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ABSTRACT

One trend that rivals and stands to potentially eclipse the transformational effect of the smartphone, is the rise of wearable computing devices (wearables). While wearables have received proliferated adoption in recent times, their uncommon form factor poses challenges to designers and many such devices fail to achieve sustained user engagement. Also, within the HCI stream of IS related research, there is a limited amount of studies that address theory inspired design of actual IT artifacts, or address the ubiquitous context of technology use. To address these issues, we adopt an action design research approach and using the smartwatch context, we develop a theory inspired set of design principles that inform the process of wearable interface design.

Wearables are a class of miniaturized electronic devices worn by the bearer on top of or beneath their clothing and make up an important segment of the growing Internet of Things. Generally, they possess 3 main components – hardware sensors that enable them observe their physical environments, built-in processors to analyze observations, and communication modules to relay information to other machines (Atzori, Iera, & Morabito, 2010) . On one hand, while the hype and adoption of wearables appears to be steadily increasing, existing findings point at the existence of sustained engagement. A survey of 6,223 US adults showed that 10% of respondents owned a wearable, 50% discontinued the use of their devices and a third of this number stopped using the device within six months (Ledger & Daniel, 2014). Given that the interface design of technology artifacts has been linked to usage behavior (Van der Heijden, 2003; Zhang & Li, 2005), this study aims to tackle the sustained engagement issues of wearables from the interface design perspective. Our argument for a new design framework is hinged on the understanding that unique characteristics of these devices (ubiquity, sensing capabilities, and input/output channels) necessitate an idiosyncratic user experience design approach.

Action design research (ADR), as proposed by Sein et al. (2011), refers to an IS research approach that aims to explicitly recognize how interests, values, and assumptions about an organization or people shapes the design of IT artifacts. ADR is consistent with the dual mission of IS research regarding making sound theoretical contributions as well as developing solutions to problems faced by practitioners (Benbasat and Zmud 1999; Iivari 2002; Rosemann and Vessey 2008). ADR specifies a 4 stage research process and associated principles which is adopted in this research study. In so doing, we achieve two research objectives, namely: our activities are a design intervention with practical implications (helping developers design better user experiences) as well as a theoretical exercise (articulating and evaluating design principles to guide the development user interfaces for the emergent class of wearable computing devices).

To capture organizational influence, we set up an ADR team (Sein et al. 2011, p. 46) in which one of the researchers in this study worked closely with a developer team in creating 5 applications for the Gear 2 smartwatch. Our design framework is also influenced by external developer exchanges, user reports within observed lab sessions and online user reviews. The design decisions made in the project are influenced by three theoretical perspectives - an affective quality, social norms and utility accrual perspective. Our research setting is loosely modelled around the series of events, interactions and platforms associated with a software crowdsourcing contest held by Samsung Electronics (May–November 2014), inviting developers to submit apps for their recently released *Gear 2* line of smartwatch devices.

The primary contribution of this work, is a theoretically developed and evaluated framework that advises the design of user interfaces for wearable computing devices. In the current iteration, our chosen theoretical perspectives guide the derivation of six actionable design principles - *sensor based interaction, normative adherence, isolated functionality, complementary value, glanceability and computational offloading*. This study makes important progress in the front of making recommendations to industry. As opposed to conventional HCI research approaches which conduct usability or impact tests of existing UI models, this work provides the opportunity to adopt theory inspired and empirically tested ideals in building truly *novel* and *practical* UI models that are positioned for greater impact. Our study is also particularly timely because it provides opportunity to spur research discussions around the budding topic of wearable computing and its implications for both individuals and the enterprise.