

Automated Attention Analysis: a Valuable Tool for Online Marketers?

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Abstract—The paper presents a study in which automated attention analysis has been used to determine the differences between brand related websites of beer companies. The automated (and thus fast) comparison of websites originating from different markets and cultures might provide stimulating and helpful feedback for online marketers. The results indicate that the automated attention analysis could be an inexpensive yet relevant tool for brand site development.

Index Terms—culture, web design, automated attention analysis, tool

I. INTRODUCTION

NEW technologies in modern marketing have stimulated emergence of several new interdisciplinary approaches. For example, measuring responses to marketing stimuli with technologies such as functional magnetic resonance imaging forms the base of neuromarketing [1]. Another example is automated eye-tracking which represents an interdisciplinary connection between marketing and visual perception/cognitive psychology and becomes an integral part of visual marketing [2].

Eye-tracking is a research method focused on monitoring the eye activity. Research in (then low-tech experimental) eye-tracking became a scientific discipline more than 100 years ago. Rayner [3] dates the early beginnings of the research back to the end of 19th century when many characteristics of eye movements were discovered. During and after the 1930s, more applied research has emerged, encompassing e.g. experimental psychology or behavioristic theories. From the 1970s more improvements, especially in eye movement recording systems, have been achieved. More accurate measurements included in a wide variety of eye-tracking systems are now easily available [4]. Eye-tracking methods are broadly used in many disciplines such as neuroscience, psychology, or computer science. Eye-tracking has been routinely used in many applied research fields, including engineering or marketing/advertising [5]. Marketing researchers use a variety of methods to evaluate consumer reactions (physical or physiological) to

advertising stimuli [6]. Marketing research involves the eye-tracking methods to determine consumer's visual attention over advertisements – in order to follow and process a visual marketing stimulus, consumers move their eyes [7]. Eye movement consists of two different components: saccades are rapid eye movements focusing at a specific area, while the fixations are relatively still moments during detailed visual processing [8].

The sequence of saccades and fixations across the visual stimulus (such as advertisement) is called a scanpath [9]. Recording and analyzing a scanpath can reveal objects which “pop-out” from the image. The order of objects and the path between them is a valuable information how the observer perceives each scene/image. Even if costs of eye-tracking experiments are high, advertising clutter means that ad pretesting becomes a common activity to ensure the effectiveness [10]. The use of eye-tracking is not limited to print only, evaluated advertisements can be tv spots or online objects as well [11].

Wide-spread use of eye-tracking in online marketing also brings in a call for cheaper and less time consuming alternatives. There are studies investigating the correlation between movements of user's eyes and mouse pointer. Although the results are promising, the accuracy is not high enough as there are differences between where users look and where they point the mouse when browsing the website [12]. Almost two-decades of research in neuroscience and natural vision processing resulted in automated systems which can simulate the human attention. Such systems produce similar results to a common eye-tracking study. Attention heatmaps are comparable to eye-tracking maps and can be interpreted in a similar way. The comparison is shown in Fig. 1.



Fig. 1. Eye-tracking output (left) and automated attention analysis [13] Captured snapshots of a website are analyzed on various features such as color, orientation, density, contrast, intensity, size, weight, intersection, closure, length, width and curve of displayed objects. Text, skin color and face detection are also included [14]. Other tools may identify as many as 50 other features which attract human attention the most [15].

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Automated tools for user-centered website assessment have been a recent phenomenon [16]. The most popular systems which allow uploading an image (e.g. screenshot) and get a visualization of estimated attention include EyeQuant (<http://eyequant.com>), Feng-Gui (<http://www.feng-gui.com/>) or Attention Wizzard (<http://attentionwizzard.com/>). However much debate [17] has evolved around their ability to simulate human perception and robust evidence is still missing. Authors of those automated tools claim 75–90 % correlation with real eye-tracking data [13, 18]. The aim of this study is to contribute to this debate and to explore whether cultural differences in web design can be captured through automated eye-tracking tools.

II. RESEARCH DESIGN AND METHODOLOGY

A. Cultural Differences

The impact of culture on consumer behavior has been researched for several decades. Market interdependence have prompted emergence of theories, which attempt to explain differences between markets [19]. Studies of cultural differences introduced by Hall [20], Hofstede [21] or Trompenaars and Hampden-Turner [22] have become the classics of academic literature and the prominence of intercultural studies have survived or even grown in research interest [23].

Discussions about cultural specificity affected all components of marketing mix, including online marketing. Web designers began reflecting and adjusting to user's cultural characteristics [24]. Internet customers are different across the world according to their culture [25], however their online behavior can be similar in some ways [26]. Cultural differences between web designers and users determine success of web-based applications [27], however companies, origin of which is known, design their websites in a way that reflects their culture of origin rather than cultural norms of targeted customers [28]. Culture impacts on web design as well as on web content [29]. Websites need to be culturally adapted [30], although several cultures incline to adapt global patterns, behaviors or brands [31].

Literature highlights strong impact of high- and low-context communication styles on web design and website content organization and similar effects have been attributed to Hofstede's individualism-collectivism and power distance [30]. Websites in high context cultures display fewer interactive features [32], less varied and more shallow content [33] and are less informative [34]. High context website are usually less clear and less attractive [30]. Websites from more individualistic cultures often offer more opportunities for face-to-face communication, because viewers feel more comfortable with impersonal communication [35]. Channels for mutual communication between clients and vendors are readily available in cultures with low power distance; the websites are rich on information as secretiveness would not be a source of advantage or power [32]. Evidence from studies focusing on the impact uncertainty avoidance on web design is ambiguous: the evidence is either inconclusive [27] or partially supportive for overall website attractiveness, content depth and information richness [30]. However,

uncertainty avoidance influences the way users accept technological advancements [36]. Masculinity and femininity dimension has only little empirical support: in less masculine cultures website themes may be echoed with stronger relationship to aesthetics, nature and use of metaphors [37].

A. Research Questions and Sample

Studies on cultural differences in web design confirmed that consumers from different cultures have different expectations and preferences about web design, which is also reflected by web design [38, 39]. Some of them used a multi-method approach including eye-tracking [40]. Therefore comes the research question:

Could be the cultural differences in web design revealed by automated attention analysis tools?

Research sample consisted of commercial websites presenting beer brands. Alcohol consumption has been wide-spread across cultures, although motivation to drink alcohol differs [41]. Beer has been popular with consumers across countries and has been the most widespread alcohol drink [42]. Local beer markets offer opportunity to global as well as local brands, whereas brand cultural belongingness is usually well articulated. Beer is also a product with similar price and societal positioning in most cultures [43]. Largest beer producers are in China, USA, Russia, Brazil, Germany and Mexico [44]. Beer consumption per capita has been the highest in Czech Republic. This country shares strong beer culture and tradition with Great Britain [45], although national cultures differ [46]. Britain has ranked 6th on the list of biggest per capita beer drinkers and is the 8th largest brewer in the world [44].

Japan represents a country with different approach to beer drinking [47]. Although the beer market has been well developed and beer drinking has become popular alongside of traditional liquors [48], Japan scores 35th in beer consumption ranking (but the 7th largest brewer). All three countries are culturally different to each other – Britain representing the Anglo-Saxon Protestant ethics, Czech Republic representing Catholic Slavic roots, and Japan for Asian Shinto tradition. Hofstede's cultural dimensions [46] confirm key differences: Power Distance Index, Individualism, Masculinity, and Uncertainty Avoidance Index are for Czech Republic 57, 58, 57, and for Great Britain 74; 35, 89, 66 and 35; and for Japan 54, 46, 95, 92. Still, all three territories belong to countries with strong local beer production.

To establish a control group, in addition to those three markets the study included a group of prime international brands with highest worldwide consumption (in case the brand featured on the local top consumption list as well, it was surveyed with the international group only as international brands could promote different than local cultural values). List of all websites included in the study is in Table I. Selected websites were tested for similarity of user interface.

TABLE I
LIST OF SURVEYED WEBSITES

Czech Republic [49]	Great Britain [50]	Japan [51, 52]	International [53]
Gambrinus	Carling	Asahi	Snow (China)
Radegast	John Smith's	Kirin	Budlight (USA)
Staropramen	Old Speckled Hen	Suntory	Budweiser (USA)
Krušovice	Cobra	Sapporo	Skol (Brazil)
Pilsner Urquell	Newcastle Brown	Orion	Corona (Mexico)
Budějovický Budvar	Fuller's London Pride	Baird	Heineken (Netherlands)
Bernard	Hobgoblin	Taisetsu Ji Bīru	Miller Lite (USA)
Velkopopovický Kozel	Marston's Pedigree	Okhotsk Bīru	Guinness (UK)
Starobrno	Abbot Alle	Tokachi Bīru	Coors (USA)
Ostravar	Tanglefoot	Otaru Bīru	Fosters (Australia)

Opening introductory websites were surveyed unless there was a requirement to acknowledge user legal age first; in that case sites appearing after age check were analyzed. Opening website usually presents the key features kept for other sub-sites [54]. Analyzed websites were captured in 1280×1024 px resolution, which (or higher) was the most typical user resolution at the time of research [55]. Websites were then analyzed through Feng-Gui tool for the number of points of interest (AOIs) which would be likely the focal areas of user eye activity. The number of AOIs was captured as well as the overall area occupied by AOIs (in pixels). Analytical results can be visually displayed in a form of heat map (see example on Figure 2).



Fig. 2. Example of Feng-Gui Analysis

It was expected that Japanese websites would be less visually appealing in comparison to Czech and British sites [30], less interactive [56] and offering less content [34]. International websites should than reflect and be more similar to presentations from countries with longer beer tradition. Most Czech brewers use a combination of dark colors, creating a feel of authority and seriousness, and one other color, which is either green (Radegast, Staropramen, Pilsner Urquell) sensing (in western cultures) nature and freshness, or brown/wine red (Gambrinus, Krušovice, Budweiser Budvar) intuiting health, earthiness or tradition [57]. Color choice has been consistent with long Czech brewing tradition. Websites use sizeable and illustrative pictures in vivid colors, in alignment with low context cultural habit [58]. Among top ten brands only one seems to take a different approach with combination of blue and white.

British websites are similar to the Czech ones. Dominant colors refer to tradition, wholesomeness, earthiness,

dependableness, steadiness, and healthiness [59]. Green color is used quite often on the British sites and other markers of low context cultures are also present.

Color scheme of Japanese beer websites speaks a completely different language. The dominant color is white. In western countries, this would be the choice for sensing simplicity, neatness and precision. However in Asian countries white is perceived as color of death, mourning and spirit [57]. A little different are websites of Baird and Taisetsu Ji Beer, which remind websites of European brands and choose combinations featuring black, resp. dark red colors.

International websites are a diverse bunch of brands, originating from distant parts of the world. The first place goes to Chinese Snow, North America is represented by Budweiser, Central America by Corona; Heineken and Guinness hold European flags and Fosters comes from Australia. International brands push the feeling of uniqueness. Combinations of darker and another color are very frequent: Heineken – green, Budweiser – red, Fosters – blue, Guinness – blue. Other brands (Corona, Miller Lite, Coors Light, Bud Light) take a different route and prefer blue. Blue is a popular corporate color creating impression of trustworthiness. Very different is Snow website – its Chinese origin is reflected in color choice and dominant white reminds several Japanese brands.

III. RESULTS AND DISCUSSION

Paired similarity in number and area of AOIs was tested through non-parametric Mann-Whitney test [60] which is deemed suitable for this type of observations. The analysis was performed through SPSS Statistical Software. Websites from two different countries were compared against each other. A complete picture depicting dyadic variations was compiled. Table II depicts the key findings.

TABLE II
RESULTS OF AOI ANALYSIS

Number of AOIs	Great Britain	Japan	International
AOIs Size			
Czech Republic	same	different	different
	same	different	same
Great Britain		different	different
		different	same
Japan			same
			different

A. Czech vs. British Websites

Difference in number of AOIs between the Czech Republic and Great Britain is not statistically significant (p-value = 0.167) as well as the difference in AOI size (p-value = 0.257). Czech and British beer sites are similar in terms of number and size of focal points. Czech and British beer websites seem to be a homogenous group in terms of focal attributes.

Although Hofstede's cultural classification assign different

cultural profiles to each nation (especially for individualism and uncertainty avoidance), both countries share the strong beer culture propped by lasting beer drinking tradition [45]. Both markets are labeled as low context; hence approaching consumers through websites might be similar. Both website groups feature rich and vibrant colors with shades emphasizing trust, tradition or nature. Number of interactive objects is high complemented by rich information content. Such findings are in line with previous studies detailing low context online environments [37, 56].

B. Czech vs. Japanese Websites

Number of AOIs is significantly different for Czech sites and for the Japanese ones (p-value = 0.032). The difference is significant even for the size of AOIs (p-value = 0.007). The difference is not only in the number of AOIs (fewer of them in Japan) but in their size (larger ones in Japan). Japan is considered one of the most high context cultures. Absence of interactive features (such as consumer-consumer interactivity, fewer objects with smaller information content) could be explained through the lens of Japanese cultural distinctiveness [32, 33].

Whereas traditional beer cultures use rich and vibrant colors bringing forward serious, natural and calming impressions, Japanese beer websites utilize clean and plain white color which reduces first-impression attractiveness. More, white is believed to be the color of sorrow and death in Asia [61].

C. Czech vs. International Websites

Number of AOIs is different for international brands and for Czech leading beers (p-value = 0.008). However, the sites are not different in area taken by AOIs (p-value = 0.406). Czech websites were similar to international ones in the area taken by AOIs but had higher amount of them. Several international brands do not originate from western low-context cultures but from Asia or Latin America featuring fewer interactive qualities [32, 56], less diverse and informative content [33] and are less informative in general [34]. Their main purpose may be intentional to cover large and diverse international audiences without targeting or offending any particular culture or adversely building on the global consumer.

D. British vs. Japanese Websites

Number of AOIs is significantly different for British and Japanese beer websites (p-value = 0.007). AOI size is different on the edge of statistical significance (p-value = 0.059). The finding is consistent with the similarity found between Czech and British websites. Japanese websites contain fewer interactive options and fewer focal objects than the British ones.

E. British vs. International Websites

Number of AOIs is significantly different for Great Britain – international brands comparison (p-value = 0.002). However, the screen area occupied by AOIs does not seem to be dissimilar (p-value = 0.364). British and international brands are presented differently in terms of number of focal points but the overall space taken by key features is similar. Representation of non-Western brands from high context cultures (Asia, Latin America) which do not have English

websites (or English language versions) could explain some of the differences.

F. Japanese vs. International Websites

The difference in number of AOIs is statistically insignificant for the analysis of Japanese and international brands (p value = 0.908). In contrary, the difference is significant for a comparison of AOI size (p-value = 0.023). Japanese and international websites are different in the screen area taken by AOIs (Japanese are bigger). International websites stand on the verge between East and West. International brands apparently do not target consumers from traditional beer cultures specifically. It may well be that developing or emerging markets seem more promising for international beer brewers. Traditional beer cultures typically host several strong local brands which outperform international brands (which seems to be the case in all three countries under study: Czech Republic, Great Britain, and Japan). International websites present similar color schemes to traditional beer cultures, capitalizing on vibrant colors rather than on plain white.

IV. CONCLUSION AND LIMITATIONS

Cultural differences between websites can be deduced not only through demanding resource-consuming user testing or through expert panels. Cultural differences can be diagnosed via automated tools which simulate natural vision processing. Automated tools do not reflect local fluctuations or context and are prone to inappropriate sampling and personal bias. On the other hand, automated approaches offer less rich findings. The results could be also interpreted another way, since the automated tools do not perform testing on the same basis – user testing is based on specified task and eye-tracking results could be different according to different user scenarios. The results are also influenced by prior user experience or task with the website [62]. None of these factors are included in automated attention analysis and automated tools are not suited to depict such contingencies. Nevertheless, automated tools for website assessment have been a recent and increasingly popular phenomenon and have become prominent in other areas of web design. For instance, the CWS tool for harvesting visual cultural markers on the web [63] provides guidance for website layout and color scheme.

Automated tools can never fully substitute human experts in assessing human-computer interaction or user experience. Automated tools may provide fast and relatively inexpensive results for initial assessment of e-commerce and online marketing interfaces. The tools digest management-relevant outcomes for marketing managers or web designers who oversee and take decisions about the international portfolio of brand websites. Using initial automated testing may reduce website development cost and contribute to more efficient marketing communications.

Additional research questions have been raised whether the most valid Hofstede's dimensions (IDV and MAS) are consistent with our results. Ranking for median number of AOIs (Japan: 5, Czech Republic: 7, United Kingdom: 8.5) corresponds with country ranking for individualism/collectivism (Japan: 46, Czech Republic: 58,

United Kingdom: 89). Additionally, ranking for median size (measured in pixels) of AOIs (Czech Republic: 8796, Great Britain: 9841, Japan: 12 585) corresponds with masculinity results (Czech Republic: 57, Great Britain: 66, Japan: 95). More individualistic cultures need perhaps a greater number of eye catchers - website impulses, whereas less individualistic cultures may focus longer on smaller number of attention areas and explore the links between them. Rather masculine cultures prefer bold websites, in which attention areas are large and easy to determine with strong focus on tasks, challenges or controls, while feminine cultures might be used to work with subtler hints, giving preference to higher number of smaller AOIs [67].

A. Research Limitations

Although the findings are stimulating, they should be interpreted with usual scientific pre-caution. Correlation between traditional eye-tracking and automated eye-tracking has still been a matter of academic debate.

Our findings also may not reflect cultural differences only and could be based on designer's personal taste. Designer's personal bias is immanent to all website-based studies conducted outside closed labs and can be mitigated through inclusion of multiple websites residing in one cultural region. Cultural bias of automated tools also remains to be empirically verified. System calibration for other cultures would be useful feature and could enhance its predictive power. Further restrictions may rest on a relatively limited amount of output measurements – in comparison with rich findings from human eye-tracking [64, 65]. Automated tools usually offer just a handful of indicators: identification of areas of interests, their size and process of transition between various AOIs.

Future research could address some of the limitations; replicate our study on a set of different globally similar products, with real eye tracking or with utilization of multiple eye-tracking automated tools. Similarly, research in neuromarketing [1, 66] could become a viable avenue for future studies. Before any further work is done, academia as well as practitioners can utilize automated tools as an easy partial answer to a complex issue.

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