



# The Impacts of the Cascading Style Sheet Standard on Mobile Computing

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## ABSTRACT

*By design, mobile computing aims to support numerous expressions of varying interfaces, contexts, and automation. Thus, as mobile computing becomes more prevalent, it is important that designers build systems in support of as many as possible unique, in-use, and user-defined characteristics. We explore these requirements and propose to support them with two existing standardized technologies: Hypertext Markup Language (HTML) and cascading style sheets (CSS). Whereas we investigate the impact of the CSS standard in the context of computing in general and mobile computing in particular, we also focus on two emerging roles of this standard: device independence and usability. Our findings suggest that the application of the CSS standard can improve data delivery across independent devices with varied bandwidth and resource availability, thereby providing device independence and improved usability, respectively. We demonstrate that through their effect on device independence and usability, CSS plays an important role in the evolution, expansion, and openness of mobile computing.*

*Keywords: cascading style sheets; computing; hypertext; mobile computing; standards*

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## INTRODUCTION

In our effort to understand technology, to propose its potential value, and to anticipate its use, we often find that information systems, especially those used in

mobile computing, represent an ad hoc collection of data, services, and devices that have been created and recreated by users on an as-needed basis. It is difficult for designers to predict exactly how applica-

tions will be used in mobile computing, because it is the user who ultimately defines on the fly what applications and configurations are used in which contexts. As mobile computing becomes more prevalent, it is important that designers build systems that support these unique, in-use, and user-defined characteristics. This research aims to extend our knowledge about how designers can use standardized interface design to aid and improve mobile computing.

Mobile computing has gained increasing importance as systems and devices continue to move toward an assemblage of distributed Internet-based services that support the exchange and sharing of data and processes. Technologies such as cellular telephones, personal digital assistants, and Web portals are used daily in mobile computing. These technologies allow for user expressiveness or customization around such issues as computing style, program preferences, and aesthetic layout (Pask, 1971). Therefore, mobile computing implies a dynamic environment that supports a vast array of varying interfaces, contexts, and automation (Abowd & Mynatt, 2000; Gabriel, 2002). In this article, we explore the expressiveness within computing in general and mobile computing in particular, and propose ways to use existing technology standards to enhance this characteristic.

Many dimensions describe mobile computing, including the convergence of technologies, the relinquishment of personal data for the receipt of particular services, and the blurring boundaries between physical and virtual spaces (Abowd & Mynatt, 2000). We investigate and propose solutions for achieving two aspects of mobile computing: device independence and usability (Lum & Lau, 2002). Device independence is the separation of data and pre-

sentation in support of the movement of data between technologies and heterogeneous computing systems. Device independence describes any data-device relationship that is capable of being replaced without affecting data, services, workflow, or personal computing style. Device independence provides users access to the same data when the data are unbound from a particular device, irrespective of the device from which the request originates. Whether passing data between devices or across new versions of the same devices, mobile computing and its support of user-designed expressive systems require that we consider device independence.

Usability refers to issues such as the delivery of data to a variety of devices with unpredictable screen sizes and technological capabilities as well as the rapid delivery of data over heterogeneous networks. We contend that usability is a user-centered issue that affects the success of computing in general and mobile computing in particular. Shneiderman (2000) argues that usability has become an important issue for computing research. In particular, he suggests that broad technical variety has a direct impact on usability and that speed in the distribution of data across devices must be considered. With that, we explore usability in the context of the technical variety available within mobile computing through three measures of computing and network efficiency.

We use published design standards (CSS and HTML) and their ability to separate requested data and its presentation to both achieve device independence and improve usability. Accessing and using the same data regardless of platform on a PDA, a laptop, and a telephone demands the separation of data and presentation, and we need only to revisit existing and emerg-

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