

# Context in Computing

Patrick Brézillon • Avelino J. Gonzalez  
Editors

# Context in Computing

A Cross-Disciplinary Approach  
for Modeling the Real World

Foreword by George A. Papadopoulos

 Springer

*Editors*

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# Foreword

The dimension of context has played an important role in many disciplines, such as Psychology, Philosophy, Sociology, Medicine and, indeed, Computer Science. In the latter, it has found applicability in many areas of contemporary Computer Science research, such as HCI, CSCW, Ubiquitous, Mobile or Distributed Systems, etc.

It is unavoidable and understandable that such a well researched, interdisciplinary and multidisciplinary notion has generated many definitions, based on what someone considers as being the most important facets of context. Probably the most acceptable definition is that by Dey (2001):

Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.

The nature of context can be, for example, spatial (location, orientation or speed), temporal (date, time or season), environmental (temperature, light, noise), and social (people and their activities). It can have direct applicability to Computer Systems, such as context related to computation or network resources. It can also be of a different nature, such as physiological (blood pressure, body temperature or heart rate) and psychological (emotions, or preferences). Often context is being understood as being internal in nature and captured from a user's interaction activity (e.g. user's goals or emotions) or external and measured by sensors (e.g. location, light, or sound).

As a consequence of the involvement of context we have the so-called context aware systems. Dey (2001) gives the following definition:

A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task.

Here it is worth pointing out that there is an ongoing debate as to whether a context-aware system is sufficient to simply record and use context or whether it should also be able to adapt itself to context (Ferreira and Alves 2014). In any case, a context-aware system will typically be able to present information to users augmented with contextual information, execute services based on the current context or associate digital data with the user's context.

Context-awareness is closely related to the vision of ubiquitous computing, as described by Weiser, who advocated a world where computing is available anywhere, anytime and for everybody but in such a way that computers themselves are « hidden » in the background and go unnoticed by the users. Other similar notions related to context and context-awareness are pervasive computing, proactive computing, adaptive computing and ambient intelligence.

There has been much research in context and context aware systems (see for instance the survey paper by Hong et al. 2009). However, this research area remains very active in the general field of Computer Science, due to recent developments in Advanced Software Engineering, Cloud and Service Oriented Computing, Intelligent Systems, CSCW and Social Computing. Consequently, this volume presents a contemporary view of state-of-the-art interdisciplinary and multidisciplinary research in many aspects of context-based systems. I therefore applaud the editors Patrick Brézillon and Avelino J. Gonzalez for having assembled and organized a number of high quality and divergent in topic papers, into this very exciting volume that promises to deliver to the readers a broad view of how context is used in computing.

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# Preface by the Editors

The word *context* is used commonly in our vernacular. It is a concept that cuts across all the domains, cultures and languages. Context and our recognition of it have served to make communication among us efficient. Context, furthermore, can define expected behavior while one is in a particular context, as well as provide expectations of what may or may not happen. On the other hand, the absence of a shared or commonly accepted context between communicants can often lead to misunderstandings. For example, in the case of a person arriving on the first day of a new position with a new company, it is expected that he/she have the appropriate professional background to carry out the assigned duties. However, also important is that the person soon learns the corporate culture (i.e., strictly hierarchical, open communication, etc.) as well as the implicit social rules of the company, such as having a daily coffee break with colleagues, participating in golf or bowling leagues, after work happy hour, etc. Not understanding this social context can often make it difficult to carry out duties in spite of having professional competence.

Nevertheless, as familiar as the concept of context is to us, there is no single theory of context that crosses domains and applications. This is actually a good thing, as it allows each of us to define context in a way that best serves our specific real world application. This book illustrates the richness of this concept, and we hope takes us further towards the goal of using context as a modeling tool for a wider range of human activities. However, the concept of context as a modeling tool has not been well understood by the larger computing research community. It has not been extensively used possibly because the nature of context is continually misrepresented with respect to knowledge and reasoning. For example, in knowledge management, context is either (a) ignored, or (b) related strictly to “management”, but practically never associated with knowledge. Context depends on the *focus* of an *actor* (one who experiences the context). That is, a piece of knowledge at one step may become a contextual element in a subsequent step. Nevertheless, the encouraging news for us who work with context is that the concept of context has been increasingly found in the computing research literature over the last several years. Context has been lately used to great advantage in computing, especially when human knowledge and/or behavior are to be modeled, represented and exercised. This may be because, while it may be hard to define, we can instantly recognize a context when we see it. Context has been associated

with data, information, knowledge and reasoning, as well as in the fields of cognitive science and linguistics. More practically, context has been applied to managing data (*context awareness*), managing information (*context sensitivity*), managing knowledge (*contextual knowledge*), representing tactical agent behavior (*context driven*), intelligent reasoning (*context-based*), decision support, machine learning, and dialogue management for virtual humans, as well as for several other things.

As longtime friends, co-authors in several publications and now co-editors, our vision for this edited volume was to create, along with our outstanding contributing authors, what we hope will be the defining work in the field of context and computing. This field of research is relatively young (20–30 years), and encompasses many different and rich points of view. The volume compiles and describes the ideas, concepts, technology and research from the leaders in this field. The fundamental theme of this volume is how context has been and can be used in computing to model human behaviors, actions and communications as well as manage data and knowledge. This contributed volume, therefore, provides a broad as well as deep treatment of context in computing as well as in related areas that depend heavily on computing (e.g., cognitive science, medicine, engineering, law and many others). Its coverage is broad because of its cross-disciplinary nature and deep because each chapter treats its topic in sufficient depth to permit a reader to implement context in his/her computational endeavors. We hope it will be the defining work on context for computing.

The process used to invite, review the contributions, and publish what we have here now has been a long and effortful process, both on our parts as well as that of the contributing authors. We had conceived a proposed table of contents and published it at the outset of our effort to create this book. This began during the summer of 2013 when we requested two-page extended abstracts from our well known colleagues as well as several newly known ones. We asked our potential contributors to select a topic and address it in their extended abstracts. However, we also accepted abstracts from others who chose to focus on related topics that were not in the published ToC. As long as the topics described in these two pages were in line with our vision for the book, we accepted them and requested full-length manuscripts from the authors, offering some feedback as to how best direct their contributions to be in line with the objectives of this book.

Nearly six months later (February 2014), the full-length submissions were received. Each proposed contribution was carefully reviewed by us as well as by two outside reviewers. Many of the contributors served as reviewers and for that, we thank them. Their comments resulted in improved papers all throughout.

After receiving the comments by the reviewers as well as our own documented comments, we determined which of the submissions to accept and provided further feedback to the authors. Final manuscripts were received in late May and early June of 2014, which allowed us to meet the stringent deadline of July 15.

Lastly, the accepted papers you will see in this volume necessarily caused us to modify the table of contents to reflect the actual contents. In the Introduction (Chap. 1), we describe the classification of the contributions and the organization of the volume.

We thank the contributing authors for their participation in creation of this volume, both as authors as well as in many cases, reviewers. Without them, there would be no book. Secondly, we thank those other outside reviewers who, without compensation of any kind, agreed to help us in the review process and provided thoughtful and insightful reviews. Lastly, we thank the staff at Springer for making the publication process as easy as possible for us.

Finally, the wide applicability of context in the many disciplines makes it one of the most cross-disciplinary areas of research, especially in computing and all disciplines that depend on computing for critical support (i.e., a large number of domains, especially now with new personal communication technology growing at a rapid pace). It is exactly this usefulness and wide applicability of context that we hope that this volume emphasizes.



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