principles is particularly important for the use of movement as a means for catching the eye. It is the one that concerns *contrast*. According to this, users will notice an object if it stands in contrast to other elements in the same field of vision (Mullet and Sano, 1995). In web design, several graphical parameters can be varied to achieve this contrast: form, size, color, location, orientation and not least movement. Our hypothesis is that web designers need not make use of big, forceful, hectic or aggressive movements to achieve the eye-catching effect. Soft and harmonious movements will suffice in catching the user's eye if they stand out from an otherwise static web page.

Our first principle is therefore:

> Use relatively soft and harmonious movements as contrast to static graphical parameters such as shapes, sizes, color, location and orientation.

3.2 Getting Attention

Users will be more likely to decode certain moving elements rather than others. This depends on, among other things, where on the screen a movement starts. Movement starting in the periphery of the user's visual field seems to increase the users´ level of attention. The explanation is that phylogenetic these movements were associated with potential danger and resulted in a change in the body's physical condition to make it ready to evaluate the object, and act. Movements , which enter a person's vision from the side, may constitute visual surprises, which spark attention the most.

To understand what periphery of vision is in relation to web design, consider a user focusing on an object in the middle of the 2D screen. A movement initiated near the borders of the screen is in the periphery of the user's visual field. Movements initiated close to the middle of the screen is not peripheral; e.g. an object coming from a point in the distance and becoming larger as it gets closer.
The second principle is therefore:

> Start movements in the periphery of user's visual field (away from the user's expected point of focus) to sharpen senses and help perception and decoding.

Perception studies have shown that viewers' attention during commercials increase in the presence of movement but also that the high degree of attention varies during the actual movement sequence (Reeves and Nass 1996). According to these studies pictures shown *one second into a movement sequence* was remembered more clearly than pictures shown *exactly when the movement started*. The studies also indicate that an increase in attention level caused by a movement is no more than a few seconds long before it drops to its normal level. To take advantage of this increased level of attention important information must be introduced *immediately after* a sequence has ended. Carrying this logic into web interface design means that it is important to place the information to be decoded one second after the movement has started or immediately after it ends. The third principle is therefore:

> Introduce important words or graphical elements in the movement sequence when user's attention is at its heights; approximately one second after the movement begin or immediately after it ends.

In the light of these principles, web designers may be tempted to use short frequent movement sequences to ensure a constant, high level of user attention. But this is not likely to work, since such a design of movement will lead to a gradually decreasing level of attention until the user's thinking blocks. Most of us have experienced the feeling of our minds tuning out, when watching music videos with continuous quick cuts between scenes. Studies have also shown that excessive repetition of a message might give rise to negative attitude towards it (Petty Richard and Cacioppo John, 1986). Taken to web design, this implies that users will be displeased if they are exposed to excessive repetitions of a message on a moving object.

We have not found any convincing empirical evidence to suggest the optimal number of sequences of successive movement and rest. It depends – among other factors - on both the actual user as well as on the web page in question. However, this should not lead to the conclusion that movement in all shapes and forms should be avoided. Rather it should challenge any designer to experiment with the number of sequences, using her aesthetic judgment and intuition coupled with rigorous user testing. However, the web designers' bias should be few repetitions. The fourth principle is therefore:

> Avoid many successive sequences of movement as they lead to significant reduction in attention, even completely terminate user's decoding process.

3.3 Avoiding Distraction and irritation

If movement is intended to help the user decode properties on the moving element (or something close to it) in addition to catching the eye, then the user's eye must focus and rest in the moving object for the informative elements of the object to be cognized. One could say that the movement is through the eye and into consciousness. It is not sufficient that the user's eyes flicker shortly to the moving object. In this connection,

there is a subtle but significant distinction between "catching someone's eye" and "catching someone's visual attention". Catching the eye is when the users´ point of focus moves to a given area on the screen. Catching the attention is when the user's eye stays on the area of the screen and a process of conceptualization takes place. In this respect visual attention determine which sensory input will be minded by the user if he proceeds into a reflective cognitive process in order to understand the message on the screen. This we may call a process of knowledge acquisition, which require conscious reflection as opposed to the eye's merely visual registration of e.g. an object.

Catching someone's visual attention implies that the movement design must make room for the user to decode the words and graphical elements of the moving object. It takes time to transform the object from percept to concept. Movement that never stops is a continuous stimulation, which distracts and prevents the transformation, and it may block user's thinking completely.

Hence a rotating company logo will likely have the exact opposite effect than what is intended. The user's eye will flicker between the logo and other parts of the screen because of the constantly rotating element. The only possibility for decoding the rest of the screen is for the user to ignore the rotating logo. It is simply too much, it is a bombardment of stimuli and in extreme cases, users will physically cover the logo with their hand to get time and space to concentrate on reading the screen. Other users may scroll away from the part of the screen with the moving logo to avoid it (Spool et al. 1999).

There is also a considerable risk that movements will disrupt users' interaction if they have to wait long for a sequence of movements to stop before they can continue their interaction. For the person looking for a specific piece of information, this is perceived as *irritating* waiting time delaying his search. Because movement unfolds in time, unlike color or other static graphical elements, the sequences of movements may be experienced as too long, and the user may simply leave the site. The sequence of movement will take on the character of movie clips that the user is almost forced to watch and he has no control over the duration. Prolonged Flash tunnels are obvious examples of these practices.

To allow the user room to decode and interact - a balance must be struck between "movement and rest" (Reeves and Nass 1996). A solid point of departure is that short movement sequences, showed only once or twice will allow the user the visual break necessary to perceive the information and conceptualize it. The fifth principle therefore is:

> Use only short movement sequences and show them only once or twice.

Many competing sequences of movement, shown concurrently or immediately following one another, make it less likely that the user will be able to maintain focus long enough to decode the important information before it disappears. The user cannot process the information before the next movement catches the eye. The result may be a perceptual *interference*; too many stimuli compete for attention and do not allow the eyes the necessary rest needed to actually decode any information. A user's attention simply cannot be in two places at the same time, and this leads to our sixth principle:

> Avoid several competing movements on one web site.

In order to explore the six principles for movement, we decided to let them act as guidelines for the design of a web prototype to be tested. We present this empirical study below.

4. Design and Test frame

The development of the web prototype was done in collaboration with the Danish department of an international design agency, Icon Medialab. Together, we chose to take point of departure in an existing web site, www.flos.net, which we changed by adding and adjusting movements according to our principles. The website is for an Italian company which produces, markets and sells exclusive designer lamps through a global network of independent dealers. Our web prototype was developed only for the purpose of experimental research. In research terms, www.flos.net constituted a case example to base the experiment on. Hence our prototype is not a traditional highly controlled and sanitized lab experiment. It is rather a situated field experiment making it possible to evaluate the guidelines under the realistic conditions of a web design context.

To avoid compromising usability as a consequence of implementing aesthetic movements in web prototype, we relied extensively on the six principles. Applying these we implemented several different types of movement in the web prototype using Flash-programming. However, in this section we present only two of the implemented movements. The first one is an automatic movement of object (primary) and the second is a user initiated move from one web page to another (tertiary) followed by a movement of an object (primary).

4.1 Exploring two techniques for user evaluation

The web prototype was tested exploring two different kinds of user evaluation techniques and each with three respondents. One of the techniques was eye recording, where respondents wear a so-called eye-tracking headset with mirrors, infrared light, cameras etc. that makes it possible to record, on video, the respondent's eye movements across a computer screen (Fischer Paul M., Richards John W., Berman Earl J. and Krugman Dean M., 1989). These test sessions were done in a lab under controlled conditions with the web prototype running off-line from a floppy disc[6]. We provided the three respondents with a task to solve. We wanted to explore what data the eye-recordings could give us, and we assumed it would be insights into how the users interact with the site, and how their eyes scan the site. Combining these would give us indications of the respondents' eye-movements, visual attention, and state of mind (ibid, 1989).

However, this technique is not sufficient in itself, as it does not tell us anything about the users subjective experience with the website. We therefore followed up with a qualitative approach where we explored the Mindtape technique(Nielsen Janni and Nina Christiansen, 2000). Mindtape was developed with the aim of trying to get closer to what goes on in the users´ mind. This is done by letting the process of interpretation take place as an "interview conversation" between the users and the researcher. During replay sessions, video sequences identified for further investigations are reviewed with user and researcher. The video acts as trigger, and the user often recalls in detail what he thought, when and why. It is the actual sequence of events shown on the videotape. which structure the recall, it is not the user's memory. Hence the cognitive processes that run associatively while the user interacts with a computer system can become partly explicit during a Mindtape replay sessions.

In our case, the eye-recording sessions were taped and sequences for further investigations identified and finally explored together with the users. The initial analysis of the eye-tracking data turned out to be more difficult and time consuming that we had anticipated – but the combinations of techniques gave interesting data.

5. User's Evaluation of Movement

In the next section, we describe the application of the design guidelines on two different movements in the web prototype

and the results from the empirical user evaluations. The development of the web prototype was done in collaboration with an international design agency, Icon Medialab[7], for one of their costumers. FLOS is an Italian company, which produces, markets and sells exclusive designer lamps.[8] The web prototype we developed and present in this paper is not the official website of FLOS. Our web site was developed only for the sole purpose of experimental research, but done together with practitioners to test the principles in a real-life setting. Unfortunately we cannot include screen dumps from the running flash prototype due to copyrights. Instead we show you illustrations of the movements; we hope they give you an idea of what the movements look like.

5.1 Three Words unfold - First Movement

If you visit www.flos.net you will see three concepts presented on the home page: LOVE, LIFE and LIGHT. These three words constitute the company's brand statement, and our first design task was to use movements to direct user attention to these words. Below, you see an illustration of the image that greets the user on our web prototype.

Figure no 1: The image that greets the user and start of initial movement in periphery of user's visual field

As you can see, the screen layout is split horizontally into two. A wide dark blue background and below this a more narrow black background. To the left, but in the horizontal middle of the blue field, you see the logo(white) on an orange square. To the right of this, coming down from the top and only partly shown you see a form which looks like the bottom part of a lamp. It "hangs" over and shines down on the naked back and neck of a big bald man. The black horizontal field "cuts" the figure so that you only see the head, neck and start of shoulders.

5.1.1 Designing with the Six Guidelines

In our prototype this page is shown without disturbance. After a fraction of a second, we let the movements start.

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Figure no. 2: The first sequence of movements

Following the guidelines of the *first principle*: using soft movements as contrast to static elements, we came up with the idea of the shape of a drop of water, which slowly collects along the bottom edge of Flos´ logo. As the drop grows virtual gravity pulls it down into the black field which (undergoes a metamorphose and) turns into water, when the drop hits and rings of water slowly evolve - and is transformed into the first word LOVE.

Figure no. 3: Second movement: A sprout growing out of the earth

The second word unfolds right next to the first. This time it is as a movement of a sprout, that gradually grows out of the black area. Through a metamorphosis this has turned into fertile ground, and the sprout grows into the word LIFE.

Figure no. 4: Sprout grows into LIFE

The last word starts with a flash of light (movement), which then turns into the word LIGHT.

Figure no. 5: A flash of light turns to LIGHT

Our assumption was that the movements we introduced - despite their soft patterns - would stand out clearly from the photograph and the logo's otherwise static nature. To heighten the users' level of attention we combined this with the *second principle*, by letting the initial movement sequence start in the periphery of user's visual field. We

expected the user's initial focus to move between the photograph and the Flos-logo but with the motive in the photo to catch their attention. Because of this initial focus, the drop movement is perceived to begin in the periphery. To satisfy the *fourth principle*, the presentation of the words took place in three consecutive sequences with movement and rest respectively. We expected that this number would not cause the level of attention to decrease. Relying on the *third principle* we introduced each word immediately after each of the three consecutive movement sequences, since attention is expected to peak at this very moment.

To avoid a block in the user's perception and provide a certain calm to allow the user to decode the words we applied the *fifth principle* and let all three movements be short and played only once. Following every sequence, we inserted half a second of rest to allow the user to actually read the word before the next sequence began. We expected this pause to be sufficient for the user to perceive the word. All three sequences are relatively short so the user does not have to wait long. In accordance with the *sixth principle*, the movements are consecutive, to avoid several movements at one time competing for the eye.

5.1.2 Touched by a Drop of Water

The data from eye recording show, that respondents' eyes are caught by and follow the movements of the drop, the sprout and the light. This scanning path is, however, interrupted by some eye flickering towards the man's neck in the photograph. In spite of this, all three respondents focus, for extended periods, on each of the three words LOVE, LIFE and LIGHT. In figure 6 details of the results from one of the eye recording sessions is shown.

Figure no 6: Hand drawn outline of the path the eyes of respondent no. 3 follow scanning the motions sequence with three words.

The eye recordings clearly indicate that the soft movement patterns of the drop, the sprout and the light effectively catch the respondents' eye and they follow the movement all through its course *(first principle)*.

The fact that the three respondents focused for extended periods on each of the three words LOVE, LIFE and LIGHT indicates that they actually perceived and conceptualized them. This was confirmed by the subsequent interviews, which showed that the respondents remembered the three words very well. The respondents remembered all three words after 2 minutes and only one respondent had forgotten the last word, LIGHT, after 3 hours. Combined this indicate that the respondents' attention level had been high (*second principle*), and not disrupted by the three repetitions of the movement (*fourth principle*). This also lends credibility to our choice of introducing the words immediately after each of the movements. The respondents did not ignore the words by looking away. Nor did we observe attempts to cover the movements with their hands (*third principle*).

We did not expect that the movement would produce any distraction or irritation among the respondents, since the sequence was short and with no competing movements according to the *fifth and sixth principle*. This expectation was confirmed by the respondents during the subsequent interviews, where they reported that they had no been irritated or distracted by the movement. On the contrary, they expressed liking the movement and feeling a certain level of anticipation as to what the web site would bring next. They even maintained this point of view when we confronted them with the video sequence showing their eyes flickering and questioned them about it. This could indicate that the flickering is merely corrective eye movements that the users are not conscious of.

If we for a moment entertain the thought that this was an instance of actual distraction, the question is: What caused it and what implications does it have for the principles?

One reason could be that – as opposed to our expectations - none of the respondents had visual focus on the photo, before the movement of the water drop caught their eye. This suggests that users did not decode the photo before the movement caught their eye. A reason could be that the rest between the static image shown and the start of the first movement is too short. A potential adjustment to test whether this is the case could be to add another two seconds of rest before the water drop movement begins.

5.2 A Wave laps - Second Movement

There is more to the site than the front page. From here the user is taken to the next web page if he clicks on a specific link in the lower right corner of the front page. This tertiary movement, which is initiated by the user, became the next focus for our redesign. We wanted to use movement to make the transition from the home page to the next page in the hierarchy less abrupt and more emotionally appealing.

The screen layout on the second page is again initially split horizontally into a white field at the top and a black field underneath. When the user clicks on the link in the lower right corner of the home page, he jumps to this next page. At the exact same moment as the second page is shown, a wave begins on the left side of the lower black area (a new metamorphosis) and moves towards the right before it comes to rest.

Figure 7: Initial start of wave

We present two pieces of information while this wave unfolds. The first is news items, which appears behind the wave as it moves. The second is a horizontal navigational menu, which rises out of the water at the exact moment where the wave comes to rest.

Figure 8: Information surfacing as wave unfolds

Our intention was to create an emotionally appealing transition to the next page without unnecessarily distracting the users' exploration of the information.

5.2.1 Applying the Guidelines

In an attempt to satisfy the *first principle* of movements as soft and harmonious, we let the movement be calm with round, organic and pleasant shapes. We also chose to let the wave cover a significant area to give the emotional experience a certain power. We expected that these design choices combined would make the wave movement stand out from the remaining static elements of the page and thereby be an effective eye catcher.

To heighten the users attention level, we let the wave begin on the left side of the screen, hence in the periphery of user's vision (*second principle*). This is due to the link placed in the lower right corner of the front page, where the user must have visual focus when he clicks and starts the movement. Furthermore, we choose not to let the wave movement be comprised of many successive movements, in order to avoid affecting the user's level of attention negatively (*fourth principle*). As mentioned above we introduce two separate pieces of information together with the wave. They both consisted of several words each, and we found them of equal importance to the users. Therefore, the design should leave it open to the user to decode whichever piece of information he chooses. In other words, we did not wish to direct the users' attention to specific words in these two pieces of information, and the *third principle* was therefore of no relevance for the design of the wave movement and thus not applied.

It was of great importance to us that the users would not be distracted or irritated by the wave, so we invested a great deal of effort in applying the fifth and sixth principle. Since the user initiates the wave himself by clicking the link on the previous page, there is no risk of interrupting important information decoding at this moment. This is because the user expects the jump and therefore is in a waiting position at this point. Later, when the menu and the

news items are presented, the risk of causing distraction with the wave movement increase. To allow sufficient room for the user to decode one or both of these pieces of information, the wave is short and only shown once (*fifth principle)*. Adhering to the *sixth principle*, we also designed so there are no simultaneous movements, which compete with the wave for attention and consequently distract.

5.2.2 Caught by a Wave - without drowning

The analysis of the eye recording data (see figure 9) shows that the respondents' eyes are caught by the wave immediately and they actually follow the tip of the wave until it comes to rest and the menu appears. Throughout the wave motion, there is no flickering at all toward the top half of the page, but the respondents let their eyes flicker once or twice towards other elements (or maybe they are just corrective eye moves towards single words in the news text), before their eyes return to follow the wave. Until this moment, the three respondents' eye scanning paths are very similar. After the wave has come to rest, two of the respondents systematically focus on each of the menu items starting from the right, and they both finally click on the item at the leftmost end of the horizontal menu. The eye of the third respondent systematically scans the news items before progressing to the horizontal menu. All in all, the scanning path of the three respondents is smooth with very few (and maybe unconscious) detours.

Figure 9: Hand drawn outline of the path the eyes of respondent no. 1 follow scanning the motions sequence with the wave.

The eye recording data clearly demonstrates the ability of the wave as an effective eye-catcher. This is indicated by the fact that the three respondents' eyes follow the tip of the wave closely from the beginning to the end of the sequence *(first principle)*. This overall picture is only interrupted by one or two very short eye movements towards single words in the news items, indicating that the wave does indeed work as an effective eye catcher, and the words are scanned, and not allowed to distract.

After the wave has come to rest all the users explore one of the two sets of information without any problems. This indicates that the wave movement has not disruptive (*second and fourth principle*).

The subsequent interviews revealed that the three respondents liked the wave. They spoke very positively about it using words such as 'nice', 'pleasant', 'surprising' and 'cool'. They were not specific about the reason, but seemed to express their immediate experience. When asked if they found the wave distracting or irritating, the answer from the respondents was a clear 'no'. We take this to indicate that we have designed the wave with adequate length that allows users the rest they need to decode the menu or the news items presented on the page (*fifth and sixth principle*). The eye recording data support the respondents' statements: two of the respondents use a relatively long period of time, after the wave has come to rest, to decode the whole horizontal menu whereas the third respondent reads the news items systematically. The fact that some of the users focus shortly on a single word in the news items may seem to contradict this conclusion. However the users do not experience this as distraction (see our discussion of this in the conclusion).

6. Concluding Reflections

One of the questions our experiments raise is whether the design principles developed will work in practice? The patterns we have observed suggest that the answer may be positive. The user evaluations showed that even calm and pleasant movements spontaneously catch and maintain the respondent's eye throughout a movement sequence. The results suggest that this eye-

catching effect may be used consciously to attract the users attention and to ensure that elements on the screen are not ignored but actually perceived and may also be remembered. This effect was achieved by letting the movement start in the periphery of the user's visual field, use three short consecutive sequences and introduce the three words at the end of each of these motion sequences. The data indicate that, in general, short motion sequences with few repetition and no simultaneous competitive movements is a good starting point for avoiding distraction. Also the use of the wave movement represents an interesting step in the direction of use of movement in an aesthetically appealing fashion without distracting or irritating the user.

However, in two instances, the test provided somewhat ambiguous results. Both instances concern eye flickering between static and moving objects. In the first instance, the users' eyes flickered between the static head and the moving drop, the sprout and the light. In the second instance, users' eyes flickered between random words in the news item and the wave movement. This suggest that users are distracted from decoding static elements on the page. However, the interviews indicate that this was not users' experience. One explanation why users do not experience this as distraction could be that the movement sequences are relatively short and therefore leaves them plenty of time to digest the static elements in the next instance. On the other hand, these surprising data may also indicate that the guidelines should be qualified. For example by further detailing when to start a moving sequence and whether it is appropriate to introduce information as a movement plays out.

We are aware that the – admittedly cursory – empirical user evaluation and movements in our test should make us extremely cautious with the conclusions we draw. They can be no more than indications. However, the data very clearly demonstrates that movement holds so much promising potential as a communicative tool that it should be investigated further. There is a need for further experiments and tests of movement patterns on websites to substantiate our findings.

With the aim of identifying key characteristics of a movement design that does not compromise usability, our work has shown that movement consistently catches the eye. Our recommendation to web design is not to exclude but to experiment and explore movements.

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[1] To understand the ability of movements to convey emotion, we organized a one-day workshop with: a classical ballet dancer, a film cutter, a cartoon animator, a theater choreographer and a modern dancer. They were given a specific assignment up-front and asked to express certain types of emotion through movement. Video recordings of their physical expressions and verbal explanations revealed patterns of expressive movements, which served as basis for development and testing of a prototype for a commercial web site.

[2] Our investigation into the first objective regarding the use of movement to evoke emotional user reactions is still in analysis.

[4] Chapter 20 and 21 on 'motion' and 'scene changes' in Reeves & Nass (1996) has played a significant role in our identification of movement principles in this section.

[6] Outside the lab, it is at present difficult to ensure, that a movement will look exactly the same on the screen of different users. It depends on machine configuration, browser, screen resolution, download time etc. Our work does not address this problem separately, but we think it will become smaller concurrently with technological progress. Today it is already possible to design quite complex movements with

Flash, which only vary very little on the screen of most users.

[7] The Danish office

[8] For more information go to FLOS official website: www.flos.net.