

The Usability of Persistent and non-Persistent Headers on Web Pages

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Abstract: Websites are used for many different purposes and can also be designed in different ways with different styles. Certain website designs use persistent headers, while some alternatively use non-persistent headers. Online guidelines give ideas on how these are best used. However, there is no published systematic study investigating the performance and user satisfaction of these types of headers. In this paper we present an empirical experiment where persistent headers are compared with non-persistent headers. Two prototype news websites varied only in terms of their headers were developed and used in the experiment. The basic results suggest that persistent headers are more usable, particularly on a slightly larger screen. The analysis indicated that performance and user satisfaction are increased with the use of persistent headers on websites.

1 INTRODUCTION

Web pages and other software applications can be created with many different user interfaces and interaction options. However, simply because one can develop a web page or application in a certain manner does not automatically guarantee usability. Usability can only be achieved by careful design, end-user inclusion and evaluation.

Certain website designers use headers on web pages as part of their design. Three main styles are available. These are persistent (sticky) headers, non-persistent headers and partially persistent headers. A persistent header is a 'pattern for keeping the header of a website or app in the same place on the screen while the user scrolls down the page' (Laubheimer, 2021). The converse of this is a non-persistent header. This disappears from view when a user scrolls down. A partially persistent header will disappear when a user scrolls down but will reappear as soon as the user begins to scroll up again. A user will not have to scroll all the way to the top for the header to reappear.

Guides and discussions on best practices are available online, e.g. see Laubheimer (2021) for a good example. However, to our knowledge no one has done a peer reviewed published systematic formal evaluation for performance and user experience of different header types. Therefore, we present in this paper a novel contribution to the research and user interface design communities, where we show the

results of a systematic formal evaluation of persistent headers and non-persistent headers.

Therefore, in the next section we will discuss some background works showing the diversity in approaches to improving user interfaces. Following this, the prototype developed will be presented. Then the systematic experimental design will be described. Next, the results from the data analysis will be detailed and finally the paper will conclude with a discussion.

2 BACKGROUND

The avenues researchers are investigating with the aim of improving user interfaces are numerous. For example, Alves et al. (2020) take the approach that better user interfaces need to be able to adapt to users' personalities.

Moreover, de Queiroz Proença et al. (2021) discuss and propose a good solution concerning the possible advantages of allowing users to apply certain customisations to web user interfaces. The authors developed a Chrome browser plug-in for this purpose. Their testing of this convinced them that allowing flexibility will help users have a better experience.

Further, in some earlier research (Dessart et al., 2011) it was discussed that having an adaptive user interface can cause disruption to the users. Their solution was to propose 'animating a transition scenario showing the evolution from the user interface before adaptation to the user interface after

adaptation' (Dessart et al., 2011). In their research they found that this approach reduced the amount of disruption to the user. However, there were some negative aspects with the approach, which suggested that the animations should have been faster and easier to bypass. It was further indicated that some of the adaptive steps could have been made smaller or combined together.

Other researchers (Rendell et al., 2022) have investigated from a more psychological perspective, the use of 'nature' type images (e.g. water and vegetation) at the user interface. This was in relation to commercial type websites and the effect on end users. The authors' experimental results indicate that 'perceived nature presence has a positive influence on user perceptions of trust and visual aesthetics in response to a corporate sales user interface (Rendell et al., 2022)'.

Another study (Abrahamian et al., 2004) showed that having a personality aware user interface concerning certain human personality traits in a learning environment context can have positive effects. Abrahamian et al. (2004) obtained data to show that use of a personality aware user interface tended to significantly increase test scores in participants. Further, initial results indicated that subjective satisfaction was higher when the personality aware user interface was used by the respective participants.

Certain researchers have concentrated on specific elements of a user interface with the aim of improving user interfaces, e.g. in Murano and Lomas (2015) web page menu positioning was investigated. In their study the authors experimented with four menu positions (left vertical, right vertical, top horizontal and bottom horizontal). The results showed that the menu positions that were most efficient were the top horizontal and left vertical positioned menus. Overall, these resulted in participants doing less errors and less mouse clicks, when compared with the other two positions investigated. Participant satisfaction was aligned to the quantitative results.

Another example of investigating certain elements of the user interface is found in the article by Al-Jasim and Murano (2023). This work investigated in conjunction with real users the most appropriate ways of designing toggles within a user interface. Based on the results, the authors devised a series of guidelines for best practice in incorporating toggles in an interaction.

This background section has demonstrated that the efforts of researchers aiming to constantly improve user interfaces and the user experience are both numerous and creative. As mentioned in the Introduction section, the authors of this paper have

been investigating the usability of web page persistent headers and non-persistent headers. Therefore, the next section will present the results of an experiment conducted with the aim of obtaining concrete results by means of a formalized approach.

3 THE EVALUATION

3.1 Prototypes Used for the Experiment

In order to run the experiment, a newspaper type website was developed as an environment. Two identical prototype websites were developed, with the only difference being the header, and whether it was persistent or not. This would allow for an experimental comparison where the only variations in each prototype would be the header type. The headers were designed by broadly following the guidance in Laubheimer (2021).

A newspaper website is something many users are familiar with and a typical website that could use headers. Some headers of big news corporations can contain elements like a logo, main navigation and a search box (e.g. see nrk.no and bbc.com/news). For our experiment we chose to focus mostly on the navigation with a header containing the main navigation of the web page. Five main buttons/links to different sites were implemented for the header. These were called 'Home', 'Sport', 'Celebrity', 'Finance', and 'Foreign'. The 'Home' button took one to the homepage which is filled with news articles. The remaining header elements took one to pages with news articles within their subject area. Figures 1-3 show some sample screenshots of the two prototypes (We note that for potential copyright reasons the images have been removed for this paper. However, in the experiment, these were visible to participants.).

3.2 Hypotheses

This experiment operated around two main hypotheses concerning the use of header designs. These are as follows:

H₁: There will be a statistically significant difference between header types for performance.

H₀₁: There will be no statistically significant difference between header types for performance.

H₂: There will be a statistically significant difference between header types for user experience.

H₀₂: There will be no statistically significant difference between header types for user experience.

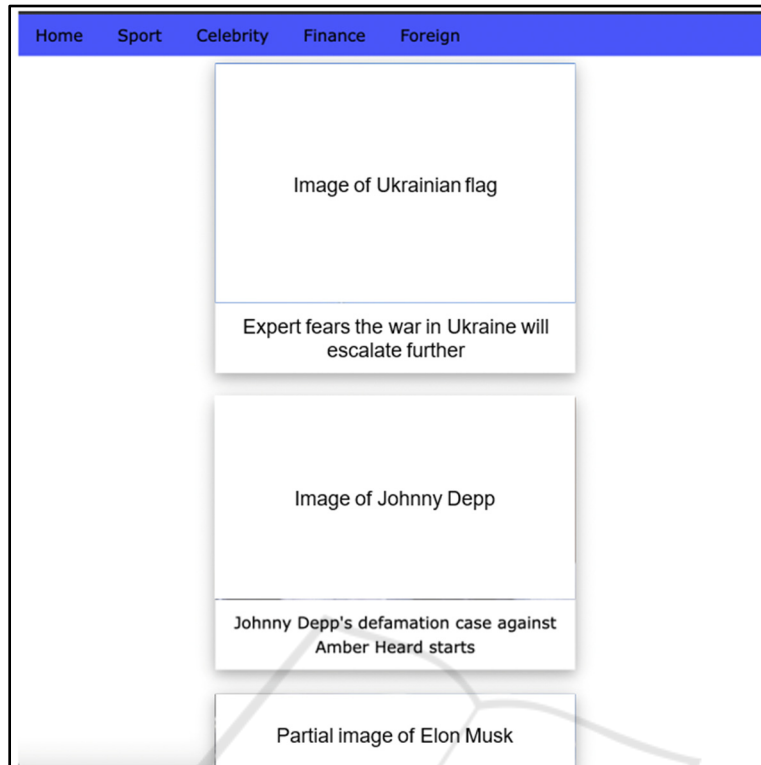


Figure 1: Screenshot from front page of the experiment website.

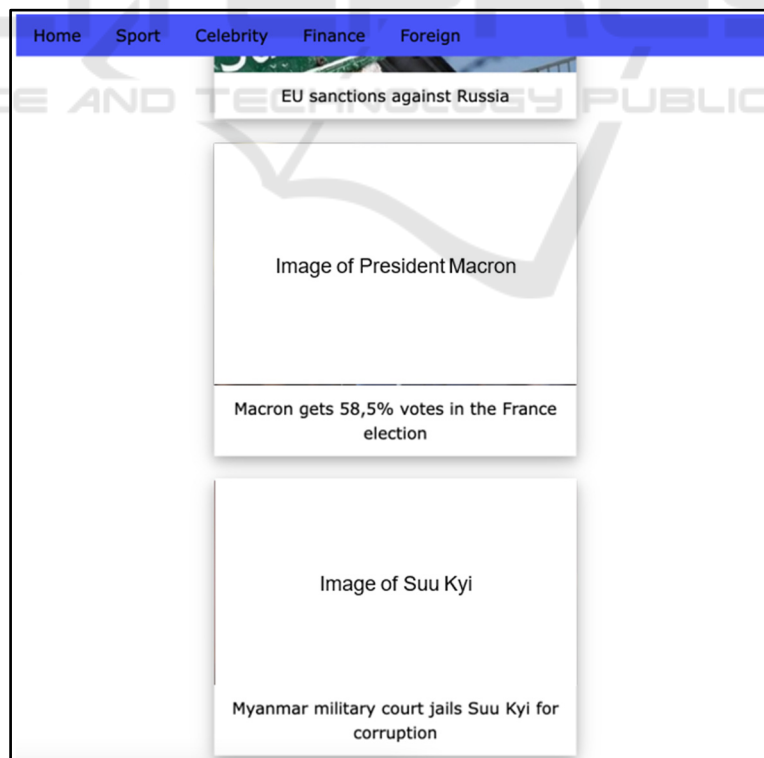


Figure 2: Screenshot from the persistent header web page.

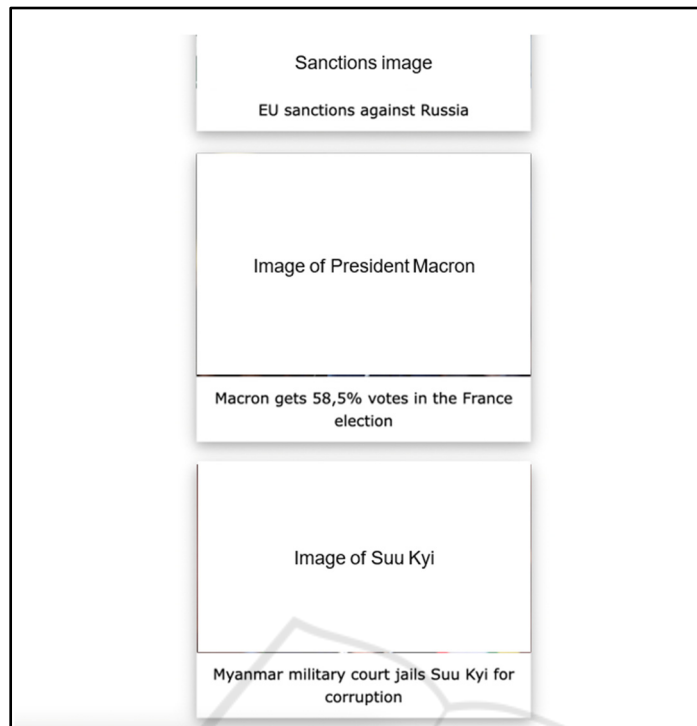


Figure 3: Screenshot from the non-persistent header web page.

3.3 Experimental Design and Recruitment of Participants

The experimental design used was a within-users design. This allowed all participants to gain some experience with both types of headers and thus be able to make comparisons in their opinions and experiences. Aiming to avoid ordering bias, half of the participants carried out a series of tasks (detailed below) using the persistent header first followed by the non-persistent header prototype, and the other half of the participants carried out their tasks with the non-persistent header first followed by the persistent header prototype.

The experiment was conducted with 24 participants (containing a gender mix) having varied ages and experience. All participants were over 18 years of age. The participants gave willing and informed consent, based on the use of an information sheet and consent form. Overall, the research conformed to Norwegian ethical standards for research involving human participants.

3.4 Variables

The independent variables were the two types of headers (persistent Vs. non-persistent headers) and the tasks used in the experiment.

Performance and the opinions elicited from the participants formed the dependent variables.

The dependent measures consisted of task time, incorrect clicks (errors) and participants' subjective opinions. Incorrect clicks were categorized as clicks on the incorrect article, incorrect header element that is not leading to the correct article asked for in the current task, or other clicks that are not either on the article they are looking for or the correct navigation element. The subjective opinions were elicited by means of a post-experiment questionnaire which covered aspects of space usage on the prototype web page, motion and responsiveness and ease of finding the navigation elements. The questions asked participants to use a Likert-type (Likert, 1932) scale for scoring and comparison purposes. The scale was 1-7 where for each question a 7 score would be the most positive response possible. Participants were also asked to make a choice regarding which of the two prototype websites they preferred along with a free form written reason for their choice.

3.5 Apparatus and Materials

The following materials/equipment were used for the experiment. A MacBook Air with a 13-inch retina display. Participants had the choice of using an external mouse or the MacBook's own touchpad. A

stopwatch for timing the tasks. An information sheet and consent form. A pre and post-experiment questionnaire.

Ten representative tasks that one might carry out whilst using a news-type website were designed. These further enabled the use of the headers under investigation.

The tasks designed were:

1. Find the article named “Elon Musk buys Twitter”.
2. Find the article named “Manchester City beat Real Madrid in epic battle”.
3. Find the article named “Expert fears the war in Ukraine will escalate further”.
4. Find the article named “Tiger King star Joe Exotic reveals new girlfriend from prison”.
5. Find the article named “Bodø/Glimt heroic effort in European competition”.
6. Find the article named “Fast & Furious” director backs out after filming begins”.
7. Find the article named “Johnny Depp’s defamation case against Amber Heard starts”.
8. Find the article named “Myanmar military court jails Suu Kyi for corruption”.
9. Find the article named “Russia expels 3 Norwegian diplomats”.
10. Find the article named “Russian athletes suspended”.

Each of the designed tasks was approximately equivalent regarding difficulty. The scrolling distance and number of clicks needed to accomplish each task was approximately equal for each task. The tasks were designed in this manner to try and avoid possible learning effects in the within-users design.

3.6 Procedure

The experiment was conducted in a quiet room equipped with a desk, chair and the evaluation computer. On each occasion only the experimenter and a participant were present at the same time. Most of the participants took part in the experiment in person while a small number of participants took part remotely using Zoom or Teams. This allowed for screen sharing and carrying out the experiment on the evaluation computer.

The experimenter answered any questions the participants may have had concerning issues of understanding or other difficulties concerning the running of the experiment. These were answered in a manner to not bias the results.

The first stage of the experiment involved the participants reading an information sheet about the research and expectations from participants, signing a

consent form and completing a brief pre-experiment questionnaire. The pre-experiment questionnaire asked participants to state their age within a pre-defined range and to give some detail on their experience in participating in online research and in reading newspapers online.

The second stage involved taking part in the actual experiment, where the tasks (detailed in the Apparatus and Materials section) were used to interact with the two website versions consisting of either persistent or non-persistent headers. The ordering of the use of each header type was rotated as each new participant took part. The tasks were timed with a stopwatch and incorrect clicks were recorded by observation. Table 1 illustrates the ordering that was followed for the first four participants (and therefore the subsequent participants) during the experiment in relation to the 10 tasks and the two header types used in the prototype websites.

Table 1: Example of Ordering Followed in Experiment in Relation to the Tasks and Header Types.

Experiment Tasks and Header Type Ordering		
Participant 1	Tasks 1-5 with Persistent Header Website	Tasks 6-10 with Non-Persistent Header Website
Participant 2	Tasks 1-5 with Non-Persistent Header Website	Tasks 6-10 with Persistent Header Website
Participant 3	Tasks 1-5 with Persistent Header Website	Tasks 6-10 with Non-Persistent Header Website
Participant 4	Tasks 1-5 with Non-Persistent Header Website	Tasks 6-10 with Persistent Header Website

To find an article participants had to browse a prototype website and click on the article once found. When it was observed that the participant clicked on the correct article, the next task or article to find was administered. Tasks/article names were communicated to a participant by the experimenter. Once all five articles for one prototype web page/header type were found a short break was given. Then the next prototype website was tested with the remaining five articles to find.

The final stage involved the participants completing a post-experiment questionnaire. The main themes of this were about space usage on the prototype web page, motion and responsiveness and ease of finding the navigation elements. Each question was answered twice, i.e. once for each of the two header types.

3.7 Results

The quantitative data that was collected were analysed in SPSS (IBM, 2023). Firstly, tests to check that the data was parametric were conducted, then based on these results appropriate significance testing took place. The subjective data based on free form written responses was summarized and any commonalities across users are highlighted in this section. The basic results are also presented in graphical format to also allow readers a quick overview.

Five tasks were carried out under use of each header type. Each task was timed in seconds and then each total was added together to give a single overall time for the five tasks. This was then compared with the equivalent total time for the other header type that was evaluated.

Using a Shapiro-Wilk test, the task times data were found to be parametric in nature (for the sake of brevity we do not include the actual figures of the parametric test). Therefore, a t-test was used to ascertain significance.

The persistent header times have a mean (M) = 46.88 seconds and standard deviation (SD) = 6, whereas the non-persistent header has M = 49.96 seconds and SD = 7.1. The result from the within-users t-test is $t(23) = -4.063, p < .001$, which is highly significant. This indicates that the persistent header website was overall faster to use by the participants. Figure 4 graphically shows the corresponding means and standard deviations.

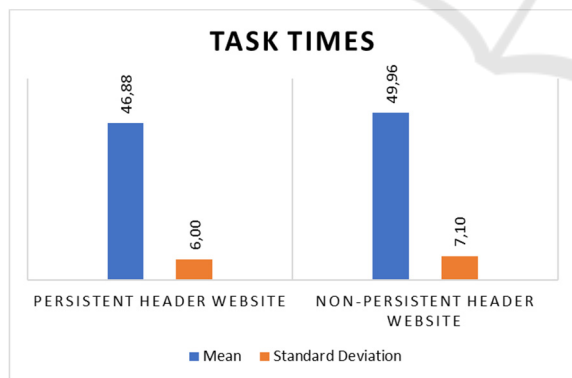


Figure 4: Means and Standard Deviations for Task Times.

For the incorrect clicks data, each header type incurred the same number of errors. Overall, across all 24 participants, seven incorrect clicks were observed under each header type. Significance testing is not presented for this data as there are clearly no differences observed under each header type.

The remaining summary of the data analysis will feature the subjective opinions of the participants in

relation to their experience in using the two types of headers. The opinions were elicited by means of the post-experiment questionnaire which used a seven-point Likert-type scale, choice selection and free form written responses. The data for subjective opinions across four questions was subjected to parametric testing using Shapiro-Wilk tests and the results indicated that overall there were strong tendencies to being non-parametric in nature. Therefore, Wilcoxon signed rank tests were used to examine possible statistical significance.

Question 1 concerned whether the header used appropriate space compared to the rest of the content on the web page.

The overall scores in relation to the persistent header were M = 6.38, SD = 0.71 and for the non-persistent header M = 6.00, SD = 1.35. The Wilcoxon signed-rank test showed that the persistent header was considered to be significantly better in terms of the balance between space usage and the rest of the content of the web page: $W = 0.00; z = -2.264, p = .024, r = .46$. Figure 5 graphically shows the corresponding means and standard deviations.

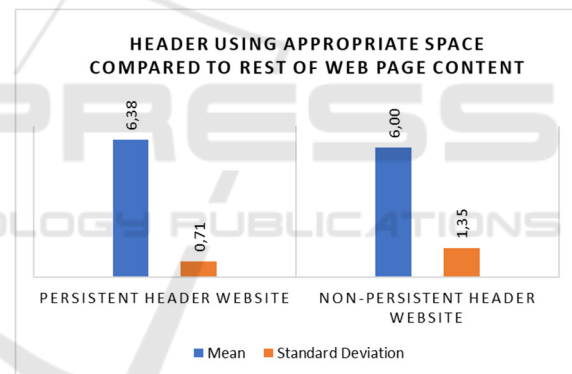


Figure 5: Means and Standard Deviations for Header Using Appropriate Space Compared to Rest of Web Page Content.

Question 2 concerned whether the web page felt satisfying in relation to the amount of space and clutter.

The overall scores in relation to the persistent header were M = 6.04, SD = 0.75 and for the non-persistent header M = 5.67, SD = 1.20. The Wilcoxon signed-rank test showed that the persistent header was considered to be significantly better in terms of how satisfying the web page felt in relation to the amount of space and clutter: $W = 0.00; z = -2.264, p = .024, r = .46$. Figure 6 graphically shows the corresponding means and standard deviations.

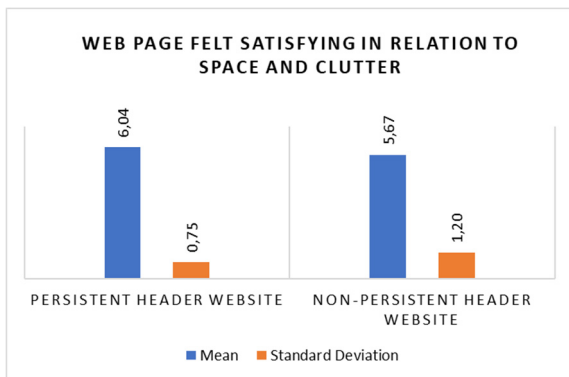


Figure 6: Means and Standard Deviations for the Web Page Feeling Satisfying in Relation to the Amount of Space and Clutter.

Question 3 concerned whether the motion and responsiveness felt satisfying to participants.

The overall scores in relation to the persistent header were $M = 6.25$, $SD = 0.74$ and for the non-persistent header $M = 5.25$, $SD = 1.29$. The Wilcoxon signed-rank test showed that the persistent header was considered to be significantly better in terms of how satisfying the motion and responsiveness were: $W = 0.00$; $z = -4.062$, $p < .001$, $r = -.17$. Figure 7 graphically shows the corresponding means and standard deviations.

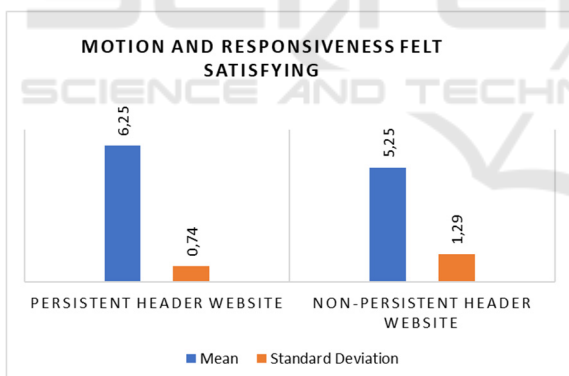


Figure 7: Means and Standard Deviations for the Motion and Responsiveness Feeling Satisfying.

Question 4 concerned the ease of finding the desired navigation elements.

The overall scores in relation to the persistent header were $M = 6.04$, $SD = 0.81$ and for the non-persistent header $M = 4.63$, $SD = 1.35$. The Wilcoxon signed-rank test showed that the persistent header was considered to be significantly better in terms of how easy it was to find the desired navigation elements: $W = 0.00$; $z = -4.215$, $p < .001$, $r = -.9$. Figure 8 graphically shows the corresponding means and standard deviations.

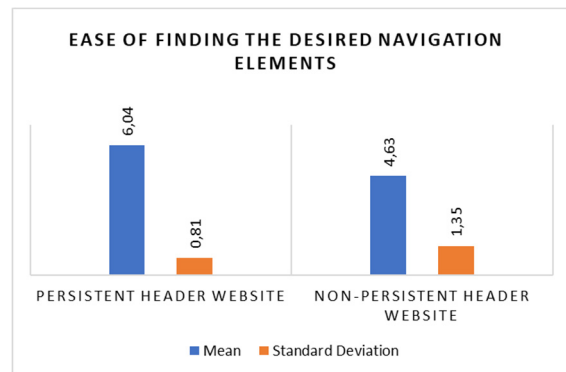


Figure 8: Means and Standard Deviations for the Ease of Finding the Desired Navigation Elements.

The fifth post-experiment question asked users to declare which header type they preferred. All 24 participants answered this question and 75% said they preferred the persistent header, 8% preferred the non-persistent header and 17% said they had no preference. Figure 9 graphically shows the preferences.

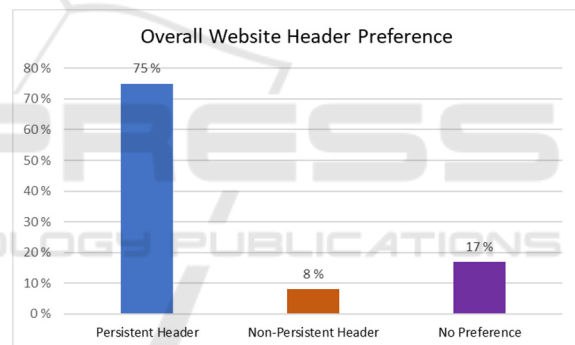


Figure 9: Overall Website Header Preferences.

The sixth and seventh questions asked the participants to write free form answers. The sixth question asked the participants to give a reason(s) for their preference. Eighteen participants answered this question and the responses have been summarized and grouped according to similarity of theme. These are shown in Table 2.

The seventh question was general in nature and asked participants to write any other comments concerning the prototype websites, headers, experiment or their experience. Five responses were obtained for this question. Most participants made general comments regarding the appearance of the prototype websites and one specifically said that the websites were easy to use and clear.

In the next section we will discuss the results in light of already existing guidelines.

Table 2: Summary of Participants' Justification for Header Type Preference.

Preferred Header Type	Reason Given for Preference	Number of Similar Responses
Persistent	Easier navigation	11
Persistent	Less scrolling	4
No preference/equal	Preferred both websites equally/good	2
Non-persistent	Like to focus on main content when scrolling	1

4 DISCUSSION AND CONCLUSIONS

The very clear significant results obtained suggest that the non-persistent header feature that some designers implement is not the most usable option. This is in terms of both performance and user experience.

In our experiment, the persistent header was significantly faster to use and the vast majority of participants significantly preferred interacting with the persistent header. Wrong clicks were not affected by either header type. Specifically, the wrong clicks that were observed, were linked to participants selecting the wrong option for finding a news article. However, this was simply a user decision issue and not a usability issue in the header types. Therefore, in relation to the two experimental hypotheses stated earlier in this paper, we accept both positive hypotheses. Each stated that there would be a significant difference in terms of performance and user experience, between the two header types.

Clearly usability is affected by the header type. We would also suggest that strongly linked to usability is universal design. The original seven principles of universal design (Story, 1998) are a useful tool in both design and evaluation. The results we obtained indicate that Principle three – ‘Simple and Intuitive Use’ (Story, 1998) is more adhered to if designs use persistent headers. One of the most common comments received from the participants (See Table 2) was about the navigation being easier under the persistent header condition. This was in line with the significantly faster task times under the persistent header condition. The results further indicate that Principle six – ‘Low Physical Effort’ (Story, 1998) is more adhered to under the persistent header condition. The faster task times could imply that there was less physical effort under the persistent

header condition. Some participants (See Table 2) also stated that the persistent header enabled them to do less scrolling, which also implies less physical effort. Lastly, we would suggest the results also link with Principle four – ‘Perceptible Information’ (Story, 1998). Since the persistent header is in view all the time, the user interface is allowing the user to perceive the information at all times and therefore not require extra interactions or thoughts, other than thinking about which selection to make.

One aspect that is not available in any kind of header that we are aware of, is the option to allow the user to choose a header type, e.g. persistent, non-persistent or partially persistent. This could be quite easily implemented in an easy-to-use manner and would satisfy more Principles one – ‘Equitable Use’ and two – ‘Flexibility in Use’ (Story, 1998). These two principles concern specifically diverse users, preferences and abilities. These also overlap with The eight Golden Rules of Interface Design (Shneiderman et al., 2017), particularly rule two, which is to ‘seek universal usability’ (Shneiderman et al., 2017). Rule two reminds designers to remember that all users are not necessarily the same in terms of skills and requirements. In our sample a very small percentage of the participants expressed that they preferred the non-persistent header. Therefore, website designs could default to a persistent header with the option to switch to another kind of header. This approach would be more inclusive and be more universally designed.

Some limitations in this research suggest that further work could reveal more interesting findings. Our experiment specifically compared persistent headers with non-persistent headers. Further work could look at evaluating partially persistent headers too. In addition, future investigations could focus on which components of the header will scroll, actual header positions and animations. Another aspect that could be investigated in future concerns screen size. Since this experiment was conducted on a 13-inch screen, it could be useful to evaluate the three header types on very small screens, e.g. smartphones and also larger screens to see if the results would differ. Users with particular needs and of certain elderly age groups could also provide further insights into the usability of the header types.

Overall, this research has shown some clear evidence that persistent headers are more usable and preferred by users in the context of a laptop type screen. While other researchers have discussed the use and best practices of header types (e.g. Laubheimer, 2021), this work is very novel and useful to designers, because as far we have been able to

ascertain no one has tried to find systematic evidence using a formalized evaluation. It is our hope that these findings can inform designers and developers in the future. We would strongly recommend to use persistent headers as a default and to add an easy functionality that allows users to select another style of header should they so wish. This is particularly in relation to slightly larger screen types.

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