BA LACKS THE EXTRA TOUCH

How BA can improve their use of graphical elements in their climate communication

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This evaluation was written as an exam assignment at MIX202 "Design for Media Use" in the spring of 2020. The course is part of the Bachelor's program Media and Interaction Design at the Department of Information and Media Science at the University of Bergen. The course leader was Professor Lars Nyre. Subject teachers were Professor Andy Opel (Florida State University), Senior Engineer Zulfikar Fahmy, PhD Fellow Fredrik Håland Jensen, PhD Fellow Oda Elise Nordberg and Master's Student Jonathan Lindø Meling. The evaluation is translated into English by Kristin Eidsheim.

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Introduction

The purpose of this evaluation has been to find out how homeowners experience and interpret the communicative ability of graphic elements in articles on weather and climate, and give advice on how such expressions can be improved in the future. The report will first present Bergensavisen and the articles we chose to evaluate, before going into key design principles for the evaluation. Furthermore, it will mention tools and choices of method. The main findings will then be presented systematically and will form the basis for our design implications.

Our project

Bergensavisen

BA (Bergensavisen) is Bergen's largest local newspaper and currently has 78 employees (Proff, 2020). Founded in 1927 (Amedia, 2020), the newspaper had an average of 92,000 online readers and 37,000 on paper each day in 2017 (Medienorge, 2020). At the start of this evaluation project, we met editor Sigvald Sveinbjørnsson, who said that BA is keen to be out in the field to cover weather, climate and environmental events, despite not having a dedicated climate editor. He further stated that one goal for the newspaper is for readers to be informed and entertained by what they publish. Sveinbjørnsson could also tell that most of the newspaper's subscribers are adults and older people, and that they usually have strong roots in the city. Against this background, we decided to move forward in the project with homeowners older than 30 years old as a target group. Homeowners are an important community group and make up over 70% of the population of Bergen Municipality (SSB, 2020). When BA aims to inform and entertain its readers, it is important to meet this group.

Informants

Our selection of informants (Figure 1) consists of nine informants; four women and five men. They range in age from 30 - 61 years, with an average age of 45 years. The informants own housing in various areas of Bergen, including Fana, Fyllingsdalen, Solheimsviken, Nordnes and Sandviken. They work, for example, in preschool, in the transport sector, as a researcher, engineer, therapist and secretary.

One of the informants subscribes to BA, while the others read, watch or hear news elsewhere. Most cite mobile or PC as their preferred news reading device, while one cites the newspaper in paper format as their favorite.

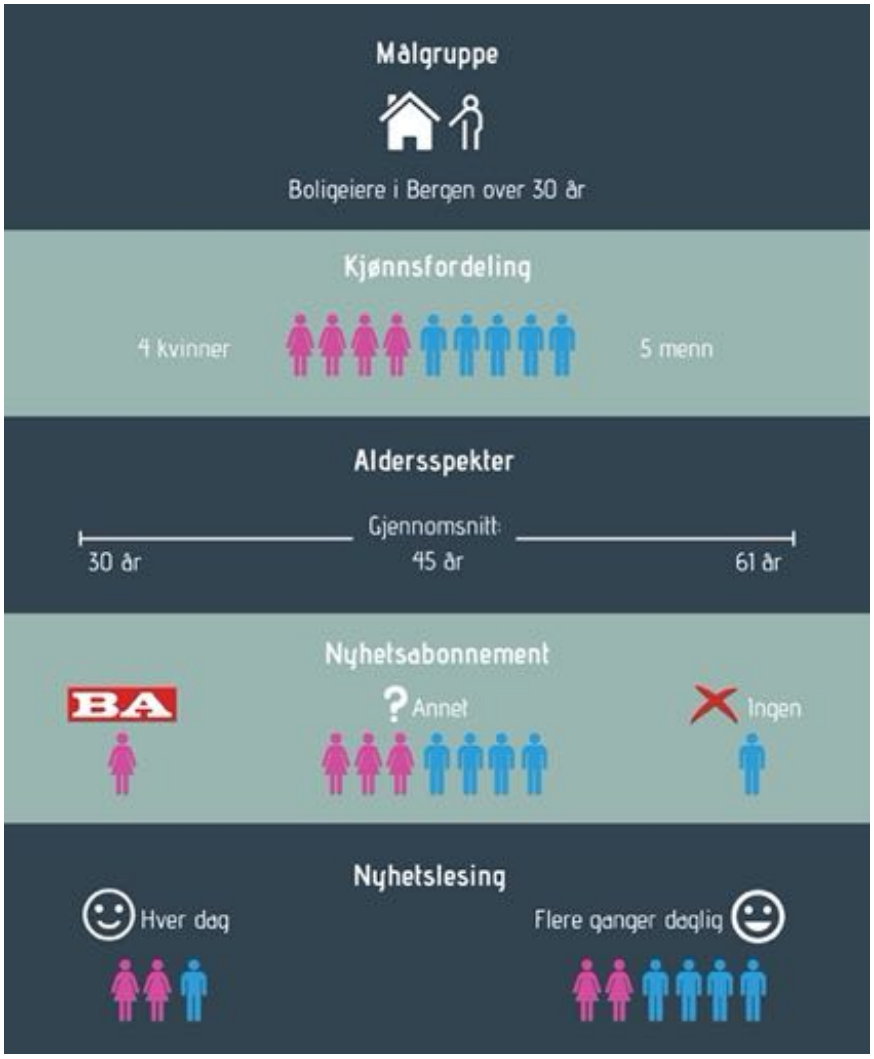

Figure 1: Visualization of our selection of informants, where pink figures represent women and blue figures represent men.

Evaluated news articles

As a basis for our analysis, we have selected two articles with climate as a theme from BA's online edition. Both articles contain graphic elements, which was important to us and our research question. The first article, "These are the biggest dangers in the different districts of Bergen" (Figure 2), is quite long, and deals with the biggest dangers in Bergen.

A risk and vulnerability analysis forms the basis for the assessment, where extreme weather is among the dangers that are given the most attention. The graphic element in this case is an interactive map (Figure 4) showing the dangers in the different districts.

Figure 2: The second article.

Figure 3: The first article.

The second article, “In 100 years, the water may have risen by up to 70 cm” (Figure 3), is considerably shorter than the first, and addresses the consequences for Bryggen in the event of a potential storm surge in the future. The article emphasizes the sea level that is steadily rising, and how Bergen must improve its flood protection in order to cope with a potential flood in the future. Visual elements in the article include a static map (Figure 6) illustrating the sea level at such an event, as well as a bar graph (Figure 5) showing the sea level in Bergen from 1915 to 2019.

Our thought was that issues related to local hazards could be perceived as more interesting to our target group, as homeowners have invested in something that may be affected by such external factors. During the evaluation, we were looking to see how the informants interacted with the map, and how they experienced the dissemination of factual and numerical information in all the graphical elements.

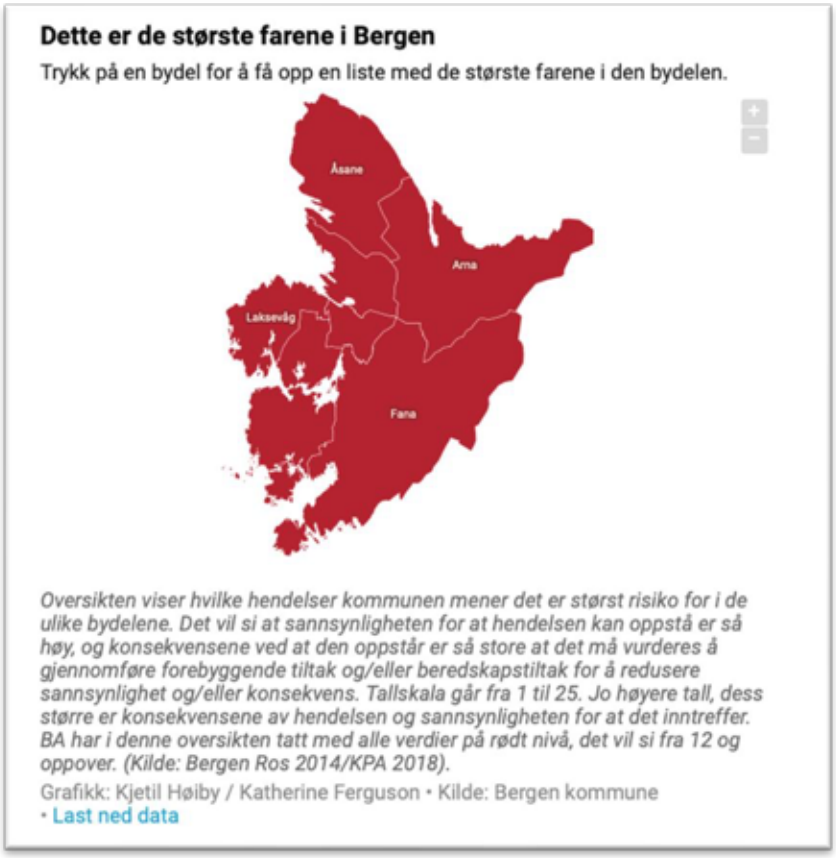

Figure 4: Interactive map in article no.1 showing the greatest dangers in the different districts of Bergen.

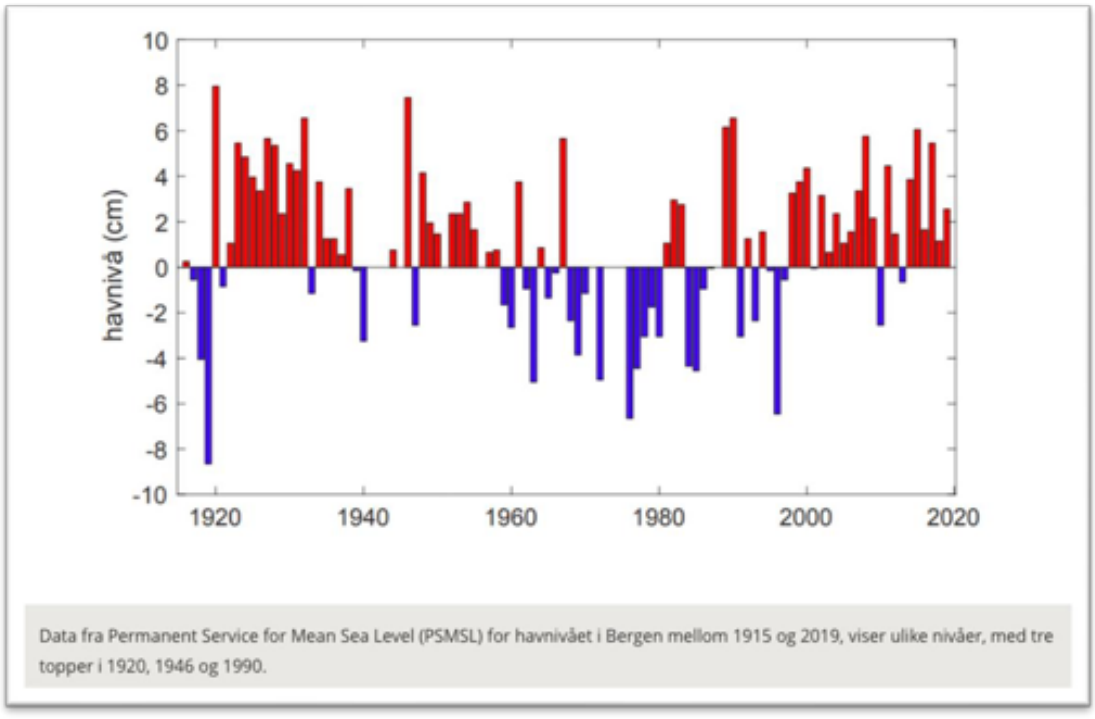

Figure 5: Bar graph in article 2 showing the sea level between 1915 and 2020.

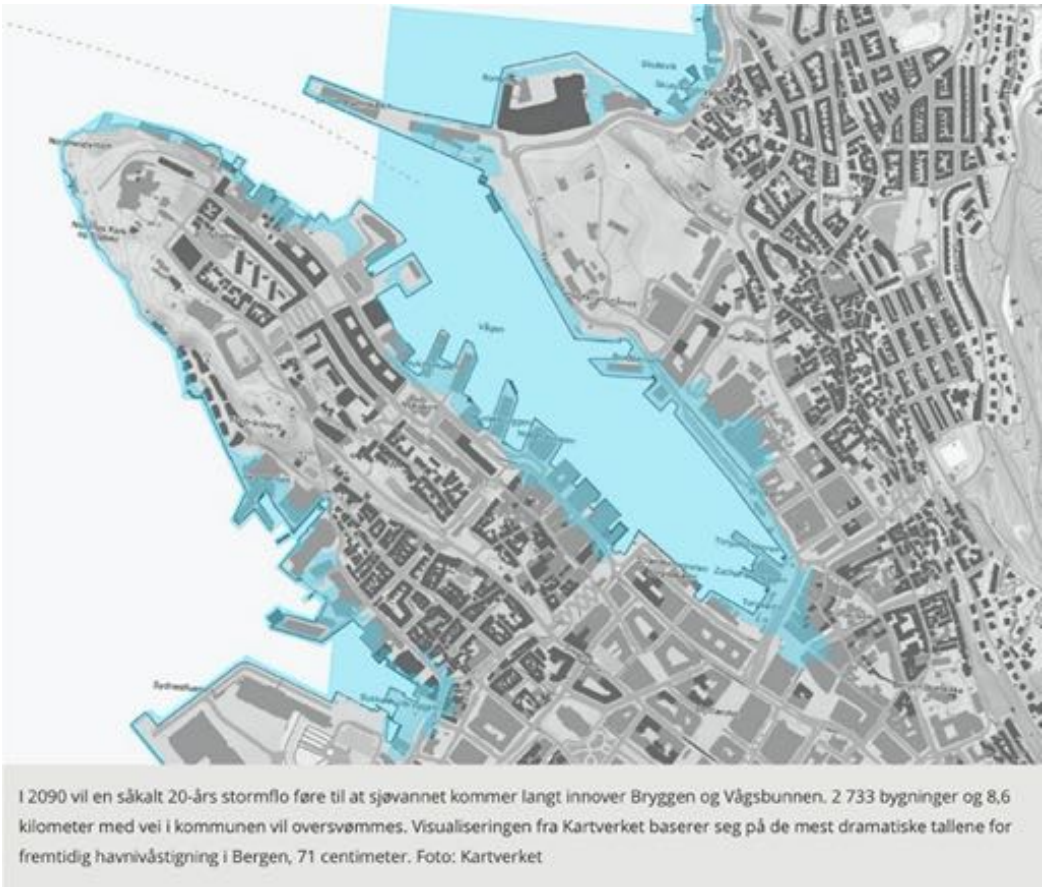

Figure 6: Static map in article 2 showing how the estimated sea level rise will affect Bergen in 2090.

Method

The data collection in this project has been conducted through nine semi-structured qualitative interviews (Helland et al., 2017, p.103), where we prepared an interview guide in advance. In two of the interviews we also used technological equipment to collect objective data. Objective data means data that is not influenced by what the informant says or their social desirability (Crowne & Marlowe, 1960, p.349). The equipment we have used is the eye-tracking glasses Tobii Pro glasses 2 and the stress bracelet Empatica E4. By using eye tracking, you get data that shows where the informant focuses his gaze on a point of interest, called fixation (Lazar et al., 2017, p.371). The gaze's rapid and unoriented movements between the fixations are called saccades, and last between 10 and 100 milliseconds (Lazar et al., 201, p.370). This data can be used to create gaze plots and heat maps. Gaze plots illustrate the range of points the participant looks, as well as the time spent on the different points, while heat maps illustrate where the informant looks and to what extent, without saying anything about order (Tobiipro, 2020).

The stress bracelet gives us physiological data such as sweating, blood volume pulse, heartbeat, movement and temperature (Empatica, 2020). An incidents in the physiological data must be followed up with a conversation to confirm what the incident means (Holmqvist & Andersson, 2017, p. 10).

In order to ensure ecological validity (Helland et al., 2017, p.124) in this project, we have focused on making the informants feel safe in the interview situation, in addition to emphasizing that it is the articles that are being evaluated and not the informant. We have also used methodical triangulation (Helland et al., 2017, p.125) to strengthen the validity of the project. This is through the use of qualitative interview as subjective method and eye tracking, and physiological data as objective method.

The ecological validity may have been influenced by the Hawthorne effect (Preece, et al., 2015, p.471) which we discovered when there was a significant difference in the average time spent, on the informants who read with and without physiological equipment. For the first article, informants wearing equipment spent 5 minutes and 36 seconds, on average, while informants without equipment spent 3 minutes and 9 seconds. On the second article, there are 4 minutes and 20 seconds, and 2 minutes and 38 seconds respectively. This indicates that the informants who were measured with equipment were more aware that they were in an unnatural situation and therefore spent more time reading the articles. In addition, the recorded reading time of BA, 1 minute and 5 seconds on both of its articles, shows that all of our informants spent significantly longer reading the articles than the newspaper's own readers.

Informed consent

All informants have been informed about the project process, data collection and their own rights, both orally and through an information letter. Prior to the data collection, a form was sent to the Norwegian Center for Research Data (NSD), which has approved the project. All informants have also signed a consent form. During the data collection, we also made sure to emphasize to the informants that they always had the opportunity to withdraw from the project.

Schedule and execution

Prior to the evaluation, we made a schedule for the evaluation (Figures 7 & 8). This is divided into four phases and gradually describes how the interviews should be conducted. The first phase was to make the informant aware of the project's purpose and create a comfortable atmosphere. Here the consent form was explained, read and signed. For the two interviews with objective data collection, the stress bracelet was also put on. Phase two dealt with the identification of the characteristics of the informant and its relation to news.

Figure 7: Schedule for the evaluations. White text applies to all evaluations, while blue text is for evaluations which also included eye tracking and measurement of physiological data.

Next came phase three, where the eye-tracking glasses were put on and calibrated. When this was done, the informant got to read the first article and was then asked about it. The same applies for the second article. At the start of phase 4, the eye-tracking glasses were removed, and the informant was further asked how they thought text and visual elements communicated the news to them. Five minutes into phase 4, the stress bracelet was taken off. Results in the physiological data were then compared with observations from the eye tracking by the ones with technical responsibility. This took place at the same time as the interview and formed the basis for our follow-up questions for the informant. Here, the aim was to uncover possible reasons for different incidents on the stress bracelet results.

We found the schedule useful to ensure equal conduct of all interviews and to keep track of the technical equipment.

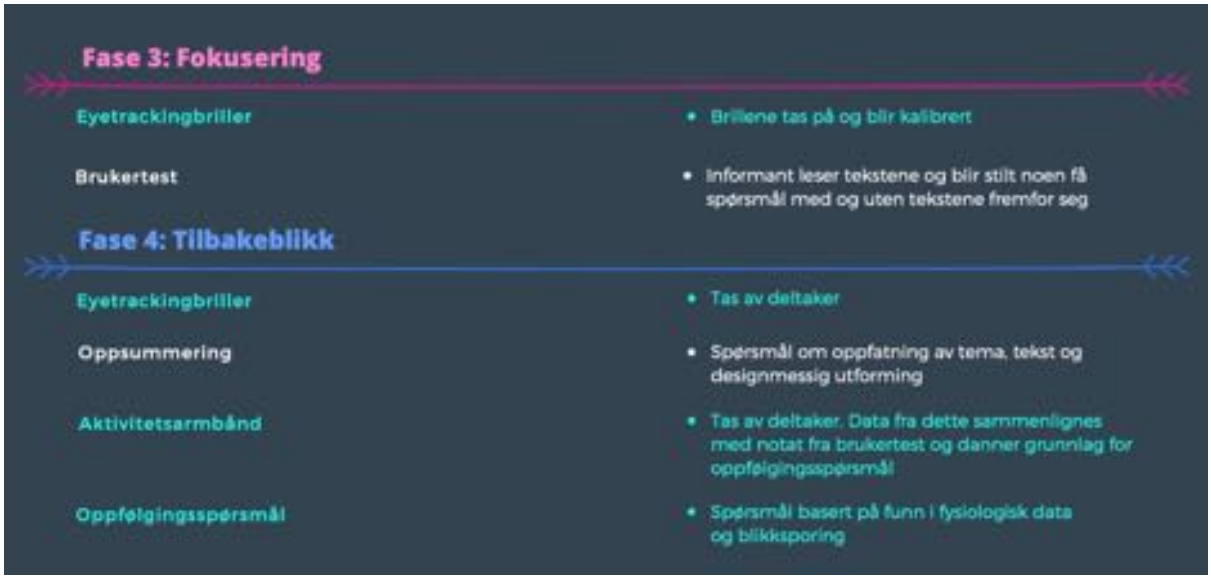

Figure 8: Continuation of Figure 7

Design principles

Different design principles can be good basic tools when you, as a designer, has to orientate on important aspects of a design (Preece et al., 2015, p.26). Several of the principles are central to user interface evaluation, but in our project we focus on Don Norman's principles of visibility and opportunity. The principle of visibility is that the more visible something is to the user, the more likely they are to know what they can do next (Preece et al., 2015, p.27). Opportunity revolves around the aspects of a design that allow the user to know how to use it (Preece et al., 2015, p.29). Furthermore, in our analysis we will assess whether the two articles meet the requirements for visibility and opportunity.

Homeowners' experiences of graphic elements

For a medium to become important in people's lives, it should be measured not only by profit and ease of use, but also by how good it is at communicating (Nyre, 2014, p. 92). In the two selected articles, BA tries to communicate complex topics in a simplified way that should be easy for most people to read and understand. Through the evaluation, a number of observations and measurements have been collected that we have chosen to condense down to three main findings.

These deal with visual journalism and dissemination of factual information, and are as follows: interactivity is not evident, graphics communicate research data poorly and the static map is intuitive but difficult to relate to. In this section, we will present these findings in relation to the design principles mentioned earlier.

Interactivity was not evident

The finding applies to the interactive map of hazards in Bergen (Figure 4) in the first article presented to the informants. The interactive function of the map is to present information on the greatest dangers in the various districts of Bergen. The feature is triggered by pressing or holding the mouse over one of the neighborhoods on the map. The small text on the map is the only thing that tells readers that there is an interactive feature, and the feature is essential to make sense of the map. We found that as many as six of our nine informants scrolled past the interactive map in the first article - without noticing that it was interactive. This became evident through observation and in the interviews that were done after the informants had finished reading the article. One of the informants looked at the map for 22 seconds without noticing the interactive feature. In the interview, the same informant stated that:

«...I looked at it for a while and thought it was a bit strange that everything was the same color, and then I went on».

BA's use of red color to symbolize that there are dangers in each district does not seem fortunate for visibility, and since everything is red, this symbolism does not become as clear. For another informant, who, unlike the majority, found out about the interactive feature, eye tracking data shows that this took 15 seconds; The informant had explored the entire map visually and read the caption, before the text on the map, which points out the interactivity, was noticed.

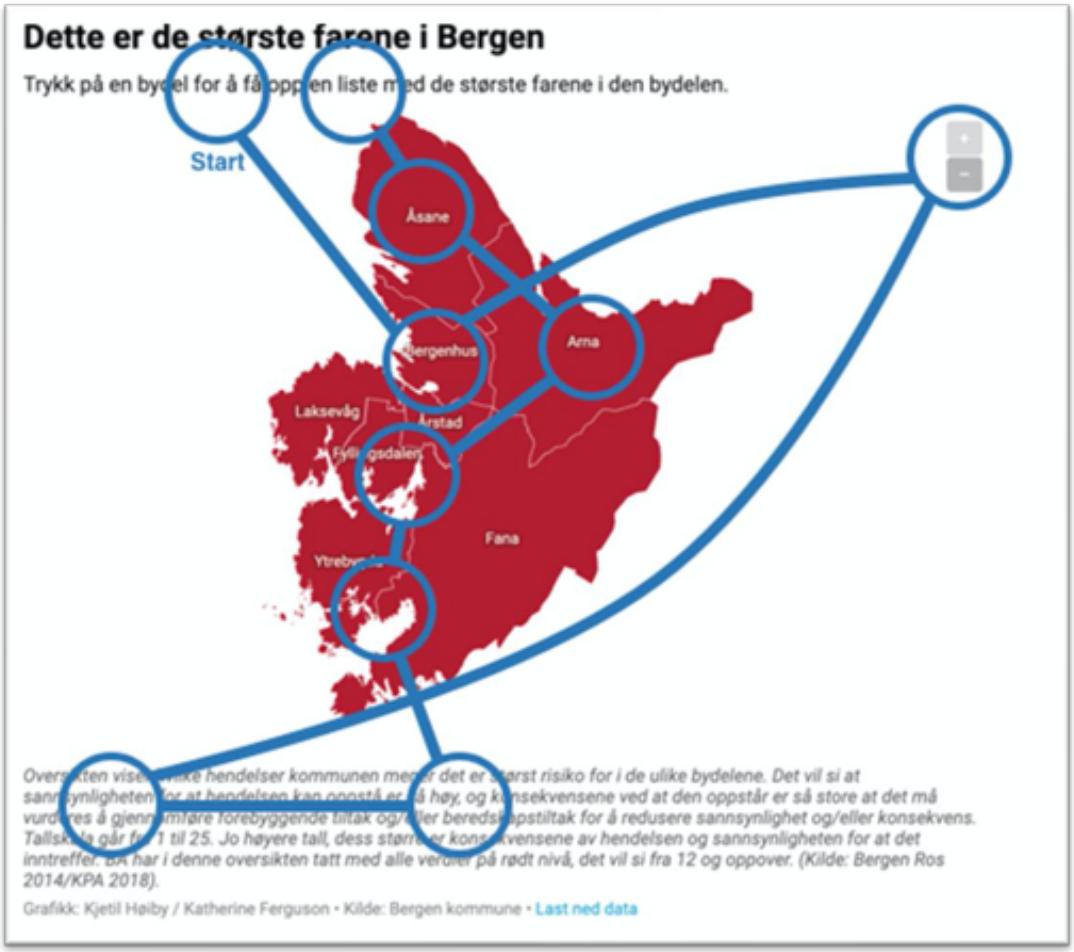

Figure 9: Shows the 15 seconds that informant 5 spends looking around the map without noticing it is interactive.

The finding shows that Don Norman's design principle of visibility and opportunity is clearly violated. All important functions should be clearly visible to users, so that the user can know what to do next (Preece, et al., 2015, p.26). Furthermore, the user's opportunities should be obvious (Preece, et al., 2015, p. 29).

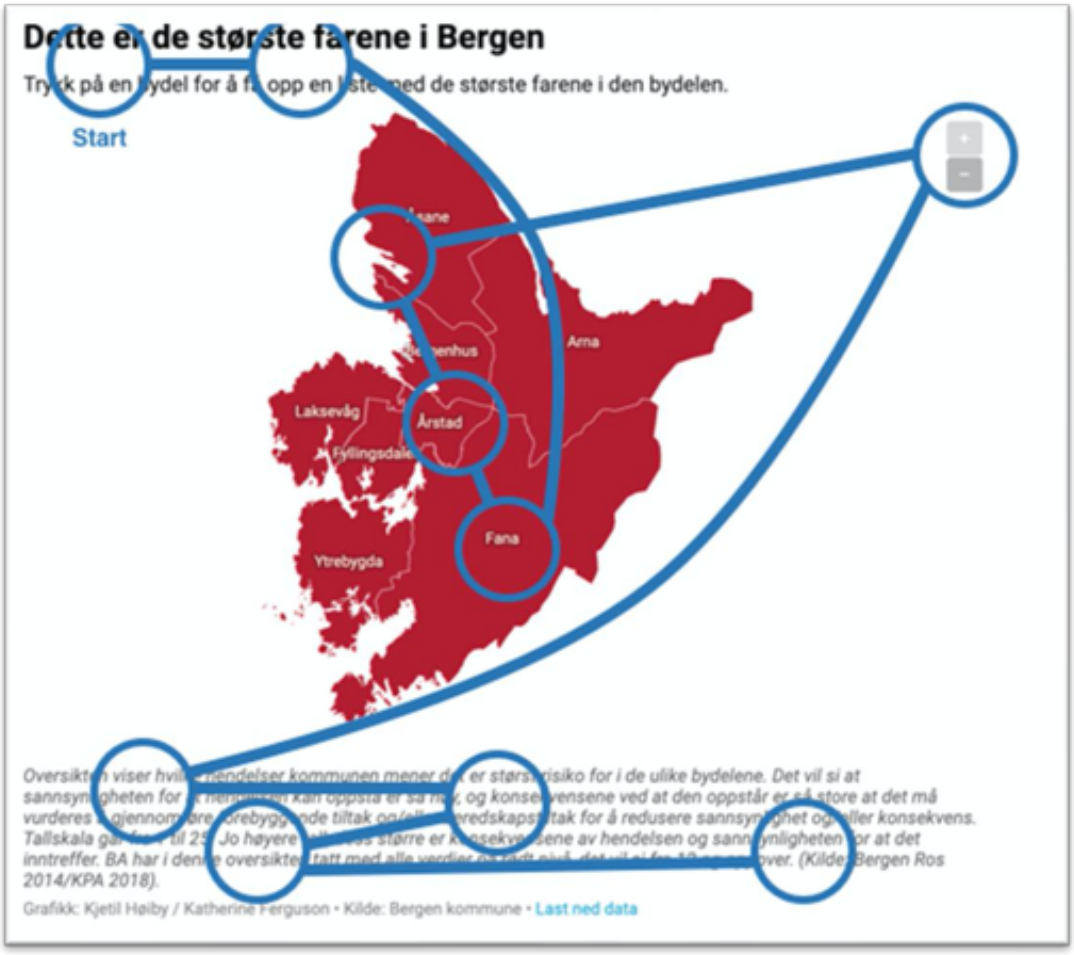

Figure 10: Shows the order of focus points for informant 2. The gaze's movement lasted 22 seconds and the informant did not detect the interactive feature.

The graphics communicate research data poorly

The finding applies to the interactive map (see Figure 4) and the bar chart (see Figure 5). Four out of nine informants did not think the bar chart was intuitive, and after spending time looking at the chart they expressed that they thought it was disseminating the data poorly. In particular, the numbers representing the sea level in cm above and below the average, several informants perceived as confusing (Figure 5). What the average is calculated from and when is not explained either in the text or in the caption. In addition, it was pointed out that the high values in rise were not easy to apply to real consequences.

For both informants who wore the stress bracelet, the physiological data showed a change in heart rate when looking at the bar chart.

For one of the informants, the heart rate increased from ≈86 to ≈93 beats per minute, and for the other, the heart rate increased from 50 to ≈100 beats per minute. The increased pulse lasted about 10 seconds for both informants, but both claimed that they understood what the bar chart conveyed afterwards. When we asked questions about the informants' reaction, we were able to explain the results in the physiological data: One informant stated that he reacted to the fact that what the bar chart convey about the sea level was contradictory to the article's headline. The informant said the following:

«It has stayed within the same level for quite some time. [...] There is no drastic development here according to what I see on the graph»

Figure 11: Shows a vigorous increase in heart rate when informant 5 first looks at the bar chart. The informant claimed that this may have been because the informant liked pure statistics that could be interpreted. This informant also points out that the graph does not match the heading.

The other informant who experienced an increase in heart rate (Figure 11) also said that the bar chart was contradictory to the headline of the article. However, this informant claimed that the heart rate increase may have come from the fact that the informant felt like they got a lot out of the graph, because pure statistics are easier to interpret. The physiological measurements and statements of the two informants differ from what the majority expressed. Nevertheless, we see that a common feature for the majority of informants is that they did not interpret the bar chart as it was intended to be interpreted.

It also emerged that the interactive map (Figure 4) was not particularly informative for several of the informants. This became evident after they were told/found out that it was interactive and got a closer look. Mainly, there was confusion about how "probability" and "consequence" are combined into "risk", and expressed in numerical form:

«No, that doesn't mean anything to me. Large Fire? 12 big fires in Bergenhus?» and «Once, many times, every year, every other year. So - the figure says nothing» are statements from two informants who confirms the confusion. Two other informants claimed to like interpreting the meaning of graphs and visuals, as they were used to dealing with such in a job context. For people who are not usually exposed to such visual representations, it is not as easy to interpret and understand research data alone, and they would rather look to authorities that can explain the context, predict the consequences and simplify the essence of the research (Pinto, et al., 2019, p.2).

Based on the informants' statements, we see that the interactive map and bar chart have not accounted for the significance of the figures to a reasonable degree, which has significantly weakened both graphic's communication ability. Since media tend to be the primary source for information on climate change and other environmental problems (Pinto, et al., 2019, p.5), we experience this as an important finding that certainly should be dealt with.

The static map is intuitive, but does not engage

In the article about storm flooding in Bergen in the future, a static map is presented from Kartverket (Figure 6). All the informants stated that they immediately understood what this conveyed. Statements from informants during the interview also confirmed that the map was perceived as interesting: «It was a little more interesting to see, really how much is affected». From one interview, which also dealt with the measurement of physiological data, it was stated that: «It becomes a bit like you're staring at that, you kind of want to see for yourself how the places you have a relation to will look like when there is a flood». The map clearly shows a possible consequence of climate change, which also has a great local impact. The local aspect can help readers perceive the problem as more interesting to them, while at the same time the dramatic consequences one sees may promote a desire to act, precisely because it has a greater emotional impact (Corner, et al., 2015, p. 5). In addition, Affective Images of Climate Change (Lehman, et al., 2019) indicate that images which show the causes and consequences of climate change are perceived as most relevant to the topic (Lehman, et al., 2019, p. 7). However, one informant claimed that:

«When they try to predict something that is far, far ahead, I can't quite take it seriously, because there is so much that can happen in that time»

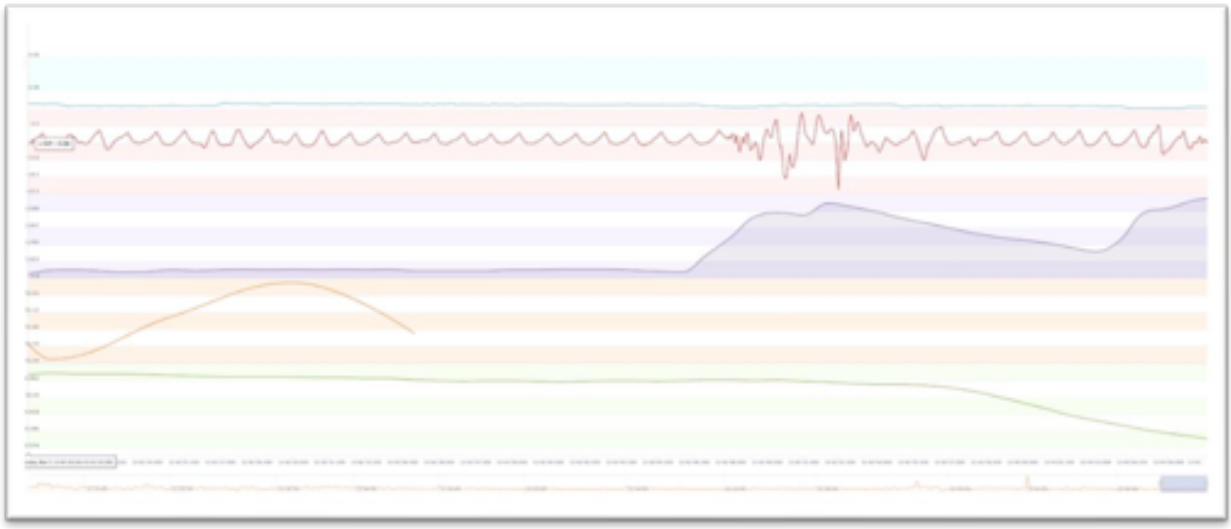

Figure 12: Shows little impact when the informant looks at the static map. Note that although the increase in heart rate looks dramatic, there is only an increase from ≈51.04 to ≈53 beats per minute.

Although the informants generally expressed their fondness for this map, some of them felt that it was nonetheless not engaging. The physiological data also show very little impact (Figure 12). This may indicate that the informants are generally somewhat indifferent to the map; even if it does not create frustration, we can, with the lack of physiological incidents, imagine that it does not create as much joy or engagement either.

Design implications

Based on the findings from the analysis, we have considered some possible design implications that may strengthen the communication of BA's visual elements. Since our findings are related to specific elements, we choose to provide some specific advice on these. We will also provide other, more general, advice that can be used in future design of similar visual elements.

Make interactivity visible

Our first advice is based on two of the most important design principles; visibility and opportunity. The most prominent finding we made was that the interactive function on the map (Figure 4) was not noticed by over half of our informants. To increase the visibility of this map and similar interactive graphics in the future, a larger and clearer text indicating that there is interactivity and explaining briefly its function is appropriate, and that the entire graphics are scaled up to cover large portions of the screen. In this way, it will be more difficult for the cursor to wander by, and easier for readers to identify the opportunities that exist.

Two of the informants also pointed out that the map probably would have signalised interactive features if more than one color had been used. For this map, we therefore see that it will be more clear if the different types of hazard level in Bergen are color-coded. In practice, this can be designed so that the different neighborhoods on the map have different colors based on the danger level of the selected danger (Figure 13). The use of color and color coding is something we would recommend to BA for similar interactive graphics, as it can convey information more clearly, make the graphics more visible and readers more aware of the functionality. Color symbolism is an important aspect here that should be included in such an assessment. By implementing the advice mentioned above, we strongly believe that the interactive map and similar graphics will satisfy Don Norman's principle of visibility and opportunity to a much greater extent.

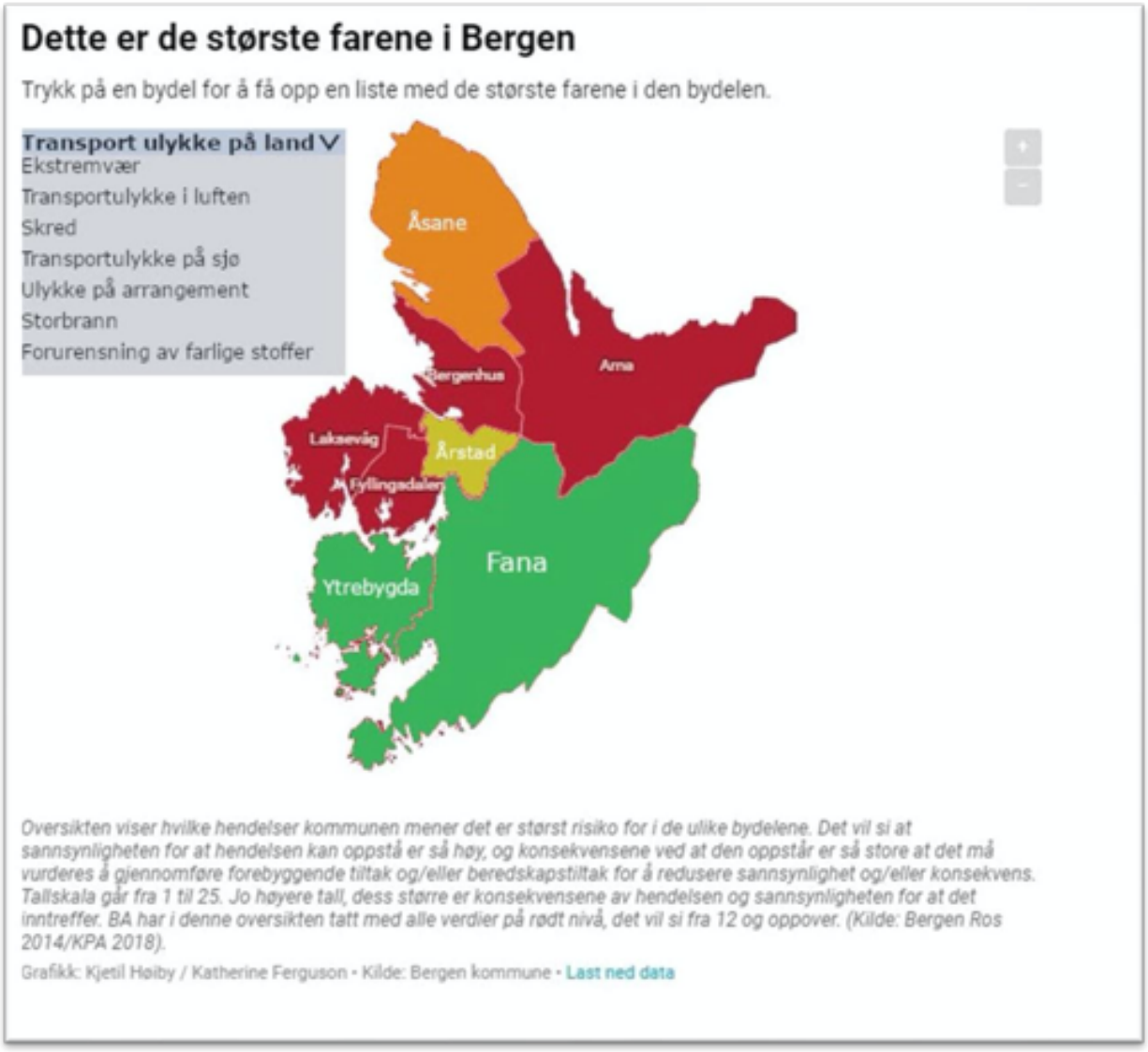

Figure 13: Self-made maps suggesting how to use color coding to make a visual element more visible. In addition, it shows how color symbolism can make communication more efficient, in this example green is where it is least likely to occur while red is most likely.

Clarify numbers and research data

The analysis revealed that the informants experienced confusion about the use of numbers. For the interactive map (Figure 4) it was mainly because the number represents two variables that are merged into one. As the data currently is presented, it is impossible to tell how much risk there is for an event to occur and what the consequences it would have. A better solution would probably be to present these variables separately. This will give a better picture of the actual danger you are facing and remove the reader's uncertainty.

If in similar graphics there are compelling reasons why such variables must be presented as a single variable, we would like to point out the importance of the editors explaining the method used to merge them and how each variable is weighted in the calculation. This separation of the data in combination with a more conscious use of colors will probably make the information easier to understand and contribute to a more engrossing experience as it will be easier to compare the different dangers between the districts.

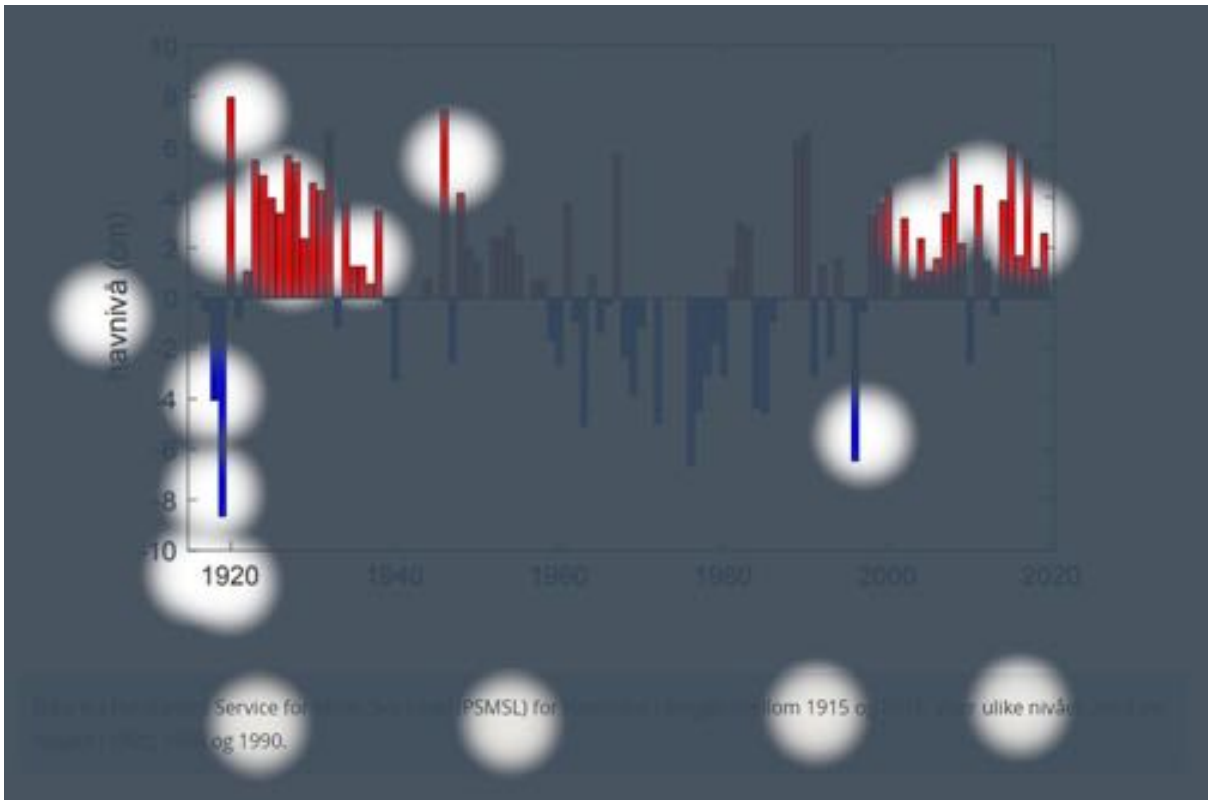

Figure 14: Shows where on the bar chart the informant looks the most. Here we can also see that the informant is studying the peaks carefully in 1920 and 2020, which may indicate an attempt to put the numbers into context.

For the bar chart (Figure 5), the significance of the sea level numbers was not explained. It was also not stated how many centimeters above the average it needed to see real consequences. This was something several informants expressed as confusing. For exactly this chart, BA should include in the caption what the average "0 cm" is and what it is based on. In addition, the caption or chart can advantageously convey when the rise values are so high that they have consequences, in order to associate the chart more closely with the rest of the article.

Coherence and context are important in presenting research data. The United Nations Economic Commission for Europe (UNECE) guidelines for the use of tables state that tables must contain enough information to be taken out of their original context and still make sense (Petteri et al., 2009, p. 12) . We believe this applies to all visual presentation of research data. In this way, BA, and others presenting datasets, can make it presented in a way that is understandable.

How the bar chart is interpreted after the numbers are explained, based on what the informants see visually, is also an important aspect of the chart's communicative ability. Since we found that two informants interpreted the diagram opposite of the article's angle, we think it would be appropriate to take the sum of the red values (rise in sea level) and the sum of the blue values (decrease in sea level) in the given time period, and present the difference between these. This will to a greater extent reflect an increase in sea level and thus substantiate the article's content. The essence of this advice can also be transferred to similar charts. More generally for such visual graphics that present research data, we recommend that an authority in the field of expertise briefly explain the meaning of the graphic or how it should be interpreted (Pinto, et al., 2019, p. 2). In this way, a great deal of tension will be avoided in the readers' interpretation, as we experienced. In addition, we would recommend BA to attach sources directly to research material or illustrations, for those who are particularly interested or others who need more interpretation.

Engage readers by letting them be in charge

Recent findings from the analysis are positive considering that almost all of the informants perceived the static map (Figure 6) as intuitive; but also negative as nothing indicated that they got engaged. In addition, one of the informants stated that it was difficult to imagine something that was so far ahead, thus we believe this map can be even more exciting if you add an interactive feature that allows the reader to flip from present to the future, at the same time as the sea level shows change. This can be done, for example, by having a visible timeline at the bottom of the illustration where you can move back and forth in time by dragging a cursor along the timeline.

The years on the timeline will be the years between 2020 and 2090, where the year on which the cursor is placed appears in a visible frame, and changes according to where the cursor is placed. The estimated water level for each year will also appear on the map in the same way as today, only with this implication one can see the development. We also think it may be an idea that the water moving over a critical zone be colored red to symbolize this. The significance of the red color must then also be explained in the illustration.

In an interview, it was also mentioned that it was difficult to locate their home on the interactive map in Article 1. For maps to visualize events and their consequences, it is very relevant for the homeowner to know where their home is located. A nice feature to include would be a search box where the reader can enter their address and have it highlighted on the map. Such a search box will invite the reader to interact with the map. It will also be able to make the map more relevant, and make it easier for the reader to retrieve the information they are looking for, what the consequences will be for them and their nearest ones.

The basic principles of the suggestion above can also easily be adapted to similar maps. People will naturally try to compare new, unknown observations with what is known, to see the relations and make sense of what they see (Boswell et al., 2019, p. 6). An interactive feature that facilitates this will then put things in perspective for the readers, thus making the information easier to relate to. In addition, interactive elements can increasingly attract attention and encourage readers to interact, which in turn makes the information more interesting and engaging (Bradl, 2019). In other words, there are several good reasons why interactive functionality, if it satisfies the principle of visibility and possibility, can benefit the communication to ordinary static illustrations.

Summary

This report deals with our evaluation of Bergensavisen's use of graphical elements in communicating climate news, where we wanted to find out how homeowners interpreted and experienced the communicative ability of such elements. To find out, we conducted nine evaluations with qualitative interviews, two of which also included

eye tracking and measurement of physiological data. In this way, we have had both a subjective and objective approach to the informants, and ensured higher validity in the data.

Based on our analysis, we see that there are several aspects of the visual elements that do not meet key design principles, or manage to engage. In addition, research data is presented in a way that is not intuitively perceived by the informants. Based on this, we will conclude that BA's use of interactive maps, static maps and diagrams mainly communicates information poorly to the readers. With small changes, such as adding interactivity to the static map, the use of color coding and a better explanation of research data, readers will feel more informed and entertained.

Our suggestions for design implications would probably be more valid if we had had physiological data and eye tracking from more than two informants. Nevertheless, we believe they can be a useful input for BA, since they are also based on central design principles.

For future work, it would be interesting to use the design implications and carry out a new evaluation to reveal their effect on the communication to the readers.

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