Emerging Trends and Novel Approaches in Interaction Design

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Abstract—**This paper presents an outline of novel approaches and emerging trends related to Human-Computer Interaction (HCI). These trends have been present in the MIDI 2017 conference organized within FedCSIS series. In particular on-line services and mobile applications, often operated by voice-based interfaces and voice-driven assistants, are special areas of interest as to their prospective developments. Also the use of Artificial Intelligence (AI) in user interfaces seems to offer a breakthrough towards more intuitive and error-tolerant interaction needed especially in the most common, mobile context of use.**

Index Terms—**Human-Computer Interaction, Interaction Design, Usability & User Interface, User Experience.**

RECENT developments in Information Technology (IT) create new opportunities for creating new user-system interaction techniques. As a result, nowadays we are witnessing a remarkable shift in research and practice of Human-Computer Interaction (HCI).

Traditionally, the domain of HCI has dealt with optimizing user interfaces and developing new interaction styles. Historically, the humans were first placed as trained operators of computer systems dedicated to serving narrowly-defined domains like accounting, manufacturing or process control. With the introduction of Personal Computers (PCs) in the 1980s, the human has become not only a software user, but also an important stakeholder in IT projects. This shift has led to developing User-Centered Design (UCD) approach, very popular in contemporary IT projects. Most recently, availability of wireless networks and handheld devices (especially smartphones) caused that mobile applications and on-line services have become a natural part of everyday life. Ultimately, in IT projects today the human is not only a target user, but also a consumer who decides for instance which payment plan to choose or when to terminate the subscription (often caused by switching to more attractive offer from another vendor).

From a technical viewpoint, developing and launching a mobile app or website is relatively easy, but the competition is usually strong and users have a wide choice of similar solutions on-line. In such conditions the real problem is how to attract attention of potential customers and how to gain their loyalty. These are the central questions of on-line relationship marketing and on-line branding – areas not present in IT development until very recently.

As a result, currently e-customers often treat IT systems (especially mobile applications and on-line services) as *service solutions*, which help to solve practical problems (like shopping, reservations, navigation etc.) or to improve individual lifestyle (for instance in areas related to fitness, wellbeing, ecology, safety, health, child care etc.). E-customers remain loyal to specific on-line services as long they satisfy their expectations, resulting from everyday context of use (related to specific problem to be solved – what, when and where) as well as from their current lifestyle, or even fashion. E-customers' loyalty to a specific service or app no longer results merely from adequate functionality, decent usability and aesthetic look of an app [11]; now it primarily results from cumulated, constantly positive User Experience (Customer Experience), making a given app or service someone's preferred choice.

Nowadays user interface still remains an essential part of an IT product, but now it is less a technical component, instead more addressing emotional, behavioral, economical, or lifestyle-related needs. However, the contents of recent IT projects has also changed a lot: now the focus is no longer a computer system, but a specific *service* aimed to generate revenues. In addition to the technical part (now often outsourced to subcontractors), today's IT projects often address issues such as on-line relationship marketing strategy, appropriate business model, ethnographical studies, creative design and innovation development. The term "creative projects" is now often related to IT projects, and teamwork creativity (often stimulated by Design Thinking techniques [9, 10]) is expected to produce solutions which will not only attract a customer, but will make him/her loyal to a specific service brand or vendor for a long time.

In the timespan of a recent decade, these trends have changed the role of HCI in IT projects, while new interaction technologies have open new opportunities to deliver on-line services and solutions not even imagined in the past. Also the popularity of IT design paradigms such as SOA (Software Oriented Architecture) or SaaS (Software as a Service), especially attractive among business users, made

IT applications generally perceived *as services*, while ease of use and positive User Experience remain critical requirements enabling their practical use.

As a result of these developments, regarding the current role of interaction design in IT projects we are now facing some novel research problems, for instance:

- developing new methods for providing not only high usability of interactive systems, but also valuable User/Customer Experience over a long time;
- delivering consistency among mobile websites and mobile applications, because users often use several handheld devices to access their favorite on-line services;
- developing effective methods for designing interfaces for small screens, because mobile context of use becomes prevalent for users in everyday life and in business activity;
- rapid development of low-cost Augmented- and Virtual Reality (AR/VR) interfaces soon will change the way how users will be interacting with reality-based objects;
- balancing rapid prototyping techniques, widely used in agile design, with standardization and patterns which enabled easy operation of multiple devices because users were able to utilize previously acquired knowledge and skills;
- fast proliferation of social interfaces, often used in mobile context, changing what used to be Human-Computer-Interaction (HCI) more towards computer-mediated Human-Human Interaction (HHI), with all its benefits but also with quickly emerging serious risks;
- building safety, security and trust, as preconditions of positive User Experience, how they should be developed in design of an IT product/service and how they should be communicated to users/consumers.

These issues – and many others – have been in the focus of MIDI (Multimedia, Interaction, Design and Innovation) Conferences, organized since 2013. Last year's MIDI [2] held for the first time within the FedCSIS series also highlights a number of topics related to a main stream as well as to niche research agendas as follows. User experience issues, accessibility and user interface design were presented by [12][13][14][16][17][18][20][21][23][24] yet different papers put those issues in different context of programming, game design, crowdsourcing or visually impaired people just to name a few. On the other hand some other paper stated questions about affective design, applications fro supporting the ongoing therapy or pervasive robot assistants [15][19][22][25].

The MIDI 2017 Conference aims to cover at least some of issues shaping current trends in designing interactions between users/customers and interactive content or services. As usually, also papers included in this MIDI 2017 volume are expected to spark stimulating discussions on the crossroads of multimedia, interaction, design and innovation - as the conference name tells.

Submissions collected in this volume have been divided into following sections, roughly covering:

- Education Systems - interaction design for educational applications [26][27];
- General HCI – various interaction design aspects, from technical to aesthetic ones [28][29][30][31][32][33][34];
- Graphics/Speech – including multimodal user interfaces, present in everyday use, gaming, entertainment or teamwork applications [35][37].

Among latest trends and developments listed above, especially distinct is the advent of digital voice-driven assistants, especially in home and mobile environments. They allow for natural, spoken communication between the user and a computer system, thus providing much more natural interaction style than user interfaces that had been used so far.

As mentioned by many recent references (eg. [3], [4], [5]) one of the latest HCI challenges is the application of Artificial Intelligence (AI), especially voice driven assistants. There are a lot of new advancements here – ranging from enabling technologies up to entire ecosystems of applications. In July 2017 Amazon's Alexa passes 15000 skills (applications defining dialog domains) growing rapidly in one year and its competitors like Google Home or Siri are not far behind. Smart home assistants may control home appliances and are useful in everyday duties. However, preparation of voice interface isn't simple, even with supporting tools [6] and mixed-initiative dialog needs a lot of preparatory work and good knowledge of voice dialog rules. Here HCI specialist may help easing the task of dialog preparation.

We may expect, that definitions and models created for voice interaction with assistants like Alexa or Siri will influence the shape of interaction in a future. Standards for how we interact with voice assistants will emerge in the same way as it happened with web browsing and common icons, forms, and gesture styles used across the app market [7].

Nowadays yet another challenge emerges: as shown also at MIDI conference there are clear trends in computer vision and AI: image classification, scene and object recognition, game play learning, image and video question answering. Visual Dialog is a novel task that requires an AI agent to hold a meaningful dialog with humans in natural language about visual content. Specifically, given an image, a dialog history, and a follow-up question the agent has to answer the question in natural language [8]. This opened new potential applications to support visually impaired users and social human-computer interactions. However, how shape such a dialog is still unclear, but first attempts are already underway.

In comparison to previous editions of MIDI [1, 2] this year, in addition to voice interfaces and speech synthesis, some novel topics have been reflected in submitted contributions, to name a few:

- deep learning for style search engine, which combines state-of-the-art visual object recognition and text queries to find furniture in suitable style and aesthetics,

- rapid VR, graphics, pose and location estimation, which allows for realistic cloth simulation on mobile devices, precise head pose estimation, use of VR in fire safety education, multimodal multi-device ecologies exploration;
- digital heritage, thanatosensitivity, for interaction with digital memorials.

A wide spectrum of other papers presented at the conference indicates how vital is the extended understanding of HCI for the modern IT. MIDI proceedings also address the timely challenges produced by the emergence of mobile computing as the most common interaction paradigm. In many papers interaction design is now considered as an important factor facilitating users' attitude to the interactive product, and shaping its attractiveness. This extended perspective opens an interesting research agenda, for reaching beyond traditional understanding of human-computer interaction, and also for treating interactive systems not only as engineering solutions, but also as services aimed to solve a specific user's problem. We believe that contributions in this area are particularly relevant as making sure that the abundance of data generated by computational artifacts around us used effectively is bound to be crucial in deterring how our lives will look in the near future.

We hope that these proceedings present a good record of the MIDI 2017 conference and will be a valuable resource for researchers in the vibrant interdisciplinary field of interaction design.

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