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DOCTORAL THESIS SUMMARY

The influence of websites' interactivity on
consumer behaviour

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SUMMARY

In order to study the users' behavior on e-commerce websites, the actual paper uses both traditional instruments, such as the interview guide and the questionnaire, and an instrument which records the non-cerebral reactions, called Eye Tracker and which is tracking the gaze trajectory. The paper aims to assess the effects of the most important interactivity' dimensions of e-commerce websites on users' content comprehension and the attitude towards them.

The objectives of the study are the following ones:

1. To assess the interactivity construct and its dimensions by studying the literature;
2. To assess the interactivity construct and its dimensions of e-commerce websites from the IT experts point of view, through a qualitative approach, using the semi-structured in depth interview method;
3. To rank the interactivity dimensions after the answers of the IT experts and their comparison with the data from the literature;
4. To establish an interactivity index by defining a score to each website;
5. To determine the measure in which the website content comprehension varies according to the interactivity level;

6. To determine the measure in which the intentional component of the attitude varies according to the interactivity level;

7. To identify the stimuli which activate the attention and the respondents' interest by using a physiological metric (Eye Tracker device).

The actual research follows two steps: (i) a phenomenological approach which targets to gather data which refers to the personal experiences of the IT experts in order to outline a holistic image of the interactivity construct and its dimensions, by applying 11 semi-structured in-depth interviews; (ii) a qualitative approach complementary with a quantitative approach, in order to identify the effects of e-commerce interactivity websites on the content comprehension level and the attitude towards them. The preference of using a quantitative approach after applying the qualitative one, is justified by the fact that the respondents' affirmations from a written or spoken report, frequently varies from the actually measure of the visualizations. Therefore, using a qualitative approach which is complementary to a quantitative one, represents a real support which makes possible a comparison between the results and the identifications of new perspectives.

The current research proposes one of the newest and efficient methods used when aiming to improve the users' online experiences: the Eye Tracking device.

Through this device one could record the precise areas in which the user looks, the time spent on them as the sight trajectory. This method is non-invasive for the investigated subjects. We know that the written or oral report offered by the subjects tend to vary most of the time from the effective visualization measure.

This study uses also traditional instruments, such as the interview guide and the post-experimental questionnaire.

The current paper is structured in three major parts, with 10 chapters and annexes.

First part – *The assessment of the conceptual and methodological framework*, makes an investigation of the conceptual framework of interactivity and its dimensions, as well as of its implications it has in the user’ s behavior analysis.

This section includes four chapters as follows:

Chapter 1 – Theoretical foundations of Human-Computer Interaction field, which frames the research problem in the field of Human-Computer Interaction (HCI). Moreover, this chapter presents the theoretical and practical characteristics of the reference area and defines the usability concept.

Chapter 2 – The marketing communication in the online interactivity context, assesses the conceptual delimitations concerning interactivity and its dimensions.

Chapter 3 – The implications of interactivity in the user’s behavior analysis, identifies the main theories and models used in the process of new technologies acceptance but even in the process of visual attraction investigation.

Chapter 4 – A theoretical framework concerning the eye-tracking technology, reviews the visual attention, neural mechanisms, the techniques of eye movements tracking, as well as the eye tracking technology implications in online marketing.

Second part – The empirical study – An interview with the experts in the Information Technology field.

Chapter 5 – The research strategy, sets the general framework of the research strategy, describes and justifies the chosen research type, of the methods and the used instrument, as well as the aimed objectives from the preliminary analysis reported in the assumed step.

Chapter 6 – The research methodology, underlines the steps of the research, offering details concerning: sampling, respondents’ recruitment process, research instrument, the pretesting interview guide steps and finally, the operationalization phase.

Chapter 7 – The results analysis and interpretation, reveals the study results concerning the way in which it was realized and the interpretation of the gathered data, as well as their analysis.

Third part – *The experimental research (Eye Tracking Technology) and the investigation*

Chapter 8 – *The research strategy framework*, makes a short presentation of the methods and instruments used in the experimental research and the investigation and indicate its aim, objectives and hypotheses.

Chapter 9 – *Methodological aspects*, describes the main steps of the experimental phase, offering details about the subjects' profile, the sampling process and recruitment, the used instruments, the variables, the stimuli and the pretesting phase.

Chapter 10 – *The analysis and the interpretation of the results*, describes the analysis and interpretation phase as well as the presentation of the final results.

Finally, the **Conclusions**, appreciate the relevance of the obtained results for each section of the paper, emphasize the personal contributions from a theoretical and managerial point of view and presents the limitations and further research views.

PART 1. THE ASSESSEMENT OF THE CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

Significant construct of the Human-Computer Interaction field, interactivity was debated in the literature from various perspectives. Nevertheless, the

common approach reveals that interactivity is realized beginning with a change of the communication from one way to a double one, this representing in the end a process of message exchange. In the communication process, the interface represents the intermediary element or the main binder between the user and the computer.

Carnegie (2009), argues that interactivity represents the very answer of the interface to the user's actions. According to this vision, the interface represents the medium in which the interactivity is developing, facilitating the communication process between the user and the computer, user-software, user-content, software-content and user-user.

The main interactivity dimensions, identified in the literature, are synthetized in the following table:

Table 1. Interactivity dimensions

Author	Interactivity dimensions
Borsook and Higginbotham-Wheat (1991)	- the possibility to choose; - responsivity; - adaptability.
Steuer (1995)	- speed; - range; - mapping.
Ha and James (1998)	- entertainment; - connectivity; - the possibility to choose; - information collection; - reciprocal communication.
Downes and McMillan (2000)	- direction of communication; - timing flexibility; - flux;

	<ul style="list-style-type: none"> - control level; - responsivity; - the perception of the communication's aim.
Liu and Shrum (2002)	<ul style="list-style-type: none"> - active control; - double-way communication; - synchronicity.
Carnegie (2009)	<ul style="list-style-type: none"> - multi-directionality; - manipulability; - presence.
Gao et al. (2009)	<ul style="list-style-type: none"> - user's control; - double-way communication; - synchronicity; - connectivity; - entertainment; - interpersonal communication.
Koolstra and Bos (2009)	<ul style="list-style-type: none"> - synchronization; - timing flexibility; - control over content; - the number of participants; - presence; - senses.
Yoo and Lee (2010)	<ul style="list-style-type: none"> - controllability; - synchronicity; - bi-directionality.

Therefore, the first part of the paper accomplished the following:

i. Analyzed and synthesized the main ideas from the literature, concerning the interactivity in the Human-Computer Interaction field;

ii. Identified the main definitions and websites interactivity dimensions, as well as a theoretical synthesizing of them, with the purpose of a future operationalization of the interactivity construct;

iii. Analyzed and described the main results obtained in the literature, referring to our study;

iv. Assessed the interactivity implications in the user's behavior by identifying the main theories and models used in the process of the acceptance of the news technologies;

v. Assessed the attitude towards the website, identifying and analyzing the nature and the various types of influences on the perception of different levels of interactivity;

vi. Analyzed the theories concerning the visual attraction;

vii. Describes the theoretical and operational framework concerning the Eye Tracking Technology.

PART 2. THE EMPIRICAL STUDY – AN INTERVIEW WITH THE EXPERTS IN THE INFORMATION TECHNOLOGY FIELD

In order to determine the methodological strategy of the present paper, we will take into account the phenomenological approach. This approach is placed to an interpretative level of the obtained data. In this approach the intrinsic experience of the user is the most important issue, as well as the way in which he makes sense to a certain thing. This experience becomes to us a

source to understand the investigated concept. Nevertheless, it should not be neglected the fact that there is a certain tendency for personal interpretation of the results, although we focused on objectivity.

The preference for such a research, as the first phase of our research, is justified by the necessity to rank the interactivity dimensions and finally to establish its index which is useful when assessing the websites level of interactivity. The interactivity level is revealed by the number of the interactivity dimensions of that website (Cyr et al., 2010). Establishing the interactivity level represents an important step which is preceding the establishment of the scores of each website included in the study. By investigating the experts in the field of Information Technology, we expect to understand and identify the interactivity dimensions, rather than a conceptual framing.

Thus, the second part represented a preliminary analysis which proposed a qualitative approach in order to shape a holistic image of the interactivity concept and its dimensions. This step accomplished the second objective of the research, i.e assessing the interactivity concept and its dimensions from 11 experts in the field of Information Technology, using the in-depth interview.

Therefore, the results of this study revealed that the entire effort to enhance interactivity aims to make a unique experience with the user, offering him the possibility to feel in control over his actions on the

website, through filters, raising the trust in the seller and his products through comments, reviews, forums and the answers given in real time.

According to respondents' answers, interactivity means user, personalization, product filtering in order to raise the efficiency of the search, interaction with the website/ seller/ offered applications, technology, experience, feedback, real time, chat, design.

The most frequently mentioned website was emag.ro, with 59 mentions, which indicate its qualification for the highest level of interactivity due to the presence of numerous functionalities which makes interactivity, such as: filters, reviews, comments, real time support, personalization, graphical and design elements, controllability. On the other side, a low level of interactivity is the opposite of the above mentioned elements and it defines, according to the respondents, the websites which are at the beginning, without filters or any other minimum possibilities of control and personalization, such as teore.ro website.

According to participants, the defining words for interactivity were the following: personal experience, personalization, filters, review and chat. The personal experience is realized and it is improved by integrating pertinent filters, individualized functionalities, adapted to each user, forms which supports reviews and the possibility to access them and lastly, giving real time support.

After analyzing the theoretical framework, we identified personalization, synchronization and controllability as the most important constructs of interactivity (Carnegie, 2009; Koolstra and Boss, 2009; Steuer, 1995; Ha and James, 1998; Downes and McMillan, 2000; Liu and Shrum, 2002; Gao et al., 2009; Yoo and Lee, 2010; Jensen, 1998). The results of the second part confirmed that in the studied reality, these constructs have an important influence in rising the interactivity level of a commerce website. Therefore, the three constructs were included in the future research model from the third part.

In order to establish a hierarchy, after assessing the respondents' answers, it was identified the main constructs of interactivity according to the experts: personalization, synchronization, controllability, adaptability and responsivity.

The first three constructs were identified in the literature as the most significant. The other two constructs were subsequently identified after analyzing the experts' answers. Nevertheless, the first two constructs were considered by the experts as important in commerce website development. Therefore, the study identified the most important constructs for the establishment of the interactivity index.

PART 3. THE EXPERIMENTAL RESEARCH (EYE TRACKING TECHNOLOGY) AND THE INVESTIGATION

This study uses both traditional instruments, such as the post-experimental questionnaire, and an instrument which records the non-cerebral reactions, called Eye Tracker and which tracks the eye movements. The Eye Tracking device can also be used together with other instruments, including those which records the metabolic and electric reactions of the brain. The present study uses only the Eye Tracker device, together with the post-experimental questionnaire.

Regarding the sample size, after selecting the data, the final number for the experiment was 34 subjects and 36 for the post-experimental investigation.

The methodological design of this study is based on the technology acceptance model (TAM), developed by Davis (1989) and the model proposed by Ducoffe (1996) in the advertising field but adapted and lately improved

by Teo et al (2003) in order to improve the websites usability.

Efficiency and effectiveness represents two important determinants when assessing the websites, mostly used in studies which target the improvement of websites usability.

Efficiency indicates the ease in searching and accesing the information. To this determinant correspond the perceived ease of use (PEOU) from the technology acceptance model (TAM). Effectiveness indicates the quality of the information offered by a certain system and the perceived usefulness (PU) corresponds to it.

The relationship between PEOU and PU reveals that the behavioral intention is formed according to the cognitive appreciation of the user, over the way in which a certain system is expected to help improving his performances. Therefore, a high level of interactivity raises the website's ease of use and help to its content comprehension.

We assume that (1) *a high level of interactivity leads to an increased level of website's efficiency*, (2) *a high level of interactivity leads to an increased level of website's effectiveness* and (3) *a high level of efficiency and effectiveness has a positive influence the level of website's content comprehension*.

The interactivity's influence on website's content comprehension is mediated by efficiency and effectiveness. The literature argues that a website with

limited interactivity dimensions (the lack of functionalities, useless links, imperfect organization) lead to limited search and access to information, disorientation and useless cognitive loading.

When improving the websites interactivity, the users' experience is better and more, feelings of pleasure arouse, as an affective component, and a positive reaction as well, which leads to a direct influence and favourable on attitude.

We assume that (4) *a high level of interactivity leads to an increased level of the website's content comprehension* and (5) *a high level of website's content comprehension leads to a favourable attitude towards it.*

A high level of interactivity is frequently associated with positive attitudes towards the website (Teo et al., 2003; Hausman and Siekpe, 2009). Moreover, attitude is positively influenced by the perceived usefulness. A favourable attitude intensifies the users' intention to use a certain system or website.

We assume that (6) *a high level of interactivity leads to a favourable attitude towards the website.*

The interactivity index included the following steps:

1. The first phase calculated the score for each page, according to the number of the factors of each interactivity dimensions it included. The scores were between 3-12 characteristics, 3 indicating the presence of 3 characteristics on the homepage and 12 indicating 12 characteristics.

2. The median and the average was calculated. In order to group and select the websites on different levels of interactivity, it was calculated the average, which was 5.5 and the median, 7.

3. According to the previously calculated scores, the websites were grouped, with three levels of interactivity: the group with a low level of interactivity (those with a score below the median: 3 and 6), the group with a medium level of interactivity (those with a score equal with the median: 7), the group with a high level of interactivity (those with a score over the median: 8, 11 and 12).

4. In order to assess the websites, it was chosen two websites for each group.

Thus, the websites with a high level of interactivity cover 15 factors: adaptability (social networks, last releases, blogs), receptivity (recommendations, large images, additional services, newsletter), controllability (filters, shopping carts, animation elements), personalization (Login functionality, offers), synchronization (Search characteristic, real time support, email).

The websites with a medium level of interactivity involve 11 factors: adaptability (blog, social networks, external links), receptivity (recommendations, newsletter), controllability (filters, shopping cart), personalization (offers, Login functionality), synchronization (Search characteristic, email).

The websites with a low level of interactivity involves 7 factors: adaptability (last releases), receptivity (most liked products), controllability (shopping cart), personalization (offers), synchronization (order tracking Search characteristic, email).

It was assessed only the homepages of the selected websites.

The subjects were informed that on the entire process, their eyes are tracked by an infrared camera that will not injure in any way the health of their eyes.

Before starting the experiment, we explained the procedures of the study (eye-tracking and filling out a questionnaire about the previously assessed web pages). They have signed an informed certificate consent. All participants voluntarily took part in the experiment for a sport club voucher.

Further, the eye-tracking device was calibrated at a distance between 45-74 cm of each participant's face. The procedure of calibration consisted of the participant's watching twelve dots which moved in the corners and center of the screen. It was ensured that this process took place for each participant.

The participants were informed about their role and task: "Imagine that you intend to buy a new mobile phone from an online store. Therefore, you have to assess six such websites in order to gather information and lately to decide from which one you are the most inclined to buy".

Thereafter, the participant received the stimuli. It was assessed only the homepages of the websites and they were displayed in random order. While the process took place, the websites were not online, the participants reviewing only the images of each homepage. Acting in this manner, we avoided the companies' websites updating, if occurring, and thus, maintain the consistency of the study.

Subsequently, the participants received the post-experimental questionnaire about the previously assessed web pages and demographic information, including their internet experience, age and gender was gathered.

After completing the questionnaire, participants received a one-day pass, worth 25 euro, to a sport club, as an incentive.



Figure 1. Subjects websites assessment and eye monitoring

The heatmaps, the scanpaths and the graphical elements has showed that the group with a high level of interactivity (dicamen.ro and cellgsm.ro) have obtained the best results concerning their efficiency and effectiveness. These websites have obtained the shortest duration from the stimuli displaying to the first fixation,

including animation elements (0.30s), and without reaching 1 fixation and with a maximum number of subjects who had fixations (34). The results have also showed that this group have obtained a normal path of the eye trajectory, without excessively loaded areas, without a high level of cognitive processing, which would indicate the users' misunderstanding of the content. Moreover, all the subjects have identified the fastest the areas of interest for task accomplishment, in comparison with the other websites.

After the factorial analysis of the correspondences, using the SPSS Statistics 17.0, it was obtained the following results:

The statistical χ^2 test result indicated that (Sig.=0,010)<0,05. In order to highlight these correlations, the results of the factorial correspondence analysis indicated that the websites from the group with the high level of interactivity were chosen by the subjects to buy the mobile phone. They were the most closed to the origin of the axes.

The graphical representations suggest that:

1. The websites which were the most closed to the origin are dicamen.ro and cellgsm.ro. This result shows that the websites chosen by the subjects for a future buying are dicamen.ro and cellgsm.ro.

2. Moreover, Figure 4 indicate that the interactivity levels are given to dicamen.ro website are the most closed both to the graphical representation of it, but also

to the centre of the axes. This means that this website is considered interactive and very interactive and represents one of the websites the subjects have chosen to buy.

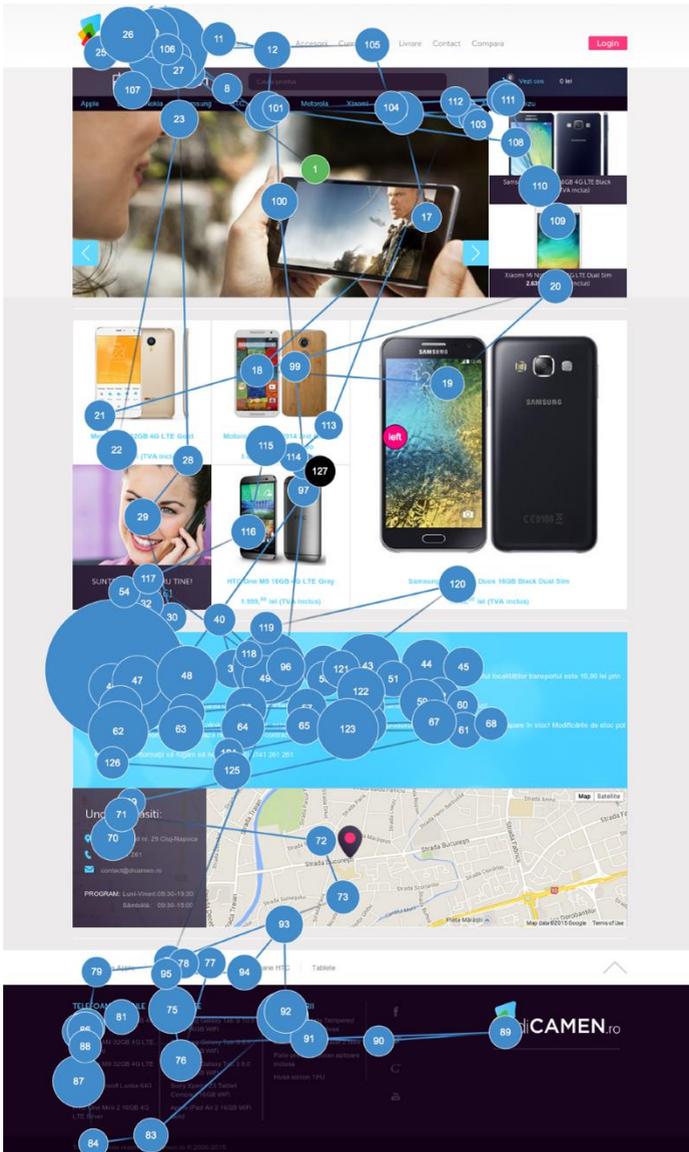


Figure 2. Scanpaths-dicamen.ro

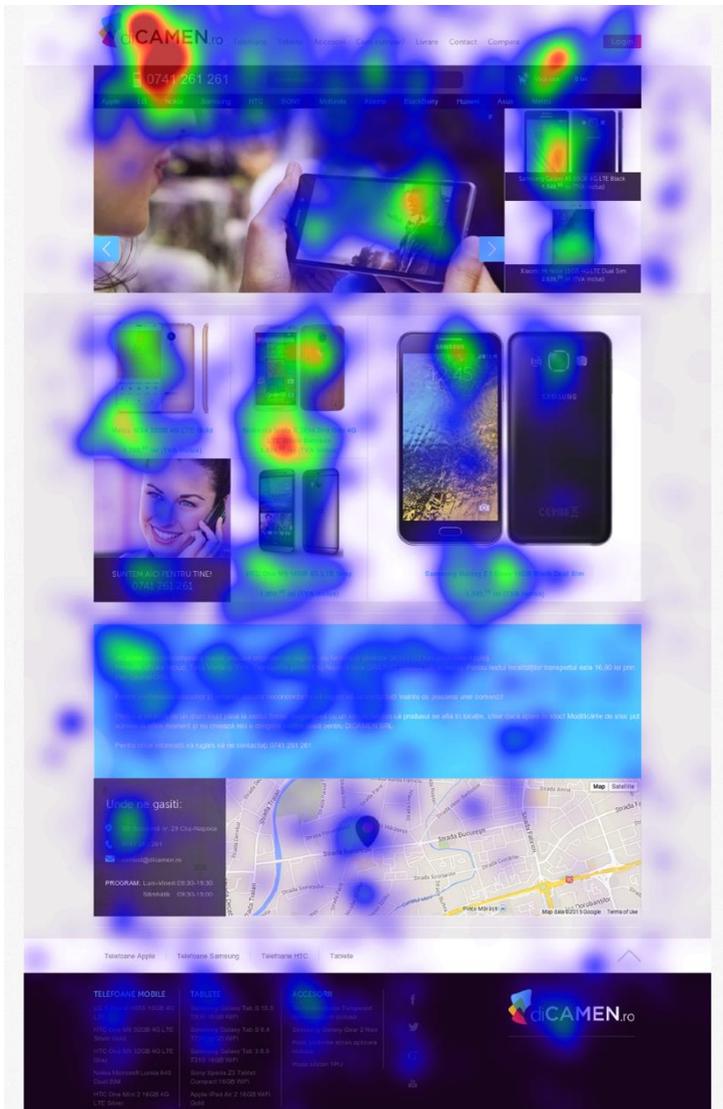


Figure 3. Heatmaps-dicamen.ro

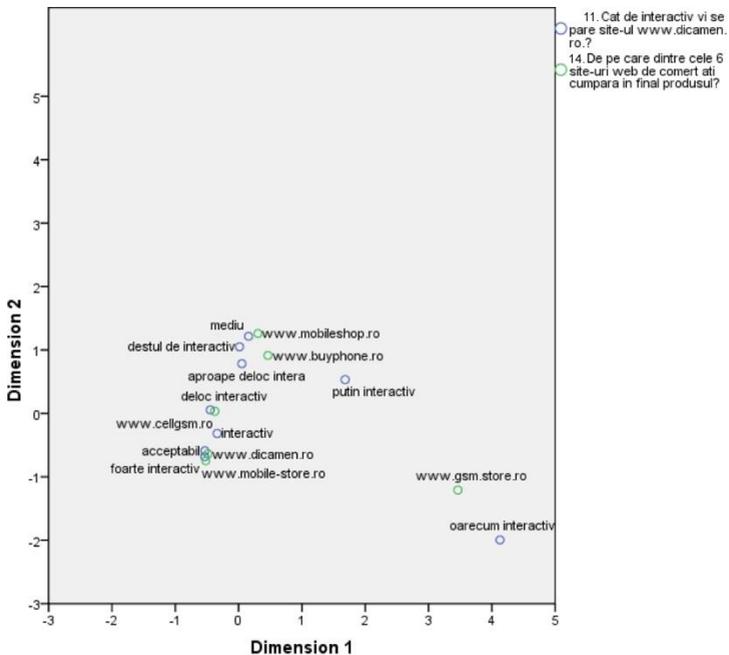


Figure 4. The representation of the variables on the first two factorial axes (Source: SPSS)

The statistical analysis revealed a positive attitude of the subjects towards the websites from the group with a high level of interactivity.

Concerning the compatibility between the written report and the eye-tracker recordings, it was observed both correspondences and differences:

- The eye-tracker recordings revealed that the logo area was the most fixated. This suggests that the subjects have given the most attention. Contrary to this result, the answers from the post-experimental

questionnaire offer a different result. According to the written reporting, the logo had a very little influence on them (44.4% of respondents) and little influence (16.7%).

- One of the questions which checked the subjects' answers targeted the phones' brands identification of those interested. In this situation, the written report is fitting with the eye-tracking recordings, the most searched phones were Samsung (36.1%), HTC (16.7%).

Concerning the hypotheses, the results indicated that all of them were confirmed.

Conclusions

The present study has an important contribution to the literature and to the research projects, the implementation and design of the commerce websites. The main contribution of this paper, from a theoretical point of view, is that it identifies the main websites interactivity's dimensions and to connect them with the theories and models used in the users' behavior analysis. The paper also gathers the main theories of the authors who wrote on this field of interest and who had a contribution to the developing of the interactivity construct.

Taking into account the actual market characteristics from Romania, the commerce websites distinctiveness and the growing tendencies of commerce websites, the

paper introduces and adapts the proper measuring scales which targets the users' attitude identification towards the interactivity dimensions included in the analysis.

Moreover, the paper contributes to the literature development through the fact that it gathers the most important theories concerning the Eye-Tracking methodology.

On the other side, the empirical study, which was a preliminary one, has proposed a qualitative approach which aimed to shape a holistic image of the interactivity construct and its dimensions. This phase targeted the second objective of the study which propped the identification of the experts' perceptions from the Information Technology field on the interactivity's dimensions.

The study has succeeded to collect data which refers to the experts' personal experiences and their reporting concerning the the way in which the commerce websites implementation process takes place. The obtained data from this phase are important both for the well running of a future research and for the commerce websites implementation process.

The importance of the results obtained from the experts' interviews is justified by the fact that a huge significance is represented by their experiences and the way in which they understand the processes from the IT field. These aspects were extremely important in shaping a holistic image on the investigated construct in the

actual context. Moreover, the obtained results have established a factual approach, based on reality and identified from the process itself in which the interactivity is implemented.

Another contribution of this study consists in the fact that it succeeded to adapt a model of interactivity index measurement, useful in the assessment of the commerce websites' interactivity level.

The present paper has succeeded to offer, from a methodological point of view, a proper and useful technique when assessing the websites' usability. The study used one of the newest technologies in the marketing field in order to identify the most appealing areas of ecommerce websites and thus, to identify patterns and actions which lead to the understanding of various behavioral types.

Moreover, the study has used the eye-tracking technology in complementarity with the investigation, by employing a post-experimental questionnaire, in order to identify new differences concerning the written report across the eye movements recordings.

The results are important to marketers, web designers in order to improve the users' navigational experiences. The identifies patterns and models could help emphasizing certain areas of the websites.

Finally, the paper reveals once more the positive effects of a high level of interactivity on websites

content comprehension and more, on a favorable attitude towards them.

Limitations and further research

This study investigated only the Generation Y. Future papers could investigate different segments of the market with different levels of web experience from our country.

An important limitation consists in assessing only five interactivity dimensions, each of them including five factors. Further studies could investigate a larger number of factors. Moreover, in our analysis was excluded some design elements.

The analysis was limited only to the commerce websites which targeted mobile phones technology. We analysed only six websites.

The eye tracking device represents a limitation, concerning the fact that the subjects were aware that their activities on the websites are traced by a camera. Moreover, the universities laboratories do not represent their natural environment of buying a personal product.

We used the Eye Proof Analytics in order to collect data, which was in Beta version. For this reason, we could gather only a limited number of indicators.

Further studies could imply other devices, complementarily with the neuro imagistic instruments, such as electroencephalogram (EEG) or the magnetic resonance imagistic (RMN).