An empirical investigation of the influence of persona with personality traits on conceptual design

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ABSTRACT

Persona, an archetypical user, is increasingly becoming a popular tool for Software Engineers to design and communicate with stakeholders. A persona is a representative of a class of end users of a product or service. However, the majority of personas presented in the literature do not take into consideration that the personality of users affects the way they interact with a product or service. This study empirically explores variations in conceptual design based on the personality of a persona. We carried out two studies in Australia and one study in Denmark. We presented four personas with different personalities to 91 participants who collectively completed 218 design artifacts. The results from the studies indicate that the participants' views and prioritization of the needs and system requirements were influenced by the personality traits of the provided personas. For an introverted and emotionally unstable personality, inclusion of confidence building and socializer design features had a higher priority compared with the identified requirements for an extravert and emotionally stable personality. The findings support the proposition that personas with personality traits can aid software engineers to produce conceptual designs tailored to the needs of specific personalities.

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1. Introduction

Products that cannot meet the needs of end users are not only unusable but they affect the economy (Goldberg et al., 2011). Based on three generations of software development at Intel Corporation, Terzakis (2013) reported that the quality of the software increased due to better requirements definition and management even though the second and third generations of software were more complex. Based on the experiences from several industrial projects, Kujala (2008) found that users' involvement during the early parts of projects improves the effectiveness and quality of software products. The close interactions between a system and its users require designers to be more involved in the thinking and emotional lives of a system's users (Miller et al., 2015). In some cases, such as e-health, end users may not be available to software engineers due to the sensitive nature of data about the patients' condition (Anvari and Tran, 2014; Jay et al., 2012) or in the case of mass-user products there can be wide varieties of end users (Aoyama, 2007; Hjalmarsson et al., 2015).

Given these types of constraints, software development professionals may need to resort to alternative means of determining the needs of users and performing high-level conceptual design. One alternative is the use of personas. A persona, defined as an archetypical user of a product or service, is a tool within the User-Centered Design methodology. The use of personas is gaining significant adoption as a supplement or an alternative to end users' direct involvement in the Systems Development Lifecycle (SDLC), (Gould and Atkin, 2015).

Each persona incorporates a number of scenarios that describe interactions that the persona can have with an application to achieve a goal (Adlin and Pruitt, 2010; Goodwin, 2009). However, persona and scenario methods have known shortcomings (Gudjonsdottir, 2010). Matthews et al. (2012) found that designers do not use personas as they find personas to be abstract, impersonal, misleading and distracting. To make personas more closely resemble end users, Anvari and Tran (2013) proposed Holistic Personas; personas that have five dimensions: Factual, Personality, Intelligence, Knowledge and Cognitive Process. To evaluate the effectiveness of Holistic Personas for determining the needs of users

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and supporting conceptual design, we have designed and conducted a set of empirical studies aimed at determining and understanding whether or not the interactions between designers and personas with personality traits lead to variations in conceptual design due to the personality dimension of the Holistic Personas.

The rest of the paper is structured as follows, after a review of related work we present the research question and methodology, results, discussion and conclusions.

2. Related work

2.1. Creativity and conceptual design

Essential characteristics of creative products include novelty, value and surprising-ness (Nguyen and Shanks, 2009). Surprisingness is an impact of the unusualness and unexpectedness of a product (Jackson and Messick, 1965). Plucker et al. (2004, p. 156), based on an analysis of articles examining creativity in a number of peer reviewed journals, defined creativity as 'the interplay between ability and process by which an individual or group produces an outcome or product that is both novel and useful as defined within some social context' . Creativity is not a homogeneous concept and can, for example, be considered to have two types: Historical creativity, H type creativity, where the work is new historically, Personal type creativity, P type creativity, where the work is new for the creator but it has already been produced before (Boden, 2009; Howard et al., 2008).

Some studies of the design process have proposed dividing creative design into separate, synonymously named, phases or segments (Akin and Lin, 1995; Howard et al., 2008): problem understanding, design and retrospection. The design phase itself can be further divided into three sub-segments: conception, development and representation (Akin and Lin, 1995). Based on a literature review, Finger and Dixon (1989a) presented a summary of the canonical design process, which has segments similar to the above processes: recognition of need, specification of requirements, concept formulation, concept selection, embodiment of design details and production, sales, and maintenance. Finger and Dixon (1989a) also presented a prescriptive model of design where the process concentrates on attributes that the designed artifacts should have rather than the processes employed to generate the design. The design process need to have goals and requirements, identifying desired structural and behavioral properties of the design artifact (Ralph and Wand, 2009). Finger and Dixon (1989b) in defining feature-based design affirm that researchers do not agree on a definition of a feature but indicate that it is an abstraction of lower-level design information.

Many researchers agree that the most important and influential phase of design is the conceptual design phase in which the behavior of a system is formed (Christiaans and Almendra, 2010; Norman, 1986). Yu (1997) provided a framework for graphically modeling and analyzing the early phase of the design – 'the "whys" that underlie system requirements' (Yu, 1997, p. 226). Maiden et al. (2010) suggested that creative problem solving is part of requirements engineering and tools of creative problem solving (e.g., creative workshops) can be recruited to assist in framing the system requirements. Evbuomwan et al. (1996) defined design as transforming the requirements, which are based on human needs, into performance specifications and converting them into design solutions. Haan (2013) described an approach to teaching 'Human Centred Creative Technology' in which students are encouraged to think creatively, focus on users and be mindful that technology is changing rapidly. Haan (2015, p. 1) defined design as: 'prototyping, feature-driven and an iterative/incremental activity, with a highly flexible and exploratory approach'. In a literature review of product development, Krishnan and Ulrich (2001) have noted that

product attributes, an abstraction of a product, are synonymous with customers' needs such as customer attributes or customer requirements and product specifications such as engineering characteristics. Griffin and Hauser (1993) examined data from twenty-five US corporations who adopted Quality Function Deployment (QFD), a process that incorporates customers input into product or service development. They found that communication improves when customer needs, i.e., descriptions of the benefits of the product in customer's words, are linked to engineering, management, and research and development decisions; hence, product design attributes and engineering measures of product performance are in accordance with customers' needs. A function of QFD is to organize customers' needs into a hierarchy and the strategic direction for the product or service are set based on the primary needs of customers (Griffin and Hauser, 1993). On the other hand, proposing novel requirements that customers have not previously considered, can lead to innovative products (Robertson, 2002) e.g., the mobile phone, Post it notes, and eBay. Mohanani et al. (2014) used the term desiderata to cover something "wanting, required or desired – mandatory or optional", and then looked at the effect of presenting these alternatively as requirements or as user stories or case narratives to indicate what might be desirable. In an experiment Mohanani et al. (2014) demonstrated that presentation of system desiderata as ideas resulted in more creative design compared with its presentation as requirements.

In summary a design artifact has 'attributes' matching users' needs. The attributes are synonymously referred to as attributes, needs, features, requirements, and goals. In this paper, we refer to the attributes of an application as design features. As this paper does not elaborate on stages of design, we use the term design synonymously with conceptual design, to refer to the conceptual (initial or high level) design stage.

2.2. Persona and its use in design of application

Software applications or products that are to be used by people have to be designed with the needs of the users in mind. To meet users' goals, Norman and Draper (1986) proposed User-Centered Design (UCD) methodology. A persona, an archetypical user and fictional character that represents a typical user of a system (Cooper, 2004), is a tool within UCD methodologies. According to Cooper (2004), a persona consists of a name, a picture or illustration and a short narrative. Personas are used to design a software application or product and complement other quantitative and qualitative methods (Cooper, 2004; LeRouge et al., 2013; Pruitt and Grudin, 2003; Rosson and Carroll, 2009). Scenarios are the actions carried out by personas interacting with a system to achieve goals (Goodwin, 2009, p.11).

The use of personas in the design of applications is well established in the software industry (Miaskiewicz and Kozar, 2011). Miaskiewicz and Kozar (2011) surveyed experts and solicited their opinions about usefulness of persona during design activities. They identified and listed a range of benefits in employing personas during design activities. Hjalmarsson et al. (2015) used persona in the UCD of web-based e-services for a bus company. Their analysis of the data showed that the design confirmed the theoretical benefits as listed by Miaskiewicz and Kozar (2011).

Guo et al. (2011) outlined their experience with authoring personas to explore users' needs and behavior and in using personas in the design and development of e-commerce applications. Nielsen et al. (2015) conducted a survey of the literature and analyzed recommendations from 11 templates for development of personas as well as investigating the development of 47 personas by Danish companies. Nielsen et al. (2015) found that in Danish industries the development and use of personas is increasing through community of practice rather than based