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PLACEMENT OF WEBPAGE NAVIGATION MENUS - A 10-YEAR PANEL SURVEY OF COMPANY WEBSITES

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Abstract

Companies use websites to present themselves, their products, and their expertise. People primarily interact with and navigate websites through webpage menus. Webpage design theory states that general access is best achieved by conforming to prevailing designs with which users are already accustomed. One important design decision is webpage menu placement. Recommendations for webpage menu placement have lacked rigorous empirical evidence until now.

We investigated the possible implementation of design recommendations through repeated data collection by observing menu placement on company homepages. Webpages from a selection of small- and medium-sized companies in two European countries were surveyed. At three time points, with five-year intervals, 658 company webpages were visited, observed and central characteristics of the webpage were registered in a fixed-format schema. The collection formed a three-wave data panel.

The data from 2009 indicate a state of confusion due to disorganized webpage menu placement. By 2014, a convention had emerged, with the majority of company webpages featuring a top menu. By 2019, this tendency had increased, establishing a de facto standard where nearly all company websites had a top menu. In conclusion, this study contributes empirical evidence to the scientific literature on conformity and accustomization for user behaviour and website design.

Keywords

Human Computer Interaction, Website Navigation Menu, Webpage Design, Panel Data, Standardization, Accustomization

Introduction

A webpage is an 'everyday thing' [Norman, 1988] and Jakob Nielsen was among the early researchers that investigated webpages as other artifacts that are designed [Nielsen, 1999; Nielsen, 2004; Nielsen & Loranger, 2006]. Company webpages were then viewed in browser on PCs and therefore that approach is continued in this research. In Nielsen's 2004 comment 'The Need for Web Design Standards' for the Nielsen Norman Group he writes that unfortunately for web design: “The confusing design elements are the bigger issues” and continues “Navigation is confusing”. The menu placement is thus in the category of 'Confusion' indicating that fewer than 50 percent of the websites are following the same navigation scheme. The other categories are 'Convention' (50-79 percent), and finally 'Standard' (80 percent or more). The same guideline statistics are found in earlier work [Nielsen, 1999] as well as repeated later [Nielsen & Loranger, 2006: 47]. The Nielsen Norman Group views on menu are also presented in 2024 at https://www.nngroup.com/articles/menu-design/.

The website is thus believed to be more successful by being more like other websites. This is indeed the essence of the Nielsen advice on usability. In the section on 'Violating Web-Wide Conventions' Nielsen and Loranger state:

> “Let us remind you of Jakob's Law of the Internet User Experience: Users spend most of their time on other Web sites ... This means that users gear their expectations for your site by what they have learned to expect elsewhere. If they are accustomed to prevailing design standards and conventions, they'll expect to

encounter those on your site as well"

[Nielsen & Loranger, 2006: 78].

Furthermore, Nielsen and Loranger continue on the same page, that because users spend little time on a website, "don't waste it on making them struggle with a deviant user interface".

Websites following different design ideas and presenting different design elements for an identical functionality confuse the user and the user will leave the website. Nielsen's advice for good website design was consequently to avoid confusion and to do as most other websites by applying a similar design.

Given that website design is rational we should expect to be able to observe a development from confusion, via convention, to standardization. The empirical support for the theory has till now only been anecdotal. Our aim was to establish a data foundation for investigation of the theory of the design progression through confusion, convention, and standardization. The chosen method of data collection provides for a rigid quantitative longitudinal analysis of the most central website design element.

The research contribution consists of the provided example evidence of how a de facto standard developed. When a standard exists, it is often found to be intuitive and permanent. The description of the development underlines the fact that standards can change.

Website standardization or company differentiation?

Especially at the beginning of the WWW the users experienced that each website demanded a learning curve to the same extent as an application. Instead of demanding a high-level learning of the user it is - to avoid the tough learning of the functioning of a new menu design - more profitable for the company to optimize the website by imitation of other successful websites. This is the design philosophy of Jakob Nielsen and his co-writers.

> "Web design is easy: If you are thinking about how to design a certain page element, all you have to do is to look at the twenty most-visited sites on the Internet and see how they do it. If 80% or more of the big sites do things in a single way, then this is the de-facto standard and you have to comply. Only deviate from a design standard if your alternative design has at least 100% higher measured usability"

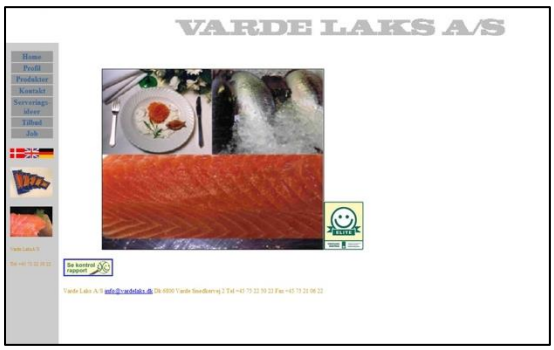
[Nielsen, 1999]

From a business viewpoint this may at first sound as poor advice because differentiation is an elementary central strategy in obtaining competitive advantage for the company. However, "In a differentiation strategy, a firm seeks to be unique in its industry along some dimensions that are widely valued by buyers." [Porter, 1985: 14]. In Nielsen's view we can assume that webpage design is not a dimension where differentiation is valued. To be a technological follower and to imitate are also valid strategies in some business situations.

When more companies are following the same convention, you can also assume that there is a network effect at play supporting the imitation of additional companies and this might lift a convention to a standard.

The object of investigation: web menu placement

The most fundamental function of the World Wide Web is that website navigation is performed by clicking a navigation link on one webpage, an action that will bring up the next. Website menus can be generally described as a structural organization of links. The placement of menus on webpages is an appreciated research object for investigation of the proposed standardization because web menus in principle can be placed everywhere on the webpage, so confusion is possible. Our preliminary observations as well as the literature review show that menus normally are situated at one of the borders of the webpage (at the top, left side, right side, or bottom) and confusion existed concerning which border was preferred. The presented research has its focus on the development of placement of website menus. Empirical data about menu placements is investigated to determine if a process of standardization was in effect.



The literature review includes several approaches performed in web design research projects with a focus on the placement of webpage menus. However, as it will be shown, much design advice is provided without scientific support although research has been performed in the area. Most research has been carried out in the form of usability test experiments to determine whether a particular menu position results in an optimal human performance or human preference.

Figure 1. Webpage for a Danish company in 2009, 2014, and 2019.

However, these experiments have been inconclusive. Additionally, the survey approach of actual websites has also been applied in some research projects. However, these surveys commonly have ill-defined populations with a limited sample size, and the surveys are only providing a single cross-sectional non-longitudinal view.

The development of web menu placement is here exemplified through the screenshots of Figure 1 that display how the website of a Danish company shifted from having the menu at the left to have the menu at the top.

Research is looking backward in purpose to understand both our departure, past, and future. The term 'evolution' is a popular choice to include in the title description of research with dynamic elements. Through visiting and revisiting company websites in 2009, 2014, and 2019 this study contributes observational data that identifies a profound change in website design. The originality of the research lies in explicating empirically what otherwise would remain unrecognized - something being considered as an obvious natural order of things. The data reveal that the placement of web menus in 2019 conforms to a de facto standard.

Content analysis

In the age of the Internet, websites are among the predominant communication tools of companies and as such websites are highly relevant as objects for content analysis [Jose & Lee, 2007]. Because we concentrate on the menus that are a formal and technical part of websites, we are reluctant to immediately categorize our research as content analysis, where the connotation to analysis of the text is very strong and a menu is closer related to the media than to the message. Content analysis of websites that includes in-depth investigation of actual content can be found in several research contexts, for example as 'environmental reporting' [Jose & Lee, 2007], investigation of the 'organizational image' [Lamertz et al., 2005], and 'company goals' [McKenny et al., 2012]. These examples of research are intensive and deep, whereas this study is broad and extensive as a large collection of websites is being observed systematically and repeatedly.

On the other hand, content analysis is defined as “a research technique for the objective, systematic, and quantitative description of the manifest content of communication” [Berelson, 1952: 18] as well as a “technique for making inferences by objectively and systematically identifying specified characteristics of messages” [Holsti, 1969: 14]. Therefore, the placement of a menu as part of the website design can be regarded as a manifest content and an important characteristic which makes the menu placement a relevant research object for content analysis.

Organization of the paper

The following second section starts with standardization and investigates literature on website navigation and menus and includes design advice, research experiments on website menu placement, and research based on surveys of websites. The third section formulates the research hypotheses and the according method where the unobtrusive data collection through a longitudinal observational panel survey is described. The fourth section shows the results of the panel surveys carried out in 2009, 2014 and 2019. The panel data bring evidence that the placement of the menu at the top of the webpage has become a de facto standard of websites, and we believe that users and companies are now accustomed to this placement of the central web menu. The concluding section contains a discussion of further research avenues also affected by additional data delivery through archives and some observations of new trends in web design.

Research on standardization, website navigation, menu, and menu placement

The literature review includes references and observations on earlier research including experiments and surveys published in journal articles and book chapters as well as in commonly available presentations of design advice for websites mostly found in monographs and on instructional websites. The focus is on the webpage menu and

especially the placement of the menu. The review delivers the arguments of a large-scale panel survey.

Before reaching menu placement the immediate subsection exemplifies the development of some de facto standards from other areas.

Standardization - witnessing learning and intuition

Selected examples of de facto standards related to user interface design are presented to demonstrate growth of standards and emergence of human intuition.

The interface of the current western computer keyboard named QWERTY was a de facto standard of typewriters as early as 1873. Although other layouts have proved more efficient, the old standard still reigns [David, 1985] which reveals that human preference and human performance are not always coinciding. We have grown accustomed to the QWERTY design.

We expect to be able to handle keyboards based on our previous knowledge. Similarly, we also expect to be able to immediately drive a rented car safely because we expect certain design choices to follow a standard that our minds, hands, and feet are accustomed to. In a Top Gear episode (season 10, episode 8) Jeremy Clarkson and James May show historical interest and put forth evidence of the development in car handling. As late as in 1927 the Ford Model T - that counted for half the cars produced that year - had a complicated layout of controls that made the car very difficult to operate. However, the now traditional layout of the brake pedal to the left of the accelerator pedal was introduced as early as 1916 by Cadillac, and the layout was copied in the Austin Seven, which was produced in 1922-1939 (https://en.wikipedia.org, https://www.reddit.com).

Another example of a long time passing before a standard is established is the very old example of the de facto standard for books that was observed by contemporary web researchers:

> "Johannes Gutenberg's Bible of 1456 is often cited as the first mass-produced book, yet even after the explosive growth of publishing that followed Gutenberg' s invention of printing with movable type, more than a century passed before page numbering, indexes, tables of contents, and even title pages became expected and necessary features of books. Web documents are undergoing a similar - albeit faster - evolution and standardization."
>
> [Lynch & Horton, 2008: 113]

The design of the keyboard, the car handling, and the standard layout of a book now all seem so obvious that we call it intuitive - meaning familiar [Raskin, 1994]. Later research established as part of a first principle that designing intuitive interfaces also includes placement in familiar or expected positions [Blackler et al., 2018] which is directly relevant when investigating placement of a web menu.

The research concerns the change in human behaviour and the technical support of the behaviour through processes of standardization of webpage design, education and even conditioning. Through a longitudinal study we can track and present the changes in the central interface of actual commonplace web design that took place between 2009 and 2019.

The 'war' between Betamax and VHS video cassette formats presents an example of a struggle to become the de facto standard. Betamax had the advantage of being first mover and delivering a slightly better picture quality. However, the timely strategy and alliances of VHS made that format the winner [Cusumano et al., 1992: 29]. Looking back, several other format struggles in the video area have been fought and the formats have now for most consumers all been replaced by streaming. The format struggles on the compact disc (120 mm) can now be regarded as examples of the quote: "Digital information last forever - or five years, whichever comes first" [Rothenberg, 1995]. Also, after discovering a de facto design standard, we must continue to be observant of new replacing standards.

The menu in human computer interaction

Menus are mentioned in textbooks on human computer interaction, but the menu is often not allotted comprehensive investigation or explanation. Preece et al. [1994: 265] point out that menus provide information clues, as does Dix et al. when comparing menus to command-driven systems: "menus have the advantage that users do not have to remember the item they want, they only need to recognize it" [1998: 127]. More intensive treatment of the menu subject is presented in the Handbook of Human-Computer Interaction [Helander et al., 1997] by the comprehensive chapter on 'Design of Menus' by Paap and Cooke [1997]. The authors explain that interfaces have a fuzziness because "menus have many characteristic features but seem to lack defining features that are either necessary or sufficient." They continue:

> "For our purposes, a menu will be defined as a set of options, displayed on the screen, where the selection and execution of one (or more) of the options results in a change in the state of the interface."
>
> [Paap & Cooke, 1997: 533].

The 40-page chapter by Paap & Cooke on menu design is detailed concerning the structural issues particularly regarding the grouping of menu items as well as issues concerning the user's performance in locating the suitable menu item (matching). Matching is also investigated in several earlier papers that typically measured the level of matching by tracking the response time of the user.

Investigations and experiments of the matching, depth, and breadth of the hierarchical menu structure give rise to many calculation formulas while the placement of menus is not offered anything near the same degree of research attention in the Paap and Cooke chapter. Placement of the menu is shortly mentioned and menu placement at the top is described: "Horizontal list layouts are often found as a command line located at the top of the screen and always in view." [Paap & Cooke, 1997: 545]. The authors conclude the chapter emphasizing the importance of menu structure and organization but also by challenging their own concluding design advice: "Given that people seem to adapt to and learn even the poorest of menu interfaces, how important are issues such as target cue, menu organization, and menu structure? Are decisions about menu interfaces trivial beyond the first few hours of learning?" [Ibid.: 568]. Nearly 30 years ago most computer users were operating only few applications and not yet visiting a multitude of websites. And in the early days of confusion each website could be experienced as a distinctive application both by the user and the designer. It should also be noted that the Paap and Cooke chapter on menu design does not include terms as World Wide Web (WWW), though the chapter does mention hypertext. Other chapters of the same handbook do mention World Wide Web for example in a separate chapter on 'Hypertext and its Implications for the lnternet' [Vora & Helander, 1997].

The World Wide Web is certainly the natural focus of a specific handbook on web design [Proctor & Vu, 2005]. This handbook includes a chapter with an excellent description and categorization of web usability guidelines [Mariage et al., 2006]; although without concrete guidelines concerning placement of menus. The second edition of the handbook [Vu & Proctor, 2011] has a chapter on the presentation of information that brings forward the eye tracking evidence of the F-pattern of human fixation on webpages: "one long vertical fixation on the left side of a page, a long horizontal fixation at the top, and then a shorter horizontal fixation below" [Tullis et al., 2011: 156]. The evidence of the F-pattern also supports the inverted-L of menu design to be encountered later.

Human performance in menu selection has been intensively investigated [Li et al., 2018; Cockburn et al., 2007; Chen et al., 2015]. However, these investigations of menu selection have their focus on the human task of picking from a vertical list of menu items and are not measuring performance differences between horizontal and vertical menu placement.

A comprehensive presentation of a taxonomy of menu properties is available from Bailly et al. where they state:

> "The design of menus raises three main questions: how to organize items, where to display menus and when to display them? The two first questions are related to the geometry of the menu while the third one is related to its temporality"
>
> [Bailly et al., 2016: 22].

Concerning temporality, we concentrate our investigation on menus that are permanently displayed at the company starting webpage. Regarding geometry Bailly et al. concentrate on the organization of menu items and their vertical display. The horizontally organized menu bar is primarily considered an anchored device used to activate a drop-down vertical menu that has the true focus of their investigation [ibid.: 7].

Web menu techniques

There is no design element constituting a menu defined in HTML. It is the other way around: Many design elements, for example an image (<img>) or a table (<table>), can constitute a menu by enclosing the items of links.

Semantic tags enclosing navigational links with <nav></nav> were released with HTML5 in 2008. However, the semantic additions are not widely spread. We only identified <nav> in the HTML code of 432 of 3.873 company homepages. This investigation was made in another website survey carried out in March 2022 among huge companies. It is not likely that <nav> was used in higher numbers for smaller companies in 2009 and onwards. Furthermore, the <nav> tag does not imply vertical or horizontal menus and does not determine the placement of the menu, either.

For that reason, even projects like Webzeitgeist [Kumar et al., 2013] with full concentration on the webpage presentation will face validity problems in isolating and determining menus on the webpage when mining for design elements. When Battle et al. [2018] successfully extract raw SVG specification for analysis this is possible from the identified SVG object. However, any loose formation of links can constitute a menu, hence, no necessary explicit menu object is available for identification purposes from the code.

The technique of Cascading Style Sheets (CSS) was introduced alongside HTML5. The w3schools.com contains several examples of CSS used for navigation bars. The central webpage (https://www.w3schools.com/css/css_navbar.asp) continues with examples of both horizontal and vertical

navigation bars. Neither of the more specific instructions (https://www.w3schools.com/css/css_navbar_vertical.asp and https://www.w3schools.com/css/css_navbar_horizontal.asp) contain explicit preference for the vertical or horizontal design nor for the placement of the menu. In the example of responsive design both the horizontal and the vertical menu are used for PC screen display while the vertical menu is preferred for phone use.

A possible explanation of why many websites started by placing the menu to the left could be the result of the rule of least resistance - for the designer! Many websites used the technology of frames in HTML or division into tables, and it is uncomplicated to neatly arrange menu items under each other in a left-hand rectangle by simply dividing menu items by starting a new paragraph. The vertical list of links will thus constitute a menu, and a new item to the menu is easily inserted. Siegel is also a recommender of frame navigation [Siegel, 1997: 92]. (It should be noted that frames are now considered obsolete by W3ORG (https://www.w3.org)).

With frame or table technology it is more complicated to distribute the menu items in a horizontal rectangle across the top of the webpage, as the horizontal width is limited and variable while the vertical length with scrolling is unlimited. Another reason for not having top menus was that early websites to a larger extent were designed as a network of very similar webpages where the menu at the left side of the webpage remained visible on all webpages of the website. Nielsen's web comment from 1999 reveals that he is 'not a fan' of the left side menu because it 'takes up about 20% of the pixels on the screen, even after the user has scrolled to the bottom of the page'. However, having a menu at the left was called a 'convention' but Nielsen admitted that he preferred the design “where the navigation links are concentrated on the top of the page” and the left-menu was discouraged as an example of “bad design elements” [Nielsen, 1999].

An ingenious methodological approach in a dynamic study is the focus on the evolution of the core technologies of websites, where not the websites but articles in magazines describing technologies are the objects being surveyed. This was performed in a study of the evolution of e-commerce websites, where the authors identified distinguished website periods: the pre-Web era (before 1990), the reactive Web era (early 1990s), the interactive Web era (mid 1990s), and finally the integrative Web era (start of the 21st century) [Chu et al., 2007: 156]. When viewing integration as achieving a tighter relationship through common designs, the move through confusion and convention, to a standard for placement of web menus can be regarded as a development path within the integrative era.

Sophisticated websites will allow the top menu to stay visible at the top of the screen when users are scrolling down. The technique of 'fixed navigation bar' is also part of the w3schools.com (https://www.w3schools.com/css/css_navbar_horizontal.asp). Sometimes after the very top including large logos have rolled out over the top, a slimmed version of the top menu - and a smaller logo - will appear. The top menu is often part of the header of the website ensuring a consistent visual expression and a consistent navigation using the horizontal top bar. “Headers are essential for both site identity and consistent navigation” [Lynch & Horton, 2008: 104]. Possibly this design was encouraged by the technological development of roll-up-and-down functionality built into the mouse and swiping functionality. Unlike the functionality of the page down key, the movement of the content became less abrupt by being presented in a sliding motion with the use of a mouse scroll wheel, touch screens, and touchpads. Furthermore, without the menu on the left side, the whole width of the page can be used for content throughout the webpage. With a top menu, the page will maintain a more consistent look when scrolling. The design can even become so consistent that it vanishes as a separate entity: “Once you know where the standard links are on the page header graphics, the interface becomes almost invisible” [Lynch & Horton, 2016: 209].

Menu as metaphor

Human computer interaction is an area populated by many useful and popular metaphors [MacKenzie, 2013: 88]. The metaphorical use can become so widespread and common that the reference to the source has faded and the item is no longer understood metaphorically. This is the case in the anecdote where a child finds a physical 3 1/4" diskette and happily exited exclaims: 'Cool! A 3D print of the save icon!' However, this is a special case of self-reference within the computer domain. Most popular computer metaphors have references to pre-computer sources of physical objects and functionality.

In 1980 Lakoff and Johnson published the landmark book 'Metaphors we live by'. This truly raised attention to the importance and prevalence of metaphors. However, the use of metaphors in computing is first mentioned in their afterword of the 2003 reprint with examples of genuine longevity such as 'desktop' but also of terms that now seem short-lived like 'information highway' [Lakoff & Johnson, 1980: 244].

About 35 years ago Norman and Chin published an article with the title 'The menu metaphor: food for thought' [1989]. The article develops and builds upon earlier work exemplifying other common metaphors used in human computer interaction with a focus on the richness of the restaurant menu metaphor. The exploration performed by Norman and Chin in comparing the restaurant menu and the computer menu gives a lead to interesting possible improvements of the computer menu. Unfortunate for our purpose this exploration does not consider the placement of the menu.

The traditional restaurant menu is typically a vertical list in the form of a small book. Only among the more affordable restaurants the menu can be found in a horizontal display including pictures of the menu items on the wall of the restaurant's order area. The hierarchical menu on the computer screen where you can drill-down and continue deeper is in parallel with the typical restaurant menu where the physical menu booklet also is hierarchically organized with sections and subsections and the order of these menu parts follows the progression of the meal with appetizers first, then the main courses, and the deserts at the end.

The basic impression carried by 'menu as metaphor' is that the user decides and selects. The connotation of menu selection is the feeling of being in charge but also being guided by the freedom and pleasure of the user. Having the menu as a metaphor for user interaction must thus be considered an extremely successful choice also from a marketing viewpoint as the menu metaphor conveys both precise instructions and positive emotions.

Navigation of websites and the advice of consistency

Website navigation is considered the focal point of the web:

> "The web is a navigational system: The basic user interaction is to click on hypertext links in order to move around a huge information space"
>
> [Nielsen, 2000: 188].

It is notable that the "metaphor of web use as travel through physical space is pervasive" [Wojdynski & Kalyanaraman, 2016: 454]. There is more to navigation than the primary purpose of being functional:

> "In the context of navigation, menus are both informative, in revealing options, and functional, in providing means to move from one area of the site to another or to access specific functionality"
>
> [Lynch & Horton, 2016: 236].

The term 'navigate' was initially [Gates, 1993] employed in a broader sense and synonymous with 'use of' and 'net navigation' which then meant the use of the Internet. With the focus on the World Wide Web the short advice on navigation design is: "be consistent" [Nielsen & Loranger, 2006: 178]. Another general advice is "navigation is best when not noticed at all" [Kalbach, 2007: 3]. This may be true, but it is not well explained how to obtain this stealth quality, whereas the advice to 'be consistent' has evidence behind it and is easier to follow.

Early advice said to "use the home page as the menu for the rest of the site" [Weinschenk et al., 1997: 239]. The concept of having the homepage (top page of the website) as an outline for the complete site was then widespread, primarily also because a website then only consisted of a small number of webpages. Also, at present, we still find examples where less advanced websites of smaller companies have implemented the idea of having a hierarchical menu system corresponding to the hierarchical construction of their webpages. This design can be regarded as a type of 'technology-centered design' [Kalbach, 2007: 20].

Consistency is the first of Ben Shneiderman's golden rules of interface design where the wording of the advice is: "Strive for consistency" [Shneiderman, 1987: 61; Shneiderman & Plaisant, 2010: 88]. As mentioned, this advice was also stated by Nielsen, who was an early energetic evangelist for the theory of consistency [Nielsen, 1989]. Lynch and Horton give a good introduction to navigation when relating to architecture and wayfinding in cities. Also, they present 'the paradox of consistency' stating: "Consistency is the golden rule of interface design!" But if everything looks the same: "How can you tell where you are?". [Lynch & Horton, 2008: 98]. Similarly, Kalbach challenges consistency when advising "balance consistency with inconsistency" because variation in "position, color, labels, or general layout" creates a sense of progress through a site [Kalbach, 2007: 149].

The advice on consistency pays off in user experience. The rule of consistency is often applied to a specific single website, but the advice is wisely extended across websites. The website is thus believed to be more successful by being more similar to other websites.

Zhang et al. present 'A Two Factor Theory for Website Design' [2000]. They map the framework of Herzberg's motivation-hygiene theory [Herzberg, 1968] to similar factors in web design. Although navigation might still be important, the authors place navigation in the hygiene category meaning that good navigation is an expected functionality that has little effect. On the other hand, poor navigation will severely dissatisfy the users, and they will then leave the website. This all points in the direction of the development of websites moving towards collectively establishing a standard.

The use of Content Management Systems (CMS) has spread since the early design of webpages. However, no brand system obtained a monopoly that could lead to consistency. Furthermore, the systems also had design options. Therefore, this research has chosen to focus on the product - the webpage - and not on the available tools.

Further design advice on menu placement

The book 'Creating Killer Web Sites' with the subtitle 'The Art of Third-Generation Site Design' shows examples of third-generation websites. The examples all have vertical menus [Siegel, 1997: 14]. Furthermore, the term 'menu' is not found in the index of the book. When considering computer menus in general - i.e. not specifically website related - HCI authors recommended: “Menu bars are often placed at the top of the screen ... or at the top of each window” [Dix et al., 1998: 127]. With this early unequivocal advice, it can come as a surprise that menus at the top are not found on every website since and ever after.

Recommendations from more recent books on web design on where the menu should be placed are often like: “as close to the top of the layout as possible” [Beaird & George, 2014: 9]. The placement of a menu is mostly taken for granted, and examples often show figures with drop-down vertical menus emanating from an initial choice on a horizontal main menu [Galitz, 2007: 316, 325]. Similarly, the modelling of Chen et al. focus on a specific drop-down vertical menu in the OS X Safari browser [Chen et al., 2015: 3]. However, this vertical menu will only appear after 'Window' is selected in the always present horizontal menu bar at the top of the screen. Therefore, in the Chen et al. study the horizontal menu ought to be considered the most fundamental menu. Earlier references to menus are found in general design protocols such as IBM's System Application Architecture and Common User Access (SAA CUA) from 1987 [Berry, 1988], as well as in references to Microsoft Windows [Galitz, 2007: 333]. The reason for the placement of the menu at the top is that most computer software adheres to SAA CUA and thus has a horizontal menu at the top. On Mac OS the menu can even be found both in the top of the application window and in the top bar of the computer screen displaying the menu of the current application. The turned L-shaped menu is also prevalent and can be regarded as a horizontal top menu where the left has been permanently dropped down forming an L turned 90 degrees clockwise.

> “Top-level breadth is shown across the top of the page which list all the high-level categories on the site. Low level breadth is shown down the left side with links to all the content at the level of the current page” [Nielsen, 2000: 207].

This is also named as global and local navigation menu [Yu & Roh, 2002: 928] and the turned L can be found named as an inverted L [Kalbach & Bosenic, 2003]. The geometry of the L is indirectly mentioned in a study concerning eye tracking: “two common locations for the navigation bar on a page is across the top or along the left side” [Djamasbi et al., 2010: 318].

An added argument for the placement of the menu at the top is the rehabilitation of scrolling as a feature and no longer considered a design flaw as it was earlier [Siegel, 1997: 88]. Nielsen and Loranger originally stated that “users are lazy and ignorant” based on the fact that “most users don't scroll” [Nielsen & Loranger, 2006: 45]. However, this fact was not time invariant; in the same book the authors note: “Now people have gotten used to long Web pages and have learned that they sometimes have to scroll” [Nielsen & Loranger, 2006: 100]. Webpages have indeed become very long including never ending 'infinity scrolling'. When looking back on earlier websites with many short webpages - each fitting a screen with 'nothing below the fold' - Kalbach cites Alan Cooper: “these hierarchical arrangements of screens force them to impose a navigational burden on their users” (www.cooper.com, 2010) [Kalbach, 2007: 5].

Experiments of human performance and preference of menu placement

Bernard presents an early investigation of the 'location of common web objects'. This work does not mention the term 'menu' but investigates “grouping of links that internally connect web pages within the same website” [Bernard, 2001: 1161]; a grouping which we will regard as constituting a menu. The result of the research is:

> “most participants expected the links to web pages within a website to be almost exclusively located on the upper-left side of a web page, which conforms to the current convention of placing internal web page links on left side.”
>
> [Bernard, 2001: 1162].

However, references to the mentioned convention are absent in the article, but when extrapolating or backcasting what later is revealed in the results section it seems likely that the upper-left placement was a convention around 2001.

Let it be underlined that when we refer to a top menu the more precise description is a horizontal menu placed at the top. This placement finds good support when Williams and Hennig investigate menu orientation for people with learning disabilities and find “that a horizontal menu may be more effective than a vertical one” [Williams and Hennig, 2015: 674]. Here it is the orientation not the precise placement that is investigated.

However, they additionally conclude "as in journalism, the most important content should be placed near the top of the page." [Ibid.: 682]. When combining the recommendations of their research, the horizontal menu at the top of the webpage is the result.

Some years before Kalbach published his book on web navigation [Kalbach, 2007) he published with co-author Bosenic an investigation of the effects of navigation menus being placed to the left or the right [Kalbach & Bosenic, 2003]. The experiment did not include any investigation of having the menu at the top of the webpage although the authors did refer to the top menu as it is noted that "the inverted-L navigation forms a kind of standard template used as a default layout for many Web designers" [Kalbach & Bosenic, 2003].

Experiments were also used to investigate the reading direction of text and the placement of the menu [Salmerón et al., 2017]. The article intended to determine whether the cultural impact of reading from right to left by Arabic users had an influence on the best placement of the menu on a website in the Arabic language. This research is rather inconclusive. However, we note that both English and Arabic websites will be read top-down thus supporting the top placement of the menu. In another experiment it was concluded that "users preferred primary menus that were located in the left or right planes rather than the top plane" [Kingsburg & Andre, 2004: 1513].

The research experiments concerning web menu placement are frequently performed with small groups and often the participants have identical backgrounds. Salmerón et al. [2017] had 25 participants, and Kingsburg & Andre [2004] had "sixteen undergraduate psychology students". Furthermore, some measurements must be characterized as being carried out as highly subjective ratings, e.g., individual scoring of visual appeal, trustworthiness, and usability as perceived by the participant after being shown a glimpse of a displayed website [Salmerón et al., 2017: 193]. One experiment of menu positioning concluded that "menus placed at the top of a page horizontally, or vertically at the left of a page, seem to elicit better performance in users. This is in terms of errors and mouse clicks" [Murano & Lomas, 2015: 145]. This research was thus based on more objective measurements. However, it was inconclusive concerning left or top placement.

As the issue was unresolved, Murano and Sander reviewed several experiments carried out on usability among different types of web menus:

> "Despite the opinions and numerous studies around this subject, there are still unanswered questions regarding which menu position or design might be optimal in terms of performance and user preference. Therefore, this paper is a review paper of the most relevant research conducted around evaluating menu types and their positioning on the screen."
>
> [Murano & Sander, 2016: 355].

Their effort to sum up the experimental research on the subject - including the presentation of a tabulation of thirteen papers addressing the menu placement - the outcome was still inconclusive as "examination of these studies shows that there is no totally clear picture to suggest which menu type or position on the screen may be optimal in terms of performance", and they continue: "There is also no totally clear picture regarding which type of menu or position may be preferred by the majority of users." [Murano & Sander, 2016: 360]. The authors then reflect on the fact that the chosen studies all apply the experimental method and propose that this is supplemented by more qualitative techniques. However, they did not investigate or propose surveys of actual websites, as we do here, where the quantitative aspect does not relate to the measurement of performance but instead the quantitative approach represents the use of a large number of websites.

Surveys of websites for menu placement

Jakob Nielsen's Law of the Internet User Experience - that users spend most time on other websites - makes it important to investigate what users of websites are exposed to concerning "prevailing design standards and conventions" [Nielsen & Loranger, 2006: 78]. After reviewing design literature with advice on placement of web menus and reviewing research experiments with web menus, we turn in this subsection to review surveys of websites thus further building the foundation for the description of the survey of websites in our research.

Frequently the monographs on web design are not written by researchers and the authors often abstain from fatiguing the reader with research references. Many authors appear to base their advice on their personal common sense and by appealing to the common sense of their readers. However, some advice is based on surveys of actual websites. In 2004 125 websites were studied for design features [Nielsen, 2004]. The conclusion was that a quarter of the measured design features - and very central ones like navigation - had neither reached a standard nor a convention. Confusion was ruling the websites in 2004.

Nielsen also implicitly performed informal surveys of websites in the form of examples of homepages presented in his books. In the book from 2000, the first webpage with a top menu is found on page 23 (MapQuest), then followed by MSN on page 57, and Microsoft on page 68 [Nielsen, 2000]. From this anecdotal example, one may assume that in 2000 only a few websites had top menus. Continuing with anecdotal examples; of the 50 examples of websites displayed in the later book by Nielsen and Tahir [2002: 298-299] a top menu is found in 60

percent. Furthermore, in the book four years later Nielsen and Loranger have the first top menu displayed as early as on page xxiii (page 23 of more than 400 pages). Additionally, of the 25 example homepages constituting a small catalogue in the beginning of the 2006-book only five did not have a top menu, so the percentage of top menus had then risen to 80 percent [Nielsen & Loranger, 2006: 8-11]. These examples form an indication of a general move towards the widespread use of the top menu.

Our investigation of menu placement

Our unit of investigation is not the human individual but the company website. A company webpage often has groupings of navigational links - as vertical lists or horizontal bars - placed at the left, top, right, and bottom of the webpage. Menu placement on the company websites is determined by observation.

The single company website can be viewed as being influenced by all the other websites. Assume that a certain layout of a webpage becomes popular. Considering human adaptation and learning [Chen et al., 2015; Paap & Cooke, 1997: 568], performance for this popular layout becomes high as the layout is experienced as intuitive. It can then also be assumed that the accumulated performance at webpages possessing similar layouts will be significantly higher than if the layouts were different and confusing. The two processes of development, where humans adapt to web layout through learning as well as websites adapt through design changes to human expectation, are what we term accustomization.

Method and research hypotheses

We find it relevant to document change also when several explanations can be put forth as explanations of the fact. First the facts must be determined.

> "It is sometimes not possible to uncover the logic (or illogic) of the world around us except by understanding how it got that way"
>
> [David, 1985: 332]

This section develops and formulates the hypotheses to determine whether the placement of webpage menus changed during the 10-year period from 2009-2019 and if a de facto standard was obtained.

The literature review and earlier argumentation indicated that a possible de facto standard might successfully have been identified erstwhile by investigation of websites of larger companies. However, when focusing on larger companies their differences from smaller companies must be considered such as higher budgets, more awareness of www presence, more trained staff for web maintenance and development, and more frequent updates of websites. From these differences it can be assumed that large companies rather than small companies at any point of time have the necessary resources and continuously and quickly transform their websites to what appears to be most appealing to the users. However, the focus of this research is on the websites of the small and medium-sized enterprises (SMEs) because the focus of this investigation is on the common and broad implementation of website design by the many companies. When the standard has reached the SME companies, we believe the de facto standard to be fully diffused regardless of this is obtained through individual design, software (CMS), or outsourcing. The design has gained general acceptance, and quite ordinary websites have implemented the change.

Observation of websites

The observations of company webpages were performed with pairs of PCs. The research is limited to the appearance of the company webpage in a common browser on PC and does not include investigation of possible responsive designs intended for other platforms (e.g. phone).

The webpages were in 2009 observed using the web browser 'Windows Internet Explorer 7' on PCs running Microsoft Windows and the technical setup was updated during the years. One PC was reserved for observing the webpage while the specific information from the webpage in the form of observation data were entered into a predefined form on a second PC. The observation included additional variables that are not referred to in this article.

Every single webpage can encompass several menus. The occurrence of a menu in each of the page position areas left, right, and top was registered. The immediate visible menus of the rendered webpage are registered. Pop-up, drop-down and other additional menus appearing after interaction with the webpage are not registered.

Larger corporate websites often have an additional menu or menu area - often arranged into columns - at the bottom of the webpage. The bottom area can contain repetitions of links available at higher positions on the same webpage and most often the bottom area is used for contact details for the customer and the company's imprint. The use of bottom page design has been spreading in the investigated period and is supported by the <footer> tag. However, earlier bottom menus were not widespread among minor websites and the information was not recorded in the 2009 wave.

The observed webpages were opened for inspection and archived as screen dump images.

Company website as unit of observation

The study applies a quantitative technique based on an unobtrusive method of observation [Webb et al., 1966] of the actual navigation menu design of the company website. The Internet provides a research data pool for extraction of data through observation and the establishment of an objective nonreactive data collection.

We state the company website as the unit of observation. More precisely the unit investigated is the homepage / front page / start page / top page / landing page of the website for the company selected for the survey. In the text we sometimes refer to the website or websites, but it is only the single webpage of the website that is investigated. We are not investigating the collection of webpages together forming the website of the company. This is identical to the methodological approach used in the cited website surveys mentioned in the literature review. In the area of web design, the single page is also the object in common language expressions like: 'The new look of the ACM website is my favourite!'

Quite early in the research of the World Wide Web it was noted that the homepage acts as a 'carte-de-visite' or business card and 'calling card' [Bates & Lu, 1997: 334], and a few companies in our sample indeed had only a single webpage at their website. However, data describing the depth and magnitude of the websites has not been recorded as this was not the focus of the research. Awareness should be raised to the fact that some of the surveyed websites were indeed very sparse. Several websites of very small companies (micro companies with single digits number of employees) consisted of only a few webpages (or even only one) in the first observation round in 2009.

Selection of companies

The research does not uncover what type of web design the web users most frequently experienced in 2009, 2014, and 2019. For that purpose, the selection of the most visited 20 websites would have been a suitable choice. The selected companies were thus not the usual well-known global companies of the information technology sector like Microsoft, Apple, and IBM. The research was not intended to uncover the state-of-art design features of webpages.

We investigated manufacturing companies of two European regions within Germany and Denmark. In each of these regions we made a random selection of around 500 small and medium sized enterprises (SMEs). For most of the companies in the survey it was possible to complement the general company data with economic measures as well as the number of employees from the Orbis database [Bureau van Dijk, 2019]. The approach resulted in a set of companies where websites - if existing - were observed at three time points in a process of content analysis based on human observational registration.

This study includes a relatively large survey of companies (1030 in total) compared to the often-small numbers of cases in surveys of websites in earlier research. While earlier website surveys mostly were exemplary and qualitative this survey approach is extensive and quantitative. The choice of this method was formed by the intention to investigate numerous websites in the pursuit to obtain a sufficiently high accuracy and to obtain a high level of significance concerning possible observed differences.

Research hypotheses

Our research is designed to determine the level of standards or conventions through a survey of actual websites with the collection of empirical observation data. As the literature review has demonstrated, website navigation can be viewed as a cornerstone of web use. Many design rules have been expounded, and conclusions have been drawn from experiments on menu placement, but these conclusions have been divided, although the argumentative support for a top menu is found more substantial. Furthermore, this argumentation was indeed already in play in 2009 when our website research began. The encouragement to use top placement of the menu is also supported by our anecdotal observations in literature - but there has not earlier been rigid empirical evidence in support of the advice.

The research is designed to answer the question of the prevalence of menu placement for ordinary company websites focusing on European SME companies. The first research hypothesis:

RH1 The menus of websites are most often placed at the top of the webpage at the three observation points 2009, 2014, and 2019.

The literature section showed examples of big company websites with top menu growing from few to 60 percent, and then to 80 percent [Nielsen, 2000; Nielsen & Tahir; 2002; Nielsen & Loranger, 2006]. As argued earlier, all companies cannot be expected to immediately act as the big companies. If these expectations are correct, it would also be expected that the bigger companies in the present sample more frequently would have a menu at the top of their webpage than the smaller companies.

Company size can be measured through several indicators like turnover, profit and loss, assets, employees etc. The definition of SME companies includes some maximum of these economic facts plus the requirement that the number of employees is below 250 persons to qualify the company for the label [User guide to the SME definition,

2015]. Following a simplification that is often used in investigations we regarded the number of employees as the most important measurement and, thus, to be sufficient for the categorization. We expect to find menu differences between different sized SMEs:

RH2 The larger companies among the SME more often have a menu placed at the top of websites.

Furthermore, we expect over the observed period a rise in the frequency of placement of the menu at the top of the website. Thus, the third research hypothesis is:

RH3 The frequency of menu placed at the top of websites has grown from 2009 to 2014, from 2009 to 2019, and from 2014 to 2019.

Results

The panel data show the prevalence of having a website rose through the ten years from 85.1 percent in 2009, 86.2 percent in 2014, to 88.8 percent in 2019.

The focus of this research is on the placement of menus on websites as formulated in the research hypotheses. However, a few other tendencies of web design are also briefly mentioned later in this section on results because they exemplify and emphasize developments of other de facto standards.

Panel survey of websites

The repeated survey delivers a time series for comparison of frequencies. Furthermore, by observing the same company website at different time points - the specialty of the panel design - we are securing full insight into the changes of the individual websites in addition to the aggregated results. The possibility of describing dynamics obtained through the panel design opened the opportunity to report in detail on the change patterns concerning the menu placement on the company websites.

The company websites were observed in 2009, 2014, and 2019 where available. During the 10 years some successful companies grew by themselves, and others grew by acquiring other companies. The companies that retained their identity in name and website were kept in the sample although they in 2019 might have grown out of the classification as being an SME. Companies evolve, some dissolve, and for some SMEs we were able to locate evidence that the company had been merged into larger companies. Often mergers were noticed because a redirection occurred from the original given website address to another URL that turned out to be the website of a larger company. Inclusion into another company might be a success story for the individual company, and an interesting fact for research in company development, but for this research it meant that the company no longer could be regarded as having the same identity. Because some companies did not have websites, and because of mergers and other reasons for firm dissolution, the sample size was reduced from the original 1,030 companies to 813 valid companies in 2019 for the final sample.

Of the 813 companies 658 had their website observed and website data collected at all three panel waves. These 658 company websites constitute the data foundation for further analysis. It might appear as a wasteful procedure to exclude data because company websites were only available for one or two waves of observation. However, the positive side is that three observation points is crucial for more elaborate panel analysis. Furthermore, the 658 of 813 are regarded as the proper respondents. In that view the survey had a response rate of 80.9 percent which in a human survey would call for celebration of an unexpectedly high response rate. In respect of the avoidance of nonresponse, the applied method of unobtrusive content analysis must be considered a success.

Placement of the menu at the top of the webpage

Table 1 presents the marginal distribution of occurrence of the three menu placements. Because of the possible simultaneous occurrence of more than one menu, the percentages of each wave add to more than 100 percent.

Table 1. Placement of web menu for German and Danish SME websites surveyed in 2009, 2014 and 2019 (N = 658).

Menu placement	2009	2014	2019
Top	56.4 %	76.8 %	87.7 %
Left	48.6 %	31.5 %	11.3 %
Right	9.9 %	7.8 %	4.7 %
Sum of menus	114.9 %	116.1 %	103.7 %

The primary placement of the web menu is at the top of the webpage for all three waves. Table 1 displays that the tendency of having the menu at the top steadily became more widespread during the investigated period from 2009 to 2019. The placement of the web menu at the top was already a weak convention in 2009 as 56.4 percent is a small majority and thus just slightly over the confusion threshold of 50 percent. However, the occurrence of a left menu was then found nearly as frequent as the top menu with 48.6 percent. In 2014 the convention for top placement had grown stronger and the observed 76.8 percent is close to the threshold of 80 percent. By 2019 the placement of the web menu at the top became a strong de facto standard with 87.7 percent.

During the same period, having a left side menu became dramatically less frequent for a company website. Because the placement of web menus is not mutually exclusive, as the webpage can simultaneously have top, left and right menus, the decline in placement of the menu to the left is not logically forced by the rise in the use of the top menu. The placement of a menu at the right was only found on a few websites in 2009, and the figure even decreased in both 2014 and 2019.

A graphical comparison in Figure 2 of menu placement at left, top, and right is convincingly displaying differences and tendencies.

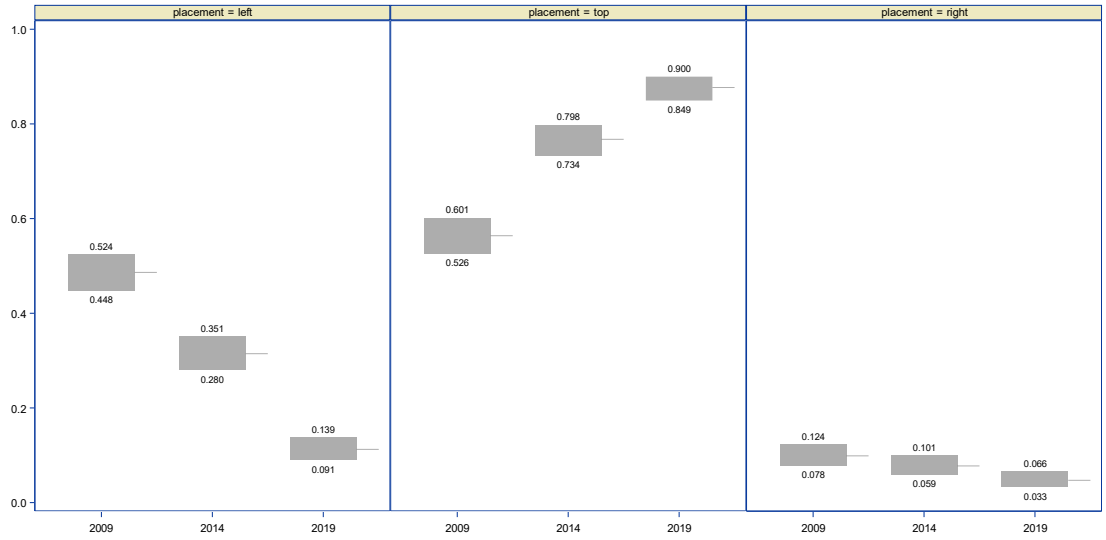


Figure 2. Menu placement with left, top, and right in separate panes and showing on vertical axis prevalence (between 0.0 and 1.0) with confidence intervals (shaded grey). In all three panes time marks for 2009, 2014, and 2019 are on the horizontal axis.

The confidence limits for the binominal distributed proportions are calculated following Brown et al. that "recommend the Agresti-Coull interval for practical use when $n \geq 40$" [Brown et al., 2001: 115]. Figure 2 shows for all three time points the left, top, and right placement of menus with their confidence intervals. The hypothesis concerning the placement of the menu at the top leads to focus on the respective figures of the confidence intervals. Among the three waves the closest contender to the top placement is found for placement of the menu to the left for the first wave in 2009 (left in the left pane, upper confidence level 0.524). At the same first wave, the placement of the menu at the top (left in the second pane) presents no overlap between these two confidence intervals as the lower confidence level is 0.526. When comparing the numbers this might superficially be regarded as a non-convincing close call. However, an explicit test for the first wave brings the result that the probability of getting the sample value (0.486) for the proportion for the menu at left under the assumption that the true value is the same as the proportion for the menu at the top (0.564) is extremely unlikely ($p < .0001$). Consequently, the null hypothesis of the two placements having equal proportions is rejected and the first research hypothesis - 'The menus of websites are most often placed at the top of the webpage' (RH1) - is thus supported for all three observation points.

Menu placement and company size

Figure 3 displays the menu placement for the surveyed SME companies categorized into the groups of company size: micro (1-9 employees), small (10-49 employees), and medium (50 employees and above). The categorization is operationalized by calculation of the mean of valid values for the period for company size defined by number of employees.

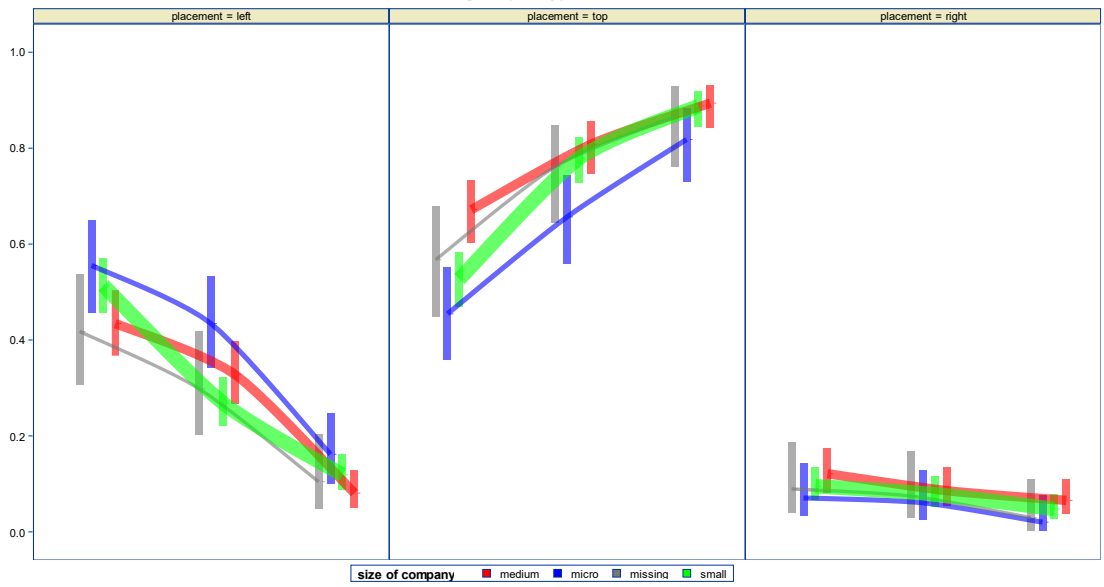


Figure 3. Menu placement with three panes: left, top, and right each showing 2009, 2014, and 2019 (horizontal) with means and confidence intervals by the vertical axis (between 0.0 and 1.0). The width of the lines illustrates the number of observed companies in the size groups: micro (blue), small (green), medium (red), and missing (grey).

The groups are deliberately slightly misaligned in the horizontal dimension of time in Figure 3 to visually distinguish the groups that would otherwise overlay because of the identical time points (2009, 2014, 2019). The number of companies in the categories differs. The companies with the highest number of employees among the SMEs are 'medium' (the largest SMEs) and this category consists of 198 companies, the 'small' covers 294 companies, and then follows the 'micro' with 99 companies. The companies where no employee information could be obtained ('missing'), have the thinnest line, 67 companies.

The middle pane of Figure 3 displays how the top placement of the menu became more popular for all groups and demonstrates the relationship that the higher the number of employees the higher is the proportion of websites having a top menu. The 2009 top placement of menu (left of the middle pane) shows significant differences as the medium companies (the largest companies in the survey, marked with the colour red) have no overlap in confidence intervals to the small (green) and micro companies (blue) thus supporting 'The larger companies among the SME more often have a menu placed at the top of websites' (RH2). As the top placement of menu becomes a strong convention there is no longer any significant difference based on company size.

More frequent top placement of the menu

The third research hypothesis (RH3) - 'The frequency of menus placed at the top of websites has grown' - is illustrated in the middle pane of Figure 3 found above. A strict statistical evaluation calls for testing all combinations. First, a test for no difference between the proportions at observation points 2009 and 2014, secondly a similar test for 2014 and 2019, and finally for 2009 and 2019. Because of the panel design where the same sample is being observed at the three observation points, the sample is paired, and this would normally call for performing a paired sample T-test. However, as the variables are binominal - the registration of whether a top menu is found or not - the test is improved by using McNemar's test which is often used to determine the effect of 'treatment' with binary outcomes. The passage of time between the observation points in this observation of websites is thus regarded as the 'treatment'. In all three comparisons the differences - i.e. the growth in the frequency - are highly significant ($p < .0001$) and RH3 is thus accepted. We have witnessed a growth in placing the menu at the top.

The agreement between two time points concerning having or not having a web menu at the top is illustrated through graphical comparison in the three panes of Figure 4.

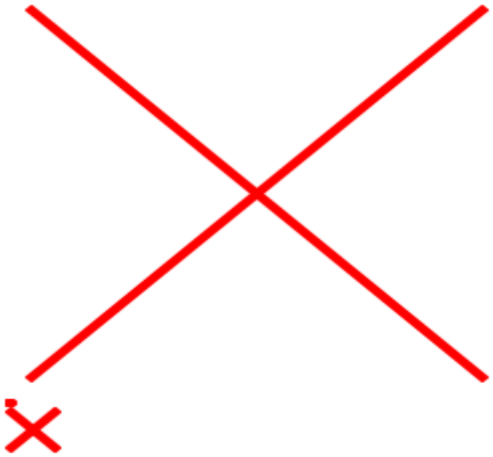


Figure 4. Agreement by maintaining the design of having a menu at the top or not. The three panes contain comparisons between 2009-2014 (left), 2009-2019 (middle), 2014-2019 (right). The size of the rectangles corresponds to the number of companies in the categories. Red rectangle (top right) shows companies having the menu at top at both time points. The orange below (bottom right) shows companies shifting from not having a menu at top to having a menu at top. The light-orange rectangle (top left) shows the very few companies shifting from having a menu at top to not having a menu at top. The yellow (bottom left) show the companies that did not have a menu at top at any of the two observations.

The agreement plots in the three panes of Figure 4 all show that the top right red rectangle is noticeable the largest in all panes which means that repeatedly having the menu at the top at both time points is the most often found combination. Similarly, in all three panes the second largest rectangle is the orange at the bottom right indicating the strong transition from not having a menu at the top to having the menu at top.

Table 2 shows the numeric absolute and percentage numbers behind the illustration of the middle pane in Figure 4 for the occurrence of top web menu between 2009 and 2019.

Table 2. Placement of top web menu for websites surveyed in 2009 and 2019 (N = 658).

Menu placement	2019 menu not at top	2019 menu at top	2009
2009 menu not at top	55 19.2 %	232 80.8 %	287 100 %
2009 menu at top	26 7.0 %	345 93.0 %	371 100 %
2019	81	577	658

Table 2 shows the strong transition towards having the web menu at the top. A normal guess would be to assume that things are about the same as they used to be. That is very much the case for companies that had a menu at top on its website in 2009 as 93.0 percent also had a menu at the top 10 years later. Surprisingly, an unconservative development is revealed for the group of websites that did not have a menu at the top in 2009 as 80.8 percent have in 2019 changed the design and are in line with the standard.

The third pane of Figure 4 illustrates the even greater agreement between the design in 2014 and 2019. This means that fewer companies changed their design choice of having the menu at the top in the last half of the investigated period compared to the first half (2009-2014).

Internal transitions between all placements of menu

So far only two time points have been investigated but the panel data have the potential for additional insight. The marginal distributions were shown in Table 1 to illustrate the overall development. Figure 4 and Table 2 exemplified the aggregated transitions between two time points. However, with the panel data it is possible to follow the design changes at the company level as the observations made at the three time points 2009, 2014 and 2019 can be presented.

For each company website the data comprise the menu placement in 2009, the menu placement in 2014 (middle time point), and the menu placement at the end of the investigated period in 2019. For Table 2 and Figure 4 the menu placement is dichotomized: at the top of the website vs. not at the top of the website. The complete description will include all five possible states of placement of the menu: left, top, right, bottom, and none (i.e., having no menu).

The menu placement at the bottom of the webpage was not recorded at the first wave in 2009. Moreover, the data from 2014 and 2019 might suffer from limited coding validity concerning bottom menus because the instruction was to observe and record the page as it immediately appeared in the browser, i.e. without scrolling down. Thus, the reporting of having a menu at the bottom of the page must be expected to be underreported.

At the first observation only 4 states are possible. At the later observations in 2014 and 2019 menus could be reported in 5 states. The number of possible sequence permutations is thus 100 (4 by 5 by 5) for description of the website's design moves through three time points. Each observed website can have more than one menu registered at each time point implying that each website can contain several such sequences. For example: a website had two menus in 2009 (both at the left and the right), again two menus in 2014 (now at the left and the top), and in 2019 only a single menu at the top. For this particular website example, the 4 combination sequences (LLT, LTT, RLT, RTT) are generated. To prevent company websites with many menus to overrepresent the movements each of these sequences in this example is weighted by a factor of 1/4 to make the 4 sequences in sum only aggregate to 1 company.

The 658 companies that had a website observed at all three waves generated 1.197 sequences of menus. The number of actual different sequences of web placement found is 64. The sequences are shown as a Sankey diagram in Figure 5.

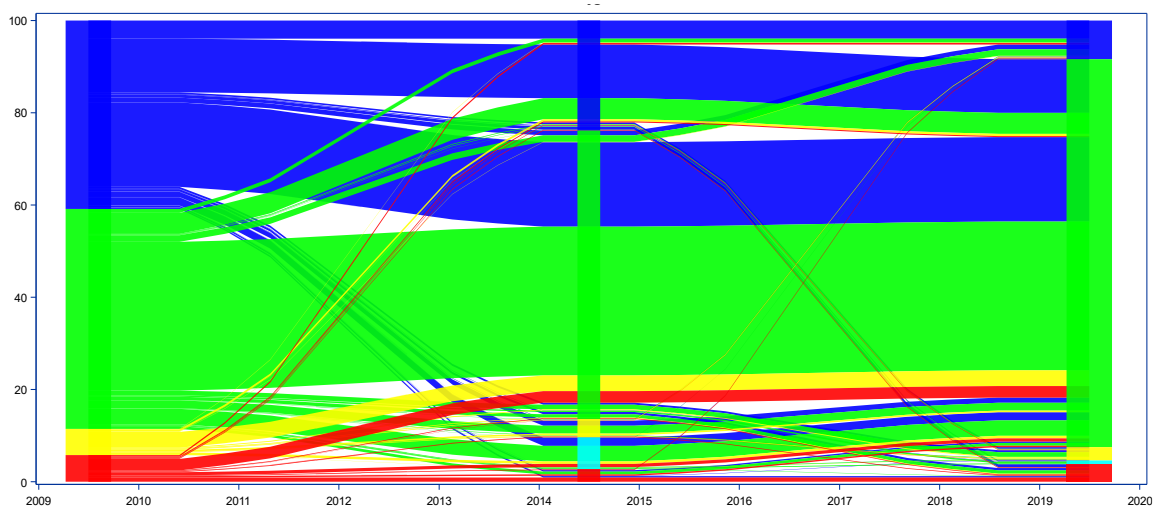


Figure 5. Sankey diagram for the three time points 2009, 2014 and 2019. Colour of path showing the starting menu: left (blue), top (green), right (yellow), bottom (cyan), no menu (red). Width representing the number of companies in percent (vertical left axis, N=658). At the three time points the stacked histogram bars show the distribution using the same colour codes.

Figure 5 shows the paths. The sequence left-left-left appeared 44 times representing 25.88 companies or 3.9 percent as illustrated by the thin blue band at the top of the figure. As the figure shows, the top-top-top sequence is the largest (316 sequences representing 212.25 companies or 32.3 percent). Figure 5 presents a convincing illustration of the standardization process and how the menu placement at the top in 2019 has absorbed the great majority as many paths of different colours (starting placement of menu, 2009, left) end in the green area (representing top placement) of the histogram for 2019 to the right.

Other strong de facto standards

In addition to the de facto standard for website menu placed at the top, the data also reveal other de facto standards that already were strong in 2009 and became stronger and almost realized to the maximum in 2014.

Advice most often concerns 'what to do' but can also be given in the negative form of 'what not to do'. In 2009 82.5 percent of the webpages did not have an intro (i.e. a screen or an introductory sequence shown when the webpage was displayed). The advice from web designers has for long been to avoid a time-consuming and often annoying intro on the website. This is well phrased by Nielsen and Loranger in their comment: “Garish, overproduced intro pages are inconvenient and arrogant” [2006: 353]. In the second wave in 2014 the frequency of the appearance of an intro had fallen to a third of the previous level, as not having an intro applied to 94.1 percent in 2014. The main annoying feature of the intro on a webpage was that the user had to wait for the intro to finish before interaction with the website could take place. Sometimes you could select 'skip intro' but even that is time consuming and brings annoyance. Modern websites might have slide shows and video sequences running without being judged as annoying. This is because the sequences typically are running in a separate pane of the webpage window and because menus and links are simultaneously available thus not detaining the user.

We also found a strong consensus concerning illustrations in the form of graphics and pictures on the website. Already in 2009 as many as 92.6 percent of the websites had illustrations and the figure was even higher in 2014 and had then risen to 96.7 percent.

When declaring 80 percent or more as a standard these proportions close to 100 percent could appropriately be named as 'super standard'. Such super standards were reached already in 2014 where only very few websites broke the rules of these de facto standards with an intro or by lack of illustrations on the website.

Future directions

Internet research comprises many disciplines from the very technical to areas within the humanities. Our focus is on the directly observable change on webpages concerning the menu placement. For that we have established a rigid longitudinal data collection of a well-defined group of company websites. Other - and larger - data collections bring a potential for additional validation. Furthermore, other new phenomena than the change of menu placement can be of interest for further research of webpage design.

Future research

The webpages of the Internet are changing at a rapid rate. You cannot google the same Internet twice! However, the Internet is being archived and the Internet Archive or the Wayback Machine at https://web.archive.org/ is a famous initiative. It presently advertises: 'Explore more than 1 trillion web pages saved over time' (March 2026). Many research articles exist on improvements, methods, and instructions for the potential use of the Wayback Machine [Tofel, 2007; Arora et al., 2016]. Some have gathered statistics on publications [Arora et al., 2016], and in the book 'The Web as History' [Brügger & Schöder, 2017] the editors have collected several examples of archival use. However, some book chapters are critical of the actual execution of the concept of the Internet Archive. Hale, Blank and Alexander test the validity and conclude: “We find that the Internet Archive contains a surprisingly small subset, about 24%, of the web pages of the website used for our case study” [Hale et al., 2017: 45]. Despite possible problems with validity, it could be interesting to determine the degree of conformity between retrieved webpages of the Internet Archive and the collection we present. Secondly, it could be interesting to investigate generalization of our results using a non-European region with companies and their websites taken from the Internet Archive.

The research presented has been limited to a descriptive mode of demonstrating how menus for website navigation have reached a de facto standard. The dynamic design of the panel means that future research could investigate whether companies that were first movers in placement of the web menus - e.g., 'innovators' and 'early adopters' [Rogers, 2003] - differ in performance compared to other categories of companies. Website modernization through following the established standard can be viewed as an indication of modernization of the whole company [Brynjofsson & Hitt, 2003].

Another issue of webpage design is the colour of the webpage. The extraordinary data collection of three waves of observation also comprises an archive of corresponding screen images of the webpages. We have made some preliminary investigations into this image collection with automated procedures and are investigating the potential of coupling the visual expression to both the current observational data as well as future register data for the companies.

New tendencies

In the repeated observation process for data collection, we noted new tendencies in web navigation that can give rise to further research. Among the new tendencies experienced - especially in the 2019 data collection - is a minimalization of menus. As commonly found in apps on smartphones, an icon of three horizontal lines - the 'hamburger button' - is becoming popular on webpages, too. The actual menu appears only when the button is clicked. Often this is found in combination with a minimalistic top menu. It could be argued that hamburger menus are less beneficial when webpages are displayed on larger screens as the button does not display information clues that can be recognized [Preece et al., 1994: 265; Dix et al., 1998: 127]. For elegant websites the minimal design might carry more weight than usability.

An automated slideshow - where each picture presents a link - is another feature that also seems to appear more often in 2019. The negative side of automated slideshows is that the automation can be annoyingly too slow or too fast and the shifting can be regarded as an interruption. The plus side of automated slideshows is the obvious advantage of being able to show more in the limited space.

Links to Twitter/X, Facebook, Instagram, mail, phone, etc. are sometimes combined in an integrated icon area, forming a small communication menu. These links can also be found embedded to pop-up from a 'selection sharer'.

We also observed that website homepages again tend to have become longer and scrolling becoming more of a norm. Furthermore, websites tend to more often have a footer that is a menu of contact information and other items central to the company.

For larger companies it is also noted that the content of the main menu conventionally includes versions of 'Home', 'About us', 'Investor', 'Contact', and 'Sustainability'.

Humans differ in their evaluation of websites. However, instead of building the design of targeted websites for groups with certain demographic-socio-economic characteristics [Leiva, 2022], we expect growth in personalization based on the electronic tracks of the user. Personalization concerns how the content of the media

pushes and presents itself to the user and personalization is most obviously used for determining surrounding advertisements. An elementary personalization was already at work in 2009 where some websites would present themselves in Danish or German depending on the location of the http request. The user's previous web behaviour on the website - but also behaviour on other websites, and web behaviour of other users - are now on many websites determining many instances of content. We anticipate that the personalization technology will become more widespread. This development will most likely also advance ordinary websites towards a dynamic adaptation of layout and content to the specific user.

A variation of personalization is the experimentation carried out by the company itself on the company website. The typical real-time investigation could concern 'Which picture sells best?' but also more profound differences could be the object for experimentation including the layout and placement of menus.

When variations and combinations of personalization, experimentation, and responsive design are becoming more widespread and accustomization is employed towards the single user we must expect greater obstacles in being able to determine existing de facto standards. Not only does the Internet change continuously but the Internet experience becomes more subjective.

Conclusion

The research of websites of small and middle-sized enterprises (SMEs) through the collection of unobtrusive observational data from a large panel of commercial websites has empirically demonstrated a significant change in the placement of the menu, the most central webpage element of navigation.

We found empirical evidence of a gradual progression from the early confusion, where navigation of individual websites with different menu placements demanded different - and thus non-intuitive - actions from the users. The transformation from confusion was a stepwise progression: first from a very weak convention, then into a strong convention, and then finally into a strong de facto standard of navigation of websites through a menu at the top. We use the term 'accustomization' to describe how a phenomenon gradually becomes so familiar that the emergence and development is regarded as unquestionable. This triggered our curiosity-driven research and the empirical design.

According to the principles of Nielsen and other web design experts, the correct choice when deciding on design elements of a website is to conform to other websites, because that is what users are accustomed to.

Our proposition is that the development of the de facto standard of placing the main menu at the top of the website conveys accustomization. The term 'accustomization' is intended to suggest that the probable causation works in both directions: 1) Company website designers and software CMS designs are imitating the layout of most competitors' websites because this layout is optimal to secure the attention of the users. 2) Users are becoming increasingly accustomed to expecting the main menu at the top of the webpage. The accustomization effect is growing as more website top menus are recognized and used. These are suggestions of causalities. The collected data are incapable of revealing the motives of companies behind the apparent imitation. Likewise, it is not possible from the data to obtain insights into the experience and learning of humans. However, the data unarguably present a development where the webpage design with a horizontal top menu reaches a de facto standard.

The de facto standard of website navigation through a horizontal menu placed at the top of the webpage developed through 2009-2014-2019. In 2019, having the top menu on the webpage is nearly a website 'law'. However, design evolves in a process with users and designers. Software is malleable, but users are as humans malleable, too. Through learning we can get accustomed to standards, and this includes getting accustomed to new standards.

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