CRITICAL ASSESSMENT OF CUSTOMIZATION DISCOURSE
IN INFORMATION SYSTEMS DESIGN:

Conceptualizing the Meaning of Access and
the Emerging Relationships Between Learners and Information
Environments

by

Antonio Gamba Bari

A thesis submitted in conformity with the requirements
for the degree of Master of Information Studies
Faculty of Information
University of Toronto

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Abstract

Some argue that we live in an “information age”; others claim that we live in a “knowledge society”. This research suggests we live in an era of adaptable and customizable widgets in which users are no longer passive receivers of ad hoc technological solutions, but active agents controlling the behaviour, content modalities, and multiple technological layers transforming the representation and interpretation of information. This study adopts a critical perspective and examines the meaning of access to information and the pertinence of customization. Specifically, it analyzes how the ISO standard AccessForAll (ISO/IEC 24751, 2008) conceptualizes the customization of e-learning environments. A qualitative approach and discourse analysis are used as a methodological strategy. The research analyzes responses to ten interviews conducted with a diverse group of participants. This foundation provides for a discussion about the challenges of customization design and recommendations for the future development of adaptive and flexible learning environments.
Acknowledgements

When you have been convinced that emotion and reason are part of the situated and distributed nature of human endeavour – without attempting any analytical distinction here, of course – you get to the point where acknowledging the work and the passion of those very close friends and colleagues creating this Zone of Proximal Development can be quite a challenging task. Nonetheless, the commitment and the inspiration I received from this unconditional supporting network must not be unnoticed.

First and foremost, I want to thank my supervisor Stephen Hockema for his encouragement and his critical eye throughout this process. Steve’s generous time and critical advice helped me to come down from the abstract clouds of philosophical inquiry and at other times fly back to them. Thank you for listening to my “oracle-like” statements – for always questioning and enriching these speculations when I attempted to understand and present the profound and not so well-understood nature of communities and learning practices.

I want to thank Professor Jutta Treviranus, who accompanied this journey from the very beginning. Her work is a permanent inspiration, helping me understand the several dimensions and challenges that entailed in the design of “accessible” information technologies.

I thank Professor Eric Yu for his inquisitive questions. I would not have been able to discover the profound challenges nor the insights in Requirements Engineering if Eric had not asked me such sharp questions at the early stages of this research; creating links and constructive dialogues between the worlds of education and software development.

I am also indebted to my Second Reader, Professor Andrew Clement, for coming into this project at such critical moments. The nature, findings and tone of my research is inspired by his critical inquiry about the meaning and scope of Participatory Design. I am confident this project is only one of the future discussions yet to come.
I want to thank to my External Reader, Professor Marlene Scardamalia. Her tight schedules in the very last days of completion never prevented me from receiving her inspiration and comprehensive understandings. I thank her for inspiring my own understanding and for helping me to examine the nature of expertise and the many challenges yet to be addressed when developing information technologies that support the evolution and configuration of knowledge communities.

Finally, I want to express my most sincere thanks to my friend Elaina for her sleepless nights spent editing and proofreading. Elaina, your comments and inquisitive reading provided much more than a demand for clarification. In so many paragraphs, my Spanish biases and wordiness found a better English expression thanks to your patience and critical reading. Thank you for the enormous support and pushing me to examine the ethical and methodological challenges of my research.
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### Abbreviations and Acronyms

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<td>AfA</td>
<td>Access for All</td>
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<tr>
<td>AT</td>
<td>Assistive Technology</td>
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<td>CMS</td>
<td>Content Management Systems</td>
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<td>CSS</td>
<td>Cascading Style Sheets</td>
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<td>DRD</td>
<td>Digital Resource Descriptions</td>
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<td>ICT</td>
<td>Information and Communication Technologies</td>
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<td>ID</td>
<td>Inclusive Design</td>
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<td>IMS</td>
<td>IMS Global Learning Consortium</td>
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<td>IS</td>
<td>Information Systems</td>
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<td>JS</td>
<td>JavaScript</td>
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<td>LMS</td>
<td>Learning Management Systems</td>
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<td>Participatory Design</td>
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<td>PNP</td>
<td>Personal Needs and Preferences</td>
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<td>RE</td>
<td>Requirements Engineering</td>
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<td>UD</td>
<td>Universal Design</td>
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<td>WCAG</td>
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1. Introduction

“Must we think of thinking or memory as analogous to external activity or do devices play a certain role as a fulcrum giving support and help to the mental processes? What does this support consist of? What, in general, does it mean to be a means of thinking or memory?”

Lev Vygotsky, (1978, p. 61)

“Culture became the major factor in giving form to the minds of those living under its sway. A product of history rather than of nature, culture now became the world to which we had to adapt and the tool kit for doing so”

Jerome Bruner (1990, pp. 11-12)

“[…] it is a delicate matter to determine where the user ends and the tool begins!”

Andy Clark (1997, pp. 194)

Customization, personalization, and increased degrees of adaptation are becoming popular trends in the design of Information and Communication Technologies (ICT). It is now widely recognized that information resources have become not only extraordinarily valuable assets, but means for participation in society. In a variety of contexts, information technologies are indispensable for accessing strategic and vital resources; including education, health, government, entertainment and financial services. Some researchers refer to this information-intensive phenomenon as a new stage in human societies characterized by the rise of an “information age”, a “network society” (Castells, 1996), and the “knowledge economy” (Foray, 2006; Kahin, 2006). Whether we agree or not on what is particularly new or how knowledge and learning practices are conceptualized, the fact is that crucial resources and services are now dependent on the interaction with ICT.

In information-intensive societies, technological development becomes the centre of great expectations: from expectations of the generation of economic growth, to the innovation, creation and distribution of knowledge. Global investment trends from both public and private sectors, in information and communication infrastructures, and particularly in e-learning platforms, suggest that a competitive and skilled work force requires sustained and innovative educational environments (OECD, 2007). In the context of rapid technological development, it is evident that access to knowledge and information resources is key. As a result, the role of designers, developers and information professionals who develop and deliver these resources demands more attention than ever.

While ICT, as a crucial means for both social participation and cognitive development, are moving into the digital realm, designs of technology are not coincidentally moving towards high degrees of adaptation
and customization. Some argue that these “adaptations” are a new stage of the Internet: Web 2.0 technologies (O’Reilly, 2005). Current ICT provide unprecedented flexibility and adaptability. Web 2.0 is characterized by a qualitative shift from static to highly dynamic systems that increase user control over what and how information is presented and processed. This flexibility manifests in the ability to embed videos, images or digested news (e.g., RSS feeds) and transform the appearance of an entire website using CSS and JavaScript. Social networking sites (e.g., Facebook or MySpace), Instant Messaging Systems (e.g., MSN, Twitter) as well as a great amount of user-generated content (e.g., youtube, Flickr, P2P, or Wikipedia) are also additional examples of these highly flexible and customizable information environments.

An emerging phenomenon is evident; one which claims customization and personalized information delivery as one of its most pervasive themes. E-Learning, e-health, and e-government are only a few examples of this emerging discourse rapidly entering into the public sphere and everyday lives. The fact is, fulfilling customers’ needs has become a major concern in economic models and strategic business decisions. Nevertheless, addressing learner’s needs and preferences and fostering environments that can empower and facilitate opportunities for learning can be quite different matters. This study is motivated, in part, by this tension. In this study, I analyze the implementation of the ISO Standard AccessForAll (ISO/IEC 24751, 2008). This standard provides a common language for describing personal needs and preferences and information resources, so that personalized and customized information solutions can be delivered (described more in Chapter 4) – with particular attention paid to its implications for e-Learning environments.

1.1 Why Access to Information Matters: Beyond The “Digital Divide”

Differential access to ICT has social and economic implications. The “digital divide” is a phenomenon deserving careful attention. Defined originally as a sharp distinction between those who have access to information services and resources and those who do not, the digital divide entails several challenges regarding social justice, inclusion, equal access, empowerment, and opportunities for learning that stem from accessing information. The OECD provides an illuminating definition:

“The term ‘digital divide’ refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities. The digital divide reflects various differences among and within countries.” (p.5) [Emphasis added]

The OECD’s definition stresses that the gap manifests in differential access to and use of ICT, excluding some people from social and economic benefits. Furthermore, this definition indicates that access to the Internet constitutes a strong indicator of the opportunities available in different geographical locations.
The OECD’s definition of the “digital divide” does not formulate a simple gap; rather, it implies a more complex judgement about the benefits and services not available to non-members (e.g. non OECD countries). Let us take a look at the paragraph following this definition:

“The ability of individuals and businesses to take advantage of the Internet varies significantly across the OECD area as well as between OECD and non-member countries. Access to basic telecommunications infrastructures is fundamental to any consideration of the issue, as it precedes and is more widely available than access to and use of the Internet.” (OECD, 2001)

What is relevant in these statements is not the almost obvious fact that ICT are built upon existing “basic telecommunications infrastructures” and the lack of infrastructures indeed compromises the development of new information services and resources. Instead, what I want to highlight here is that the “digital divide” is a well-known and established discourse that has emerged as a predominant construct influencing policy-making and the design of everyday technologies (Stevenson, 2009; Gurstein, 2003). Nonetheless, both the value and meaning of access seem to go unquestioned not only in these paragraphs, but in many other academic publications. Whether we agree or not on what is new and innovative in information-intensive societies, the fact is that with the rapid development of technology as well as the diversity of contexts in which ICT are being introduced, the very notion of access to information has evolved into a much more complex phenomenon. This has occurred to such an extent that conceptualizing the challenges of access in binary terms – including “haves” and “have-nots” – tends to minimize and perhaps obscure attention to the complex interactions at stake. One of the complexities, for example, is whether the notion of access to information services and resources changes when technology enables high levels of customization. For example, what is that that we should grant access to when designing and delivering customized and personalized technologies and resources?

Addressing such questions is the major motivation of this research. This study aims to identify the practical and theoretical challenges that arise when designing technologies capable of delivering customizable resources and services. This study critically examines the meaning of access to information resources at a stage in which customization and adaptability have become predominant trends.

1.2 Why Customization Matters
In a broad sense, customization refers to the ability of a product or service to transform or adjust according to personal preferences and needs. This flexibility in IS design has become a common practice in numerous products and services. Indeed, a shift from “mass-production” to “mass-customization” (Grover & Ramanlal, 1999) has been for decades an emerging area of research in different fields such as economics and management. In particular, customization has become predominant in the design of large-scale and generic information technologies: from web browsers and word processors to social networking
platforms, and in content and learning management systems. Quite often, customization can be understood as a reaction to traditional methods in the field of information systems design (Ehn, 1988; Sutcliffe et. al, 2006), which in the past did not consider flexibility and adaptation as a source of value or a required principle for facilitating the evolving relationships between users and information technologies.

In the last four decades (or perhaps earlier), a growing body of research has placed particular emphasis on how the design of technology can be improved in order to respond to individual needs and changes in organizational settings (Jirotka & Goguen, 1994; Bowker & Star, 1999; Friesen, 2009). In order understand the implications of this shift in IS, several questions require further attention: for example, what does access to information resources mean when technological trends move toward mass-customization? To what extent does the design of information technology enable or constrain access? Do changes in individual abilities and/or in the context of use transform the notion of access itself? These questions are, in fact, quite challenging. This research focuses only on one particular aspect, the role of customization and personalization initiatives in the conceptualization of access to information.

1.3 Why Accessibility and Usability Studies Matter

If I do not have a computer or if my computer does not have access to the Internet, I will certainly not be able to use many crucial services and resources. But let us assume, for a moment, that I do have access to a computer as well as access to an Internet connection. The problems just begin here. What if I cannot read the text? What if I do not speak the language? What if I cannot hear or see? What if I cannot use a keyboard or a mouse? What if I am in a noisy place and cannot hear the videoconference? What if I am driving a car but I need to check my email? The examples in which a simple or binary notion of access is insufficient are endless.

The point here is that having access can mean quite different things depending on individual abilities and information modalities, as well as on the conditions of the information environment. This, particularly, is the research field of accessibility and usability studies. Its value comprises a serious and comprehensive examination of the meaning of access to information, as well as the assessment of the multiple factors mediating interaction with information technologies (Lewis, 2006; Norman, 1988, 2004; Treviranus, 2009). A simple “what if” question can reveal a whole universe of assumptions, both technical and conceptual. Such questions have indeed led the most prominent criticism of IS design methodologies. They pinpoint the oversimplification of a binary definition of the digital divide, and more importantly, bring attention to the open-ended and problematic assumptions in formalizing users’ needs and designing information technologies capable of meeting them.
Finally, accessibility and usability studies introduce valuable principles that can inspire and lead research in IS design to a better understanding of users and the evolving nature of their needs and preferences. The following are some of these principles:

- To put yourself in the shoes of others;
- To challenge the notion of a “normal” and “prototypical” user;
- To pay attention to the details and the complex interactions among content, display, and control of both software and hardware;
- To examine what are the important or essential aspects when interacting with information systems; including those more extraneous, contingent, or incidental aspects;
- To challenge the authority of the source;
- To assess the cognitive value of alternative modalities; and
- To design IS that allow adaptation, re-purpose, customization.

1.4 Customization and IS Design: a Challenge for Inclusion

Providing access to and effective use of information resources entails several critical questions. If technologies can enable innovation, economic and social development, how do they do so? What type of technologies can create such opportunities? Who is included in the design process? Are ICT designed to accommodate a diverse population, including people with different abilities, disabilities\(^1\), learning preferences or cultural differences?

ICT do not always serve all “types” of users. This is precisely one of the major demands that accessibility and usability studies introduce to IS design. To great extent, large-scale and so-called “generic” ICT are not usually designed to accommodate linguistic, cultural, physical or cognitive differences. Quite often, designers and software developers do not address or examine the implications of diverse users’ unique needs and preferences. Technologies like word processors, email applications, web browsers, e-Learning environments and many other generic applications, need to be examined with questions about who is included when conceptualizing users and requirements, as well as when consulting or recruiting representative user groups to test these applications. Thus, the challenges in IS design are challenges for inclusion and understanding diversity.

1.5 The Motivation: Customization for Learning

Despite the great emphasis on information delivery, less attention has been directed to the role ICT can have in creating and facilitating opportunities for long-life learning (Scardamalia & Bereiter, 1993a, 2006). Many have argued that it is ultimately not the distribution of information, but the facilitation of learning environments that foster collective forms of knowledge creation. At the heart of what I will argue

\(^{1}\) Disability/ability distinction is one of the problematic and difficult concepts extensively debated (Jutta, )ns.. As in , ability

5
below to be a challenge to dominant modes of ICT design, there is another question. As Lev Vygotsky puts it: “What, in general, does it mean to be a means of thinking or memory?” (Vygotsky, 1978). Conceptualizing the role of technology in the creation of knowledge requires addressing deep philosophical and methodological questions about the nature and development of human mental activity.

Some learning environments can be more accessible (in an educational sense), inspiring and usable for certain learners than others. This may seem a trivial statement, but there are at least two key questions to ask when assessing the role and value of technology supporting learning practices.  

1) *What makes a technology a supportive learning environment?* 2) *How should such technology be designed in order to provide “support”?* These quite broad yet complex questions motivate this research and tie directly into the previous questions about ICT design in general, presupposing an evaluative standard for educational technology: does it create a “supportive learning environment”? The former question refers to philosophical issues about the nature of learning and knowledge in general, the latter to a practical challenge in IS design: the selection of features and interactions actually implemented.

In different research fields such as philosophy, cognitive science, education and information sciences, there is increasing awareness about the role of flexibility and the adaptation of technology to individual needs and contexts. Nonetheless, determining the scope and implications of customization in information technology design is still an emerging area of research (Fan & Pole, 2006; McCarthy, 2001; Sunikka & Bragge, 2008). In fact, several researchers affirm that the epistemological and ontological assumptions in predominant IS design have not always been fully addressed. Although the literature on IS design, including Requirements Engineering (RE), Universal, User-Centered and Participatory Design is extensive, the use of multidisciplinary perspectives to examine the cognitive role or goals of customization is quite often completely absent from current IS design research.

There are indeed some exceptions. Several researchers have agreed on the need for a revision and careful examination of the theoretical and methodological frameworks informing IS design (Winograd and Flores, 1986; Suchman, 1987, 2007, Ehn, 1988; Feenberg, 1999; Easterbrook, 1991). It is also well-documented that when learners interact with ICT, numerous issues arise due either to the learning environment or individual cognitive abilities, as in information overload and cognitive breakdown (Winograd and Flores, 1986) or the loss of “executive control” (Lewis, 2006; Keates et. al 2007). Creating opportunities for learning depends on many other factors: the actual design of the technology, the individual needs of the learner and more significantly, the orchestration of a great deal of tiny details usually associated with customization and personalization.
Furthermore, researchers in education and instructional design suggest that ICT can in fact become crucial environments to provide opportunities for learning and the creation of knowledge (Scardamalia & Bereiter, 1993a, 2006). Flexible learning environments that provide alternative information modalities (e.g. text, audio, video, images) and can be adjusted to the specific needs of each learner help facilitate meaningful engagements with educational resources – for both individuals with disabilities and those with particular learning preferences (Treviranus & Roberts, 2006, 2008). Nonetheless, the relationships between customization and learning practices, or the relationships between the creation of knowledge and the adaptability of the e-learning environments, merit further research.

1.6 Purpose of the Research

The aim of this study is to examine the practical and conceptual challenges that arise when information systems are designed to respond to personal needs and preferences. This study expands upon current research on accessibility by looking at the discourses that conceptualize and justify notions of access to information and customization. Specifically, this attempts to examine the study analyzes the benefits, as well as the challenges, entailed in the creation of Learning Management Systems implementing the ISO standard AccessForAll (ISO/IEC 24751, 2008).

The term “critical” in the title of this research project is not trivial. It implies ontological as well as methodological commitments to a particular type of research focused on analyzing, examining and presenting the social, political and cognitive implications of well-established discourses. The purpose of critical research is not to provide solutions. Instead, its major objective is to formulate questions and expand the understanding of existing narratives. Hence, using the term “critical” in this research has methodological implications. The research uses open-ended interviews and a discourse analysis strategy in order to more thoroughly understand a phenomenon. Thus, this strategy is used as a means of bringing attention to sometimes unconsciously established forms of thought and behaviour (Gee et al., 1992; Feenberg, 1999).

In order to achieve these goals, this study addresses the following research questions:

1. How do web designers, software developers, and course content creators conceptualize the notion of access to ICT? What are the criteria used in assessing the role for customization?
2. What are the benefits, challenges and trade-offs entailed in the implementation of Personal Needs and Preferences (PNP) profiles as conceptualized in the AccessForAll standard (ISO/IEC 24751, 2008)?
3. What are the implications and contributions (practical and conceptual) that customization design and the AccessForAll framework provide for understanding the interaction between users and e-learning environments?

1.7 Contribution of the Research

Despite its popularity in policy-making and advertisement, customization has not received sufficient scholarly attention. In fact, assessing the scope of customization is yet in an exploratory stage. In order to overcome this gap, this research explores how the trends toward the design of customized IS are expanding and redefining not only the meaning, but also the scope of access to information services and resources. This study provides insights about the challenges that arise when conceptualizing and designing customizable systems. Although it aims to better understand the role of customization in the context of the technologies supporting educational practices, critical assessment of notions of access to information resources and customization will be also valuable for designers and software analysts developing information systems in other domains.

This study analyzes the notions of access to information and the role of customization in the context of the AccessForAll Framework (ISO/IEC 24751, 2008). It provides a discussion about the scope, benefits and challenges in IS design, as well as a critical assessment of the issues that must be addressed in future development of adaptive and flexible learning environments. The benefits of studying the AccessForAll Framework are diverse. They range from gathering knowledge and experiences about developers, designers and users of accessible e-learning environments to advancing current research on educational technologies. In particular, this work will provide insights into the role of customization in designing information systems that deal with personal needs and preferences. Finally, in the context of scientific contributions, this research expects to provide theoretical foundations and qualitative descriptions that may increase the dialogue among at least three different but complementary research fields: Requirements Engineering, Inclusive Design and Educational Technologies.
1.8 Summary

The purpose of this research is to analyze and critically assess the *discourses* that support and justify customization in the design of information systems. Its focus is on the principles and strategies for delivering customized information services and resources in the ISO standard AccessForAll (ISO/IEC 24751, 2008). Studying how these principles and strategies are conceptualized, assessed, and implemented, it seeks a better understanding of the issues, benefits and limitations that arise when designing IS that allow multiple adaptations between users and information technology. Using semi-structured interviews and discourse analysis, this study examines and contrasts the perceptions and experiences of a diverse group of stakeholders, including interface designers, software developers, accessibility consultants and course content creators.
2. Literature Review

A review of the literature on customization trends in information systems design can be a challenging task. In fact, selecting the literature suited to this research entailed a long process of selection and analysis. At first, it seemed unclear which disciplinary domains could provide an adequate framework. The design of information systems capable of high degrees of customization and adaptation has been addressed by several different disciplines: from management, economics and computer science, to Human-Computer Interaction (HCI) and science and technology studies (STS). Hence, conceptualizing the trends toward customization requires a review of key frameworks and methodologies. IS design, however, is not a unified discipline; in the last decades, several revisions and critical perspectives have arisen transforming the field into a multidisciplinary area of research.

Thus, this literature review does not attempt to be a comprehensive examination of all the theoretical, methodological, and practical dimensions that may be considered when studying customization. Rather, the purpose of this review is to guide the reader through a series of sensitizing concepts and discussions that will reveal the scope, as well as the challenges, of customization. This review focuses on the theoretical and methodological frameworks in order to study how user’s choice and preferences are integrated into the design of information technologies. The fields addressing these issues include Requirements Engineering, Participatory Design and Universal Design, as well as two recent perspectives focused on User-Centered and Inclusive Design. What is clear from the multiple perspectives and methodologies in IS design is that the notion of “adaptation to customer’s needs” reflects not only deep philosophical, but also very practical questions.

Although it cannot be denied that the study of customization in the context of globalized economies is indeed a prominent area of research on its own, the theories and frameworks explored in this study have a different orientation. The purpose here is to analyze customization from two major perspectives. First, understanding the practical and conceptual challenges that emerged when designing information technologies that support customization. Second, examining what role customization plays in the context of technologies assisting educational practices.

2.1 What is Customization?

When the term customization is used, no hands go up in the room. Everybody seems to know what you are talking about. In this room with no raised hands, customization runs smoothly. Tacit agreement seems to take customization as a synonym for satisfaction of customer’s needs. It describes, perfectly, the benefits of several products or services. A plethora of corporate brochures agree on this meaning; using
customization as a key term for advertising some sort of adaptability to the customer’s needs. The difficulty with this agreement is that customization has become such a popular term, it can be difficult to ask deeper questions; such as, what does it really mean to fulfill customer needs, where and when do these “needs” originate, how are these needs balanced against other requirements and what challenges are at stake.

The following questions aim to start a critical examination and suggest some of the challenges of customization.

1. What can be customized?
2. How should information systems be designed in order to allow customization?
3. Who does the customization? Users or automated agents?
4. Why allow customization at all?

The answers to these questions can vary significantly, depending on the disciplinary domain. Question 1 is certainly an open-ended question, but it seems to lead to technical features. For example, the user of a particular e-learning platform could ask, “What can I change or adapt? What are the features this system allows me to customize?” Question 2 is closely related to question 1, but it refers to how customization features are actually implemented. In order to allow customization, an information system must be designed in a way that certain features or aspects can be changed and adapted in later stages of the design. Question 3 pinpoints an important aspect of customization: who/what does the customization. The adaptation of a system to particular user's preferences can be either “handed” to the users, but it can also be automated. Both scenarios present practical and conceptual challenges regarding the conceptualization of user's choice in IS design. Finally, question 4 is one of the most difficult. It entails questions about values, justifications and the philosophical frameworks that inform and define the purpose of customization2.

2.1.1 Etymological Roots and Historical Context

Since the 1200s, the term custom has been used to designate “usage”, “habit” or “habitual practice” (Custom, n.d.); from the Latin consuetudinem (nom. consuetudo). The evolution of this term is not disconnected from the historical contexts in which it developed; in particular, the context of its predominant use in English speaking countries. It took more than half a century for the English word customer, “a person with whom one has [habitual] dealings” (first reported use in the 1540s) to evolve into the verb customize (first reported use in 1934): “to make something to a customer’s specifications”

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2 Later in Chapter 3, I expand on how such why questions are about justification and they can help to understand the underlying discourses in IS design.
This etymological root is crucial for the purposes of this research. A term that at first referred to “habit and usage” developed into “customer’s specifications”. In short, what once referred to a social relationship developed to refer to the satisfaction of needs in the relationship between an individual and a product. Interestingly, the Latin term consuetudinem also provided the roots for closely related terms in other Latin-based languages. For example, both the Spanish term “costumbre” (Costumbre, n.d.) and the French “coutume” (Costume, n.d.) are linguistic forms expressing the meaning of the Latin word consuetudo; however, there are no such words as “customer” or “customization” in either of these languages. Both costumbre (Spanish) and coutume (French) designate a practice: what people do based on habit or tradition. What is pertinent from this examination is that only later in history, probably with the early stages of commerce and the Industrial Revolution, the term “customization” adapted in English to designate what a person or client prefers or needs. Thus, based on this emphasis on the individual and not on the tradition, customization has become in many cases synonymous with personalization.

This semantic shift from custom to customization has great implications. It entails a major change in emphasis. When taken not as a social construct, the individual becomes the unit of analysis; the very object of study. On the other hand, when a researcher inquires about a custom, about what is habitual in a particular region or culture, there seems to be a need to study much more than a single individual. Rather, the study of communities, their habits and traditions, seems key. What is needed here, is an understanding of what has become accepted or established over a relatively long period or time. However, when the researcher focuses on individual preferences and needs, a major shift has occurred. The unit of analysis, as well as the object of study, shifts away from understanding traditions and community.

Although customization has become a current and well-known expression, the adaptation of products and services to the needs of clients and workers has a long history. The origins of customization design can be traced back to the early decades of the Industrial Revolution, and perhaps even earlier, when the design of machines and equipment required adaptations to the physical characteristics of the labour force. In a chapter about the history of labour, Pelle Ehn reminds us how manufacturing tools were designed and adapted to the body size and strength of children workers. Levers, pedals, knobs and all sorts of devices were specifically “customized”, so that children could operate the machinery for long working hours (Ehn, 1988).

With the boom of the automobile industry in the early decades of the twentieth century, a famous statement attributed to Henry Ford provides evidence of the state of customization initiatives:
“Any customer can have a car painted any color that he wants so long as it is black” (attributed to Henry Ford, 1923 autobiography)3

Although there is debate about whether Henry Ford indeed uttered this statement, this quote introduces one of the main points concerning this research: *customization brings into question both a client’s choice and customers’ ability to shape the final product or service* relative to other competing constraints. It is not without a sense of irony that during the days of the mass-production of automobiles, an era that introduced the famous assembly lines so popular today, a client’s choice was extremely limited, if not altogether absent.

### 2.1.2 Customization in the Information Realm

Researchers in sociology, management, and economics suggest that in the decades following the automobile assembly lines of the 1920s, a major change took place in the global economy (Amin, 1994). This was the shift from *mass-production* to *mass-customization*. According to Kotha (1995), a major shift in business models took place: handing control over the final product to customers. Both supporters and critics of this shift suggest customization was a new economic strategy for the creation of value (Grover & Ramanlal, 1999; Ehn, 1988). Today, it is still believed that allowing customers to *decide* and *perform* adaptations on products and services brings additional value: increased user satisfaction. Customization initiatives can position companies in a strategic advantage over their competitors.

When analyzing the scope of customization in the context of information and communication technologies, a twofold principle also applies. Customization in the information realm introduces questions about the benefits for clients who can select among a set of choices, but also about the benefits customization provides to sellers and software companies.

Grover and Ramanlal (1999) suggest that customization practices introduced profound expectations on information technology⁴. One of the most significant is that “product customization, enabled by IT networks, would benefit buyers.” (p. 470). Grover and Ramanlal characterize this expectation as one of the “myths of Information and Markets”. They propose an alternative argument to illustrate their critical

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3 Black was the paint colour that would dry faster than any other would, so allowing the clients to choose any other color would have compromised production speed. Therefore, it seems that although the question about client’s choice and customization was acknowledged, the production and economic models did not allow for higher degrees of customization.

⁴ It is well-known that the rapid development of information technologies have popularized expressions such as the “information” or the “knowledge society”. Castells (1996) describes this phenomenon as “The Rise of the Network Society” and a great body of literature in management and information sciences use the expression “knowledge economy” (Foray, 2006; Kahin, 2006). Despite its popularity, the very notion of an “information and knowledge society” as a new and unique phenomenon, brought about by the increased development and adoption of digital technologies, has also received extensive criticism (Feenberg, 1999, Tsoukas, 2005).
point: “Product customization, enabled by IT networks, could allow sellers to exploit buyers” (Grover and Ramanlal, 1999, p. 470). What deserves special attention in Grover and Ramanlal’s argument is that the literature on customization practices has usually stressed the “benefits” for users, but the significant advantages are also promoted to sellers and software developers. This is not necessarily a theme open for discussion when advertising customization; though it indeed requires critical examination. When customization moves to the realm of digital information, software products and services, issues about user’s choices and questions about the significant power and control in the hands of software developers demand careful attention.

Several other factors can be mentioned regarding the advantages that result from customization. As mentioned earlier, the trend towards customization suggests that value is added to the product when considering clients’ preferences and allowing adjustments of the final product. Customization also provides great advantages for software industries when developing and deploying a single product into a diverse global market. This process is called “internationalization” or “localization” (Luong, et al., 1995). At the most basic level, “localization” implies that a single product can be delivered in a variety of alternative languages. Nevertheless, localization of software products may include many other subtle differences; for example, particular organizational work flows, spelling differences and cultural adaptations requiring the use of special words or expressions, as well as adaptation of time and currency formats (Luong et al., 1995). Today, localization is present in operating systems, office applications and web browsers: all are available in a plethora of different languages. Furthermore, additional examples of software localization take place when developing accounting or payroll applications. In these cases, the “customization” of IS demands much more than simple translations. It requires the adjustment of specific features, such as algorithms for calculating taxes or the implementation of regional and country-specific legislation.

What is crucial from the customization trends in software development is that although economic models exploring new forms of competitive advantage have led to multiple types of software adaptation, these trends have also increased the awareness about the cultural and social factors that mediate the design and the adoption of information technologies. As I will present in the following sections, the increased awareness about social and cultural differences is a key factor leading major innovations in IS design (Winograd & Flores, 1986; Ehn, 1988; Suchman, 1987, 2007; Ciborra, 1996; Walsham, 2001).
2.2 The Challenges of Customization in IS Design

In this section, I turn to one of the most relevant discussions for the study of customization design: the notion of “user requirements”. This section presents the conceptual, methodological and practical challenges that arise when designing systems that match the needs of the users.

2.2.1 The Rationalist Orientation

Since the early days of digital computing, one of the greatest challenges for an IS designer entails answering three questions: 1) Who are the users? 2) What are their needs and requirements? 3) How can these requirements be captured and formalized? The answers to these questions vary greatly depending on the philosophical framework used to deal with the crucial epistemological and ontological issues here at stake.

One of the predominant philosophical frameworks inspiring IS design is what some researchers called the “Rationalistic Orientation” (Winograd & Flores, 1986; Ehn, 1988). One of the main characteristics of this approach is the way in which relationships between thought and reality are conceptualized, and the steps followed to address the three questions mentioned above. Winograd & Flores (1986) provide a series of steps that reveal the major commitments of this “rationalistic orientation” in IS design:

1. Characterize the situation in terms of identifiable objects with well-defined properties. 2. Find general rules that apply to situations in terms of those objects and properties. 3. Apply the rules logically to the situation of concern, drawing conclusions about what should be done. (Winograd and Flores, 1986, p. 15)

2.2.2 Beyond the Waterfall Model: Revealing the Assumptions

The Waterfall Model constitutes a paradigmatic strategy in the development of information systems clearly aligned with a rationalistic orientation (Easterbrook, 1991). The major characteristic of this model is the distinction between identifiable “entities” or steps that can be followed in the development of any information technology. Additions and variations may include new intermediary phases or the use of slightly different terminology to describe the stages of the software development life-cycle (Jirotka & Goguen, 1994). The Waterfall Model has its origin in methodologies used in manufacturing and construction industries, and describes the process of software development as a series of sequential phases: 1) Requirements, 2) Design, 3) Implementation, 4) Verification, and 5) Maintenance.
The Waterfall model represents a paradigmatic approach to all software development methods based on life-cycles. The challenge here, then, is to present the assumptions introduced by this model regarding the conceptualization of users’ needs and requirements, as well as the assumptions about the methodologies for the elicitation of such requirements (Easterbrook, 1991). As one researcher suggests, a critical examination of this model is mandatory, since today some of these assumptions have remained almost unchanged in several other methods in IS design adopting fixed lifecycles in software development (Goguen, 1992; Jirotka & Goguen, 1994).

The fundamental assumption in the Waterfall Model is that “requirements” can be fully defined at the beginning of the software development process. This assumption is grounded in the belief that the information analysts, designers and software developers included, can accurately and comprehensively formalize uses and an organization’s needs at the early stages of the design process. The first stage in this lifecycle entails identifying the knowledge domain of the activity: including users’ cognitive abilities and expectations, as well as the different tasks comprising their work. As researchers suggest, the difference between users and designers’ perspectives presuppose a process of “extraction of knowledge” from the users, and then a “rationalization” of these requirements into explicit and formal representations (Asaro, 2000, Nonaka, 1994).

This assumption leads to two major difficulties: 1) whether users’ needs and knowledge can be fully formalized, and 2) whether the requirements phase can actually be restricted to the early stages of the software development life-cycle.

The first difficulty that arises along this process of “rationalization” is that experienced users, in fact, do know how to perform the tasks and procedures of their jobs. However, they are often not capable of
articulating such “knowledge” in the form of rules and principles, nor are they capable of easily expressing these rules in explicit propositional forms. Hence, the major difficulty is that asking the users what they want or need might not be sufficient to understand their requirements (Jirotka & Goguen, 1994).

The second difficulty is whether “gathering requirements” can be restricted to the early stages in the software development lifecycle. When does the “design” process actually end? If “user requirements” are only considered an initial phase of the process, the evolution of individual and collective forms of practice are likely to be underestimated. For example, the introduction of new technologies can transform individual and collective practices to the extent that unexpected needs, and eventually new “requirements”, arise only after the design and implementation phases. In fact, several researchers in information sciences (Ciborra, 1996; Walsham, 2001) have provided extensive case studies confirming this “transforming” effect: both individual needs and work practices can be radically transformed with the introduction of information technologies. Furthermore, it is also well documented that the maintenance phase is usually the longest and most difficult stage, demanding a great deal of extra time and resources. As Jirotka & Goguen (1994) point out, during the maintenance phase much more than minor fixes are often taking place. Maintenance includes “reassessment and re-doing of requirements, specifications, and code, as well as documentation and validation” (Jirotka & Goguen, 1994, p.177).

2.2.3 “Elicitation” or “Gathering”: The What and Where of users’ Requirements?

Dealing with users’ needs and requirements is a challenging and much debated area of research. A well-established field in computer science is devoted to this particular domain: Requirements Engineering (RE). The questions and strategies emerging from this discipline are enormous, and attempting a comprehensive presentation of this fascinating field is certainly beyond the scope and purpose of this section. However, at the core of a question about customization, there is a common ground with RE. This ground involves questions about the ontological status of “users’ requirements” (e.g. how requirements are conceptualized) and epistemological challenges (e.g. how requirements are studied).

Knowing what the users need or want is certainly challenging. So far, it has become clear that if information systems ought meet the needs and requirements of the users, several challenges have to be addressed. These issues can be formalized in the following questions: 1) Are users’ needs and requirements something like an objective reality; can we go out there and pick them up with the appropriate research methods and instruments? 2) Can designers, software developers or information analysts express users’ requirements in explicit propositional forms? 3) Can users’ needs and requirements be fully defined at early stages of the software development life-cycle? These questions are not only at the
foundation of requirements engineering, they are key questions for anyone asking about the meaning of access and the role of customization. Nuseibeh & Easterbrook (2000) are aware of these ontological and epistemological issues; as they note:

“The elicitation of requirements is perhaps the activity most often regarded as the first step in the RE process. The term “elicitation” is preferred to “capture”, to avoid the suggestion that requirements are out there to be collected simply by asking the right questions” (Nuseibeh & Easterbrook, 2000).

2.3 The Situated Nature of Users’ Requirements

The unexpected and contingent results that follow the design, implementation and deployment of Information Systems have been addressed by several disciplines. Researchers from quite different fields such as Human Computer Interaction (HCI), Science and Technology Studies (STS), sociology, psychology and education have suggested not only new inspiring metaphors to inform the design of computer artefacts, but also several theoretical and methodologies alternatives to address the epistemological and ontological assumptions present in the “rationalistic orientation”.

Major critical questions have arisen regarding both the notions of user requirements and the methods and theoretical frameworks capable of conceptualizing such requirements. Some of these perspectives have come from ethnography and discourse analysis, others from the philosophical and empirical research examining the nature of human cognitive activity, such as “distributed cognition” (Hutchins, 1995) and “situated action” (Suchman, 2007). This shift toward practice has been possible due to the emergence of new research methods and the development of new perspectives in human-computer interaction studies. Suchman explains that what is novel about the study of human-computer interaction is the influence of theoretical approaches developed in fields such as sociology and anthropology. These perspectives emphasize that interaction is a mediated activity in which language and meaning-making are the ultimate factors (Suchman, 1993).

This emphasis on practice, on social and cultural factors, constitutes a major shift in information systems design. Researchers such as Suchman (1987, 2007), Turkle (1984, 1995), and Bowker and Star (1999) have studied for decades the contextual and situated nature of human practices, emphasizing the need for ethnographic methods capable of enriching the understanding of the complex factors that take place in organizational settings. Along these lines, the work of Bruno Latour in Actor Network Theory (ANT) has also inspired studies in requirements engineering, including in social and technical aspects (Jirotka & Goguen, 1994). Formalizing users and requirements, thus designing sustainable information systems, requires understanding both the unique “individual cognitive propensities and capacities” and the “social constituencies” involved in these interactions among humans and computers. In short, we must
acknowledge that “the capacity of the system is likely to vary, before and after any specific ‘requirements phase’” (Woolgar, p. 205).

Substantive evidence is pointing to a quite obvious, but not always fully recognized, conclusion: the use of ICT takes place within evolving social and cultural contexts. Therefore, the study and design of information systems cannot disregard the fact that individual abilities, as well as organizational factors, are significantly transformed after an information technology has been deployed (Easternbrook, 1991). The “situated” nature of the interaction between users and ICT requires us to understand that system requirements are “emergent”, “open”, “local” and “contingent” (Jirotka & Goguen, 1994, p. 177).

Requirements are emergent because they are revealed only through a process of dialogue, observation and abstraction that extends throughout the software development life-cycle. Open: because there is always room for further refinement and modification. Local: they become meaningful only in particular organizational contexts. Finally, requirements are contingent because they can be redefined before and even after the implementation of the information technology.

2.3.1 Participatory Design

An additional body of research particularly interesting for assessing the role of users, their requirements and ultimately the scope of customization initiatives, is Participatory Design (PD). The foundations of PD trace to the Scandinavian and the British schools during the 70s and 80s that started prominent labour movements which experimented with innovative forms of democratic participation. PD initiatives were not explicitly focused on customization or elicitation of users’ requirements. Rather, these initiatives were pursuing more ambitious goals related to the understanding and the transformation of work and organizational practices by the active engagement of community members. PD started as an “ideological movement” (Löwgren & Stolterman, 2004: 150) inspired by dialectical materialism, entailing political commitments to social change and the critical understanding of the role of technology in shaping everyday life and work practices.

At the foundation of PD as a philosophy for social change there are at least two fundamental principles: empowerment and autonomy (Asaro, 2000; Clement & Van den Besselaar, 1993). Empowerment refers to the real benefits for workers and users when introducing organizational changes, particularly when introducing new ICT. The notion of autonomy describes the transformation of traditional top-down relationships between managers and workers. As Asaro (2000) suggests, the notion of autonomy is rooted in the British initiatives of adopting “humanistic values”, which allowed workers to have relatively more freedom when deciding about their own work practices. For example, “workers where allowed to
spontaneously develop their own work routines, make decisions, and change tasks with little or no supervision” (Asaro, 2000, p. 268).

PD has become an influential example for the design of information systems, providing strategies for understanding how users can actually play active roles conceptualizing and building the information systems they will ultimately use. The involvement of users in IS design has proved to be, in many circumstances, efficient and fruitful for the enhancement of working practices. The work of Ehn (1988), Löwgren & Stolterman (2004) provide a definition of PD that reflects the mutual engagement that is expected from users and designers:

Participatory design is a process of mutual learning, where designers and users learn from and about each other. Truly participatory design requires a shared social and cultural background and a shared language. Hence, participatory design is not only a question of users participating in design, but also a question of designers participating in use. (Löwgren & Stolterman, 2004: 152)

Following this definition, it becomes clear that PD entails much more than a methodological approach to the design of ICT. It presupposes a major shift in the organizational culture and the predominant methods in requirements engineering, such as the Waterfall method. PD entails an active and sustained engagement in which both users and designers become co-participants in the process of conceptualizing, developing and enhancing community practices.

A study conducted by Clement & Van den Besselaar (1993) documents some of the projects in which the participation of community members actively enhanced working environments and practices. In this study, Clement & Van den Besselaar suggest five “ingredients” or characteristics that can contribute to the active participation of community members: 1) Access to relevant information, 2) Independent voice in decision making, 3) User-Controlled development resources (e.g. time, facilities, expertise), 4) Appropriate development Methods (e.g. prototyping), 5) Organizational and Technical flexibility (Clement & Van den Besselaar, 1993: 31).

 Nonetheless, the extent to which contemporary research follows the Scandinavian and British origins of PD’s guidelines and philosophy remains a heated area of debate. Several researchers (Clement & Van den Besselaar, 1993; Asaro, 2000; Luke et al., 2004) have examined the use of PD and revealed some major simplifications of this framework. Asaro (2000) suggests that, in several cases, user participation in design has largely focused on providing “functional input” (Asaro, 2000, p. 262). That is, the involvement of users in design and development has been restricted to the enhancement of products and services (Asaro, 2000), disregarding the principles of empowerment and autonomy initially motivating PD initiatives.
For the purposes of this research, PD constitutes a valuable approach for conceptualizing the scope of customization and adaptability. PD recognizes not only the need for inclusion and participation of community members, but also the limitations and challenges entailed. Deciding what can be “customized”, and how or when control over products and services should be handed to the users, is not a straightforward process. Indeed, the standard notion of customization itself is challenged if customers shape the product and associated processes from the very beginning. Ultimately, there are political and economic, as well as major learning challenges for both users and designers that constrain and shape information technologies. As Luke et al. (2004) suggest, PD initiatives are not only constrained by exclusive focus on the functional input expected from users, but also by the scale of the information infrastructure, budget limitations and literacy levels required to actively participate in the design process.

Finally, a relevant aspect of PD initiatives is their historical proximity with the notion of “Situated Learning”. Learning practices constitute the foundation upon which a “co-participation” can be developed. As suggested by Lave and Wenger (1991), developing a sense of membership is a process which shapes the identity and the cognitive abilities of all community members – thus, the creation of a shared and negotiated understanding of a community’s goals, needs, and preferences. I will return to these ideas below.

2.3.2 User-Centered Design

A complementary and well-known approach in information systems design is User-Centered Design (UCD), sometimes also called Human-Centered Design. UCD introduces new valuable perspectives for understanding and conceptualizing users’ needs and preferences, particularly features associated to graphical user interfaces (GUI). Norman (1988, 1986) highlights the “psychological” dimension entailed in the interaction with information technology, suggesting that “good” designs are those aware of the “everyday things” that characterize users’ practice. This awareness translates into the identification of requirements such as the visibility and legibility of navigation bars and links in a website or the use of clear language. These, of course, are but a few examples of human specific needs that depend on particular human characteristics and arise during the interaction with the interfaces of software solutions.

UCD brings then a significant new perspective: a shift in focus from the system to the human. Designing “good” information systems demands awareness of the ways in which the IS are presented to and conceptualized by users. This shift toward the human, what Norman calls “cognitive engineering” (Norman, 1986), suggests that most of the design challenges arise only after a system has been deployed. Therefore, designers must not underestimate how users perceive the systems they design.
Do user-centered systems design: Start with the needs of the user. From the point of view of the user, the interface is the system. Concern for the nature of the interaction and for the user – these are the things that should force the design. Let the requirements for the interaction drive the design of the interface, let ideas about the interface drive the technology. The final design is a collaborative effort among many different disciplines, trading off the virtues and deficits of many different design approaches. But user-centered design emphasizes that the purpose of the system is to serve the user, not to use a specific technology, not to be an elegant piece of programming. The needs of the users should dominate the design of the interface, and the needs of the interface should dominate the design of the rest of the system. (Norman, 1986, p. 61)

Nonetheless, in UCD there seems to be still room to ask how and to what extent the user can be fully conceptualized as a formal entity, and whether a user’s requirements are a given or rather, evolve along with interaction. Furthermore, the particular emphasis on interface seems to underestimate internal architectural issues which remain hidden in core algorithms and developers models; for example, the conceptualization of tasks, users’ needs, behaviours or work practices.

### 2.3.3 Universal Design

The notion of *universality* in the design of products and services has a long history. Universal Design (UD) started as an initiative in ergonomics and architecture with a *one-size-fits-all* approach. This perspective implied a product or a particular physical infrastructure could be designed *generically*, so the greatest number of individuals would be able to use it. An exemplar of this principle is the curb-cut at street intersections. Curb-cuts represent the principle of universality in the sense that a single design can be used by many diverse users. Curb cuts not only facilitate the transit of bicycles or toddler’s tricycles, they also facilitate access to people using a wheelchair or blind pedestrians. Universal Design, then, introduces a major challenge in the conceptualization of users’ needs: it rejects the notion of the conventional or “normal” user, stressing instead the inclusion of the many other potential users that could benefit from any product or service.

Universal Design has become a well-recognized discourse in the context of IS design. From its early formulation in architecture and product design, universality has introduced a perspective for inclusion. UD comprises a series of principles that can encourage inclusion of as many people as possible. UD is a meta-theoretical position, one where qualitative principles act as high-level goals or assessment criteria to evaluate the design of information technologies. The Center for Universal Design (1997) suggests seven principles for the design of ICT:

1. Equitable Use
2. Flexible in Use
3. Simple and intuitive

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5 UD entails an ethical commitment for inclusion: “usable for as many people as possible”. Nonetheless, it is not clear whether the diversity of users can be assured providing one single solution. Crucial epistemological and ontological challenges are implied in the term universal. Some of these challenges will be addressed later in chapter 5.
For the purpose of this research at least three of these principles are particularly relevant, as they emphasize crucial commitments deeply related to the design of IS allowing customization. **Principle #1: Equitable Use** stresses a common purpose with Participatory Design: when designing an information technology, it is crucial to ask who is included in the design process and to what extent a system allows for social equity and democratic participation. **Principle #2** stresses that a system should facilitate adaptation by its users. Finally, **Principle #4** points to the ways in which IS can be perceived by the user. The relevance of these three principles in UD is that they clearly emphasize the need for adaptation and enabling user choice.

The social and political commitments to UD have remained unquestioned for decades. However, several issues have emerged regarding the practical implementation of these principles. Over the last decades, critical perspectives have questioned Universal Design principles; asking, in particular, when these ought to be implemented in the design of information technology (Fischer, 1994; Nevile, 2008). The complexity entailed by interaction with ICT, as well as the diversity of users and interfaces mediating access to online resources, brings both practical and conceptual difficulties. In fact, the idea that a single *universal* solution can serve a multiplicity of users seems quite challenging, if not altogether impossible. In a comprehensive revision of the history of accessibility worldwide, Nevile (2008) explains how the notion of universality has been shifting in government’s documents and and policy-making agendas. One of the examples documented by Nevile is the presentation “The requirements for accessibility on the Web” (Fischer, 1994) in which an eye-opening set of principles puts into question the possibility of both a universal user and a universal solution in IS design.

**Figure 2 – The requirements for accessibility on the Web (Fischer, 1994)**
Fischer’s presentation introduces simple but inspiring questions: *who, when, where* and *what* do you mean when accessing information? Deciding the right answer to any of these questions presents major challenges. Multiple design requirements arise when accessing and interacting with information resources. A diverse set of additional relationships should be taken into consideration. Not only the context of use, but also the varied array of individual characteristics, suggest that a universal IS solutions may not be addressing the diversity of users. In a report released in 1997, the American National Academies presents this challenge in the form of a requirement for a different approach in IS design:

“Not a single solution will meet the needs of everyone, so a major research effort is needed to give users multiple options for sending and receiving information to and from a communication network” (American National Academies, 1997, in Nevile, 2008).

To great extent, both UD and UCD are still design approaches committed to the notion of user and requirements as entities that can be fully formalized. A major difficulty that stems from this assumption is that neither approach seems to provide a sufficient framework for studying the emerging requirements and issues that arise during customization of learning environments:

“Please note that the Principles of Universal Design address only universally usable design, while the practice of design involves more than consideration for usability. Designers must also incorporate other considerations such as economic, engineering, cultural, gender, and environmental concerns in their design processes. These Principles offer designers guidance to better integrate features that meet the needs of as many users as possible.” (The Center for Universal Design, 1997)

### 2.4 Inclusive Design: Redefining Access

#### 2.4.1 What is “Accessibility”?

The WordNet lexical database provides at least four definitions of the word “accessible”: i) “capable of being reached”, ii) what is “approachable”, iii) “easily obtained” and iv) "easy to get along with or talk to" (WordNet, 2009). All these definitions highlight a common aspect, suggesting that something is “accessible” only when certain qualities, properties or dispositions are present in the object or person trying to be reached. These definitions of *accessibility* can be formalized as a relationship between two entities, as follows:

\[
A = \text{User} \quad B = \text{LMS} \quad \text{So that,} \quad B \rightarrow A \quad \text{can be read as} \quad \text{“B is accessible to A”,} \\
\]  

only if B has some qualities of features. (e.g. B is capable of being reached, B is approachable, etc.)

An interesting shift occurs when consulting the first lines of the Wikipedia’s entry for “Accessibility”. Here, accessibility is defined as “the degree to which a product (e.g., device, service, environment) is accessible by as many people as possible” (Wikipedia, 2009). In this variation, the condition determining what “accessible” is requires considering not only the features of B, but also introduces a question about
the users: *for how many users is the LMS accessible?* The inclusion of the user in this definition calls equal attention to individuals’ qualities, capacities or behaviours that may affect accessibility as to the particular characteristics of B – the person or object being reached. Figures 3 and 4 can help to contrast these two perspectives:

Figure 3 – A Single LMS is Accessible to many users

Figure 4 – Many LMS are Accessible to a Single user

In figure 3, the notion of accessibility emphasises the qualities of B (the LMS). B is accessible to a number of users (A1, A2, A3…An). On the contrary, Figure 4 stresses the user: multiple LMSs (B1, B2, B3… Bn) are accessible to A under the assumption that A (the user) has some capacities or qualities that determine whether the LMS is accessible.

A major difficulty emerges from these formalizations. Both assume that issues related to “accessibility” depend on *either* the LMS being reached or the user. In fact, this difficulty is present in several standards and accessibility guidelines, such as the Web Content Accessibility Guidelines (WCAG, 2009). The conceptualization of accessibility as a requirement for designing ICT assumes accessibility can be formalized in a list of features or checklists whose presence or satisfaction can guarantee the LMS will create an accessible learning environment.

2.4.2 Access as Relational Phenomena

Is accessibility a property of the user or the information technology? This section presents an alternative conceptualization of accessibility suggested by Inclusive Design initiatives (Newell & Gregor, 2000; Sweeney & Rhoden, 2005; Treviranus & Roberts, 2006; Treviranus, 2007; Treviranus & Roberts, 2008; Treviranus, 2009). The approach is grounded in a new understanding of accessibility as a requirement in IS design; one capable of overcoming “either-or” dualisms. This alternative suggests that accessibility is a *relational* dimension in which neither the user nor information systems have essential features. Instead, the success and/or failure of the interaction between users and information systems requires identifying and understanding cognitive and functional relationships. Following Treviranus & Roberts (2006); “In a learning environment, disability can be defined as a mismatch between the needs of the learner and the
education offered.” This definition implies that the design of an IS depends on technological constraints as well as particular cognitive abilities of learners, and that accessibility may vary across users and even for an individual user across situations.

A mismatch between a learner and the learning environment may manifest in many ways, including information overload, cognitive breakdown (Winograd and Flores, 1986) and the loss of “executive control” (Keates et. al, 2007). In the context of information system design, it is well-known that adequate documentation might compensate for a poorly designed or extremely complex system. In these cases, accessibility can be understood as a requirement in the user, in the form of background knowledge, technical skills or additional documentation. On the other hand, “accessibility” may entail much more than a user’s skill or abilities; it may depend also on profound changes in the interaction between users and information technologies. For example, reducing the “depth” of the interface – that is, reducing the need for long series of steps in order to accomplish a particular task (Lewis, 2006) or eliminating non-relevant links or menus, can enhance user-system interaction. Furthermore, an effective interaction with ICT can be achieved by many different adjustments, such as presenting information resources in alternative modalities (e.g. text, audio, visual). More significantly, an effective interaction entails overcoming crucial barriers fixed in the design of the system; in the interface, as well as in the functionality available in the software architecture.

The previous examples illustrate the core principle of Inclusive Design: providing access to an ICT demands careful assessment of the features and abilities that both the user and the system have, and the way in which they interact. Following this perspective, Inclusive Design states that accessibility is better understood when it is conceptualized as a relational rather than an essential quality. This relational notion entails a major shift in the classical definition of user’s requirements. It suggests that an effective LMS should examine how the abilities (or disabilities) of both users and the system relate to each other and ultimately facilitate meaningful interaction. Thus, a relational dimension does not conceptualize learners’ disability or ability as an essential or intrinsic feature. For example, a hearing individual without access to speakers is disabled when watching a movie; however, if that movie is captioned then neither a hearing nor a deaf individual is disabled.

Understanding access to ICT, not as an essential feature but as a relational requirement, opens the possibility for a critical examination of several assumptions that have remained relatively unquestioned in the field of information systems design, such as the classical software development life-cycle and the notion of “interface”. A relational perspective emphasizes the complex and emerging trade-offs that take place when users interact with an information system, and thus suggests accessibility issues cannot be
fully conceptualized in the early stages of the software development process. Instead, designing accessible information technologies demands consideration of the later phases in the development life-cycle, as this is precisely when opportunities for user engagement decide the ultimate success or failure of the interaction.

2.5 The Shift Toward Practice

“Knowledge is not mechanically acquired, but actively constructed within the constraints and offerings of the learning environment” (Hua Liu & Matthews, 2005)

2.5.1 Mind and World are Socially Constructed

Early formulations of a historical and cultural perspective on learning are attributed to the psychologist Lev. S. Vygotsky. In the early 1920s, Vygotsky (Vygotsky, 1978, 1986; Vygotsky & Luria, 1994) started to envision a theoretical framework for understanding the constitutive role that social and cultural factors, as well as instruments of mediation, play in the development of human cognition. Vygotsky is considered one of the first thinkers who attempted a revision of traditional rationalistic understanding of cognition (Wertsch, 1985; Brown & Cole, 2002). His historical and cultural approach pointed out not only conceptual and methodological challenges entailed in the systematic and empirical study of human cognition, but included innovative experiments on the cognitive development of children and people with physical and mental disabilities. Vygotsky emphasizes that simple tools play profound cognitive roles: images, notes or even a string tied to your finger can help recollection of a certain event; while using tools like paper and pencils can be indispensable for solving mathematical problems.

The study of what Vygotsky called the “mediated activity” and the “historical and cultural method” (Vygotsky, 1978) has provided significant insight to the study of “situated” learning practices. Vygotsky’s contributions provided the foundations of an experimental method by which we can examine the role of cultural artefacts (social and technical) in the formation and evolution of higher mental functions, such as memory and voluntary attention (Vygotsky, 1978). Unlike the rationalistic and cognitivist approach, a historical and cultural perspective suggests that learning can be better understood as a situated practice. Learning constitutes an ongoing and collaborative process that can only take place within communities of practice (Lave and Wenger, 1991). While the cognitivist approach focuses on general and context-free knowledge about the world, a situated notion of learning pays attention to evolving forms of knowing in the world and the diversity of auxiliary tools that support problem-solving tasks.

The implications of this method are not trivial, for it puts emphasis on how learning actually occurs; what interactions are really taking place and what communication practices can enable and facilitate the
creation of opportunities for learning. This alternative perspective highlights crucial limitations in the classical cognitivist/rationalist view:

1) If learning is understood as the individual acquisition of general and abstract knowledge, the researcher lacks a notion of *context* and underestimates the role of the environment in which the cognitive practices actually occur (Vygotsky, 1978).

2) Assuming that successful work practices can be formalized in explicit and propositional forms misunderstands the crucial relationships between tacit and explicit forms knowledge (Polanyi, 1962, 1966; Tsoukas, 2005).

3) If the assessment of cognitive success relies exclusively on what an individual can do in isolation, the researcher neglects the role of peer and expert collaboration in enabling cognitive development, expanding knowledge domains and modifying cognitive abilities (Vygotsky, 1978; Engeström, 1987).

### 2.5.2. From Knowledge as Content to Learning as Practice

A rationalistic perspective of learning usually considers knowledge as mental representation. This paradigm conceptualizes knowledge as an abstract generalization, usually as a *content* that *lives in* individuals’ heads. This notion has led to a characterization of learning as a primarily individualistic task of “acquisition”, “assimilation” or “transfer” of *information*, strictly classified in knowledge domains (Lave and Wenger, 1991; Engeström, 1987; Scardamalia & Bereiter, 1993a). However, this notion of knowledge – the accumulated abstract generalization and thus, the characterization of learning as acquisition or transfer – has been the center of heated contemporary debates in psychology, education and cognitive science. The works of Bruner (1990) in social and developmental psychology, Scribner and Cole (1989) in the psychology of literacy and comparative human cognition, as well as the research on “embodied” (Varela et. al, 1991), “distributed” (Clark, 1991; Hutchins, 1995) and “situated” cognition (Suchman, 1987, 2007) have pioneered a new paradigm in understanding human cognitive activity. This fundamental shift resulted from understanding that cultural and historical factors, as well as a variety of supporting artefacts, play significant roles in cognitive success.

### 2.5.3 Studying Systems of Activity

When studying learning practices, a socio-technical “system of activity” (Vygotsky, 1978) should be considered as the primary *unit of analysis*. As Engeström (1987) and Lave and Wenger (1991) point out, when considering the individual as the primary object of study the researcher is restricting the scope of the research and underestimating what individuals can perform in collaboration. By expanding the classical perspective from learning as an individual phenomenon of information acquisition to learning as

2.5.4 Creating Opportunities for Learning: Implications for IS Design

A social constructivist perspective demands careful attention to the historical, cultural and technological means that facilitate learning and knowledge creation. Learning constitutes an evolving form of membership that requires effective and stimulating scenarios. Learners can only achieve new skills when information resources, communication channels and the conditions of the learning environment are suitable to particular and individual needs. This emphasis on the environment suggests that learning practices depend primarily on the meaningful associations that each learner establishes between available information resources and the environment. Hence, successful learning outcomes are achieved when both technological and social conditions are facilitated in the creation of meaning. What is crucial in this approach is that technological conditions alone cannot assure the creation of knowledge. Additional social and cultural conditions are required. For example, dialogue with peers and more experienced users introduces additional support, acting as cognitive scaffolds (Vygotsky, 1978; Engeström, 1987; Scardamalia & Bereiter, 1993a). Creating opportunities for learning is an iterative process that involves the relational and situated nature of learning, as well as developmental stages in human cognition. Creating opportunities for learning, therefore, resists any definitive formalization; it demands attention to technological characteristics of the environment as much as the particular needs of the learner.

In addition, Lave & Wenger (1991) suggest that learning cannot be conceptualized as an individual process. It implies the development of a sense of belonging or membership within a community of learners; a process of identity formation and cognitive development including both the community and the individuals (Lave & Wenger, 1991). Learning constitutes a process by which an individual achieves the status of membership. For example, the process followed by a new trade apprentice, is a processes of eventually becoming a particular person: becoming a master in the art of that particular trade. At the same time, the apprentice learning process affects the identity of the community, especially when innovating a particular technique or optimizing a process. It follows from this perspective, that the relationships within the community and the community itself evolve, integrating the diversity and creative discoveries of its members.

The distinction between creating opportunities for learning and addressing the challenges entailed in the creation of knowledge are not trivial, nor a simple subject matter. It is important to acknowledge that social constructivist’s perspectives emphasizing the scaffolding role of tools of mediation are diverse and
they have been both comprehensively studied and debated. Philosophical claims in which language is considered a crucial tool of mediation (Vygotsky, 1986; Hutchins, 1995; Clark, 1997; Carruthers, 2002, 2008), as well as the constitutive role of communities in the development of human cognition (Engeström, 1987; Lave & Wenger, 1991) are representative examples expressing the complexity of making such a distinction. Furthermore, researchers in psychology (Vygotsky, 1978, 1986; Vygotsky & Luria, 1994; Piaget, 1970), philosophy of philosophy (e.g. the debate between Dennett, 1991, 1995; and Searle, 1997), and education (Scardamalia & Bereiter, 1993b, 1994) address the difficult issues at stake when conceptualizing learning practices and knowledge creation. The fact is that, the diverse “family” of perspectives that can be aligned with the “situated” and “distributed” (what in this chapter has been called a “constructivist approach” to human cognition) constitutes a valuable framework with which to examine: a) the assumptions in the traditional “rationalistic” orientation in information system design, and b) the role played by tools of mediation and the socio-cultural environment in the development of human cognitive activity.

It should be clear that social constructivist perspectives and developmental psychology do not constitute a unified or monolithic framework. In fact, crucial differences exist in the conceptualization of the tools that can facilitate learning practices and the factors that should be included when enabling the creation of knowledge. My purpose here cannot be to address these philosophical and pedagogical discussions at stake in the conceptualization of human cognitive activity. Nor can it be to discuss the entire literature in educational technology focused, particularly, on assessing the challenges of knowledge creation and its implications in the design of information technologies (Scardamalia & Bereiter, 1993b, 1994). Such a purpose is far beyond the limits of this research. What is crucial here is to recognize that although the “paradigmatic” shift towards processes and practice is a well-recognized, it poses many as-of-yet not-well-understood challenges for customization in information systems design.

2.6 Summary
The literature review presented in this chapter has emphasized the fact that understanding and accommodating diverse user’s needs and preferences entails profound challenges. Designing for customization requires dealing with crucial epistemological and ontological issues as well as major technical challenges. Design methods grounded in a rationalistic understanding of human cognition and

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I thank Marlene Scardamalia for helping me understand this crucial distinction between theories focused on facilitating opportunities for learning and perspectives addressing in particular the creation of knowledge: knowledge-building (Scardamalia & Bereiter, 1993b, 1994). I must acknowledge that this research does not provide an analysis of customization leading to reveal how information systems should be designed in order to facilitate knowledge-building, but rather it suggests a much more general exploration of how a constructivist notion of learning can inspire and challenge traditional perspectives in information systems design.
behaviour have pioneered the formalization of both requirements and software development cycles. Nonetheless, the open-ended, emergent (Jirotka & Goguen, 1994) and contingent (Easterbrook, 1991) nature of the interaction with information technologies demands alternative and complementary frameworks. One of these alternatives is a constructivist framework aligned with developmental psychology (Piaget, 1970, Vygotsky, 1978), “situated” practice (Suchman, 1987, 1993, 2007) and “distributed cognition” (Hutchins, 1995; Clark, 1991). These frameworks introduce a major shift in the philosophical foundations of IS design (Winograd & Flores, 1986; Ehn, 1988). Such a shift demands awareness about the co-constitutive nature of users and environments and the crucial role those meditational tools play in the formation of meaningful interpretations. The frameworks and initiatives in Participatory, User-Centered and Inclusive Design are also in agreement with non-rationalistic approaches, and indeed, they have opened new and pertinent perspectives for studying and conceptualizing the emerging interactions between users and information technologies. However, there is still much to be done with respect to re-conceptualizing customization in the context of e-learning systems from its rationalist origins, in a way that does justice to our understanding of the situated nature of learning.
3. Methodology

“To ensure a strong research design, researchers must choose a research paradigm that is congruent with their beliefs about the nature of reality. Consciously subjecting such beliefs to an ontological interrogation in the first instance will illuminate the epistemological and methodological possibilities that are available.” (Mills et al. 2006)

This research started by acknowledging the ontological and epistemological assumptions which arise when conceptualizing users’ needs and designing IS that fulfil these needs. A constructivist approach and the methodological challenges identified by previous research greatly influenced not only the research questions, but also the selection of a methodological strategy. In particular, an open coding of the literature review provided the initial set of themes used in the design of interview questions. The major challenges identified by previous research in IS design include:

a) how users’ needs and requirements are elicited and conceptualized, b) how users’ needs and learning preferences are integrated in the design process, and c) to what extent social, cultural and individual preferences can sometimes enable or constrain meaningful and effective access to information. Among researchers in diverse fields such as Requirements Engineering (RE) and Human-Computer Interaction (HCI), as well as Participatory, User-Centred and Inclusive Design, there seems to be at least a common methodological demand: the embrace of new and alternative philosophical frameworks which can better address the issues at stake in understanding users’ needs and designing technologies for user adaptation.

Qualitative approaches have become a predominant and emphatic reaction to the rationalistic orientation in IS design discussed in chapter 2. A focus on the practices and interactions among several different actors is certainly one of the emerging paradigms in the study of information infrastructures (Bowker & Star, 1999). Ethnomethodology studies, for example, have well-documented the many difficulties arising during the design process and adoption of ICT; particularly, in later states of implementation and deployment (Ciborra, 1996; Walsham, 2001; Clement & Van den Besselaar, 1993; Luke et al., 2004). Researchers in Requirements Engineering have also pointed out that the design of information systems requires attention to the emergent, open, local, and contingent nature of individual needs and organizational contexts (Jirotka & Goguen, 1994; Sutcliffe et al, 2006).

Although current trends toward customization have addressed some of these issues, it is evident that giving control to the “users”, facilitating access to information (as addressed by traditional notions of the ‘digital divide’) and allowing both adaptability and flexibility is not straightforward. These challenges entail not only technical limitations, but also questions on how particular philosophical frameworks conceptualize these entities and inform IS design. What seems imperative is an examination of the
underlining discourses in the design of “computer artifacts” (Ehn, 1988). These discourses entail a process full of semantic mediations, interpretations, and decisions that propagate throughout the software development lifecycle. Using Andrew Feenberg’s expression, there is a need for addressing the “hermeneutics of technology” (Feenberg, 1999, p. 84). Thus, the design of a research method should start with a major challenge: the selection of a strategy capable of examining the conceptual and practical challenges in well-established discourses in IS design: 1) Access to information resources. 2) Customized and personalized information delivery. These conceptual issues and the methodological strategies discovered in previous research led to the selection of discourse analysis and open-ended interviews as the preferred methodology.

3.1 Object and Method: The Looking Glass Effect

What we look at seems to be in an intimate relation with that we look at with. Perhaps biologists and those studying the astonishing worlds of micro-organisms are much more aware of this, since using and shifting magnification to examine an object is quite a common practice. Zooming in and out reveals different details not visible by the previous perspective. At certain point, what initially seemed a simple spot, reveals itself as a complex network with many other actors and dependencies; in fact, quite a new reality appears as the biologist shifts the lens.

It might be the case that when studying other types of phenomena, researchers find themselves immersed in the very same puzzles. The role of the information analyst may not be so different from that of the biologist. This raises some crucial questions. Are theoretical frameworks a kind of magnification glass, and if it so, what is its role when introduced in the study of technology? What is the role of these frameworks in the definition of the very object of study? The glass we use to look through can change what we call real; in fact, the very object seems to change its nature when selecting different theoretical frameworks. Actor-Network Theory (Latour, 2005), Ethnomethodology (Bowker & Star, 1999) and discourse analysis (Gee et al., 1992; Gee, 1999) have indeed issued warnings in this direction: theoretical frameworks act as lenses. As they shift, so does the object looked at. What the researcher identifies to be the object of study determines the problems to be solved, and thus the solutions that can be delivered. This is not just a challenge for the biologist or the information scientist, it is a major challenge for every science.

7 The intricate relationships between cognitive abilities and tools are certainly an old and not yet fully explored idea. I am borrowing here the title of a lecture conducted by Professor Daniel Dennett called “What do we Think With? In his lecture, Dennett presents an interesting question in close relation with the constructivist approach. Humans develop their cognitive powers when interacting with tools of mediation; whether these tools are an abacus, a calculator, an agricultural technique, or computer programs (Cfr. Dawkins, 1976, Dennett, 1991, 1995; Vygotsky & Luria, 1994).
When selecting the object of study, several dualistic distinctions have prevailed, often preventing deeper understanding of the issues and interactions at stake (Latour, 2005; Feenberg, 1999). Some of these old and well-established dualisms include: object and subject, mind and body, form and content, medium and message, figure and ground. Quite often, such categorizations of the object of study have forced researchers to take an either-or approach. Indeed, conceptualizing the “user” as an entity that is separated from the system resembles, precisely, this dualistic approach. Furthermore, traditional perspectives in IS design have started with the formulation of a framework that must be later applied to well-defined phenomena. What is missing in these methods is a critical examination of how the selected framework shapes the nature of object of study, and hence the very definition of the problems to be solved or the efficacy of the solutions being delivered. In short, when tracing a sharp distinction between society and technology, researchers often ignore the looking glass effect.

Selecting a method for exploring how customization is conceptualized and what is its role when accessing information resources is not immune from these issues. If one assumes the object of study is a static and pre-existing entity, out there in the world, then the best method would be to develop a sharp measuring tool that can “pick up” and “gather” accurate data about such entity. If the object is not a single entity, but a complex system of interaction (among people, languages and tools of mediation) the methodological decisions require a different orientation.

3.2 The need for Ethnography and Qualitative Research

Most of the studies in personalization and customization have been driven by analytic approaches; mainly, analyzing the definitions of customization and personalization in diverse disciplinary fields. These analytic approaches have provided advances in the conceptualization of customization as an object of scientific research. The study conducted by Fan & Pole (2006), for example, examines how the definitions and purpose of customization varies across disciplines (Fan & Pole, 2006). Another common trend in IS literature, is to develop frameworks with which to evaluate the personalization of online applications. In the study What, Who and Where: Insights into Personalization, Sunikka & Bragge (2008) present the analysis of bibliometric data on nearly 800 journal articles. Their findings show that in the last decade, the number of publications referring to the terms personalization and/or customization has grown almost exponentially.

The popularity of these analytic approaches, however, has turned to the recognition of a major gap. Most of these studies conclude that “further research” must analyze how practitioners perceive and implement these analytical frameworks. The study of customization and personalization demands studies pursuing
ethnographic and participatory approaches. The following statements, extracted from the conclusions of the studies mentioned above, emphasize this need toward stakeholders actually adopting and developing customizable information environments.

We suspect that a number of practitioners of personalization have pursued the architectural and relational approaches despite the fact that they have not been discussed much in the academic IS literature. Study of these practitioners seems likely to yield insights into personalization designs and methods that are different from those currently described in the literature. (Fan & Pole, 2006, p.199)

Further studies on personalization are needed; especially in the areas of consumers’ views on benefits and drawbacks of personalization, as well as the true effectiveness and efficiency of personalization. In addition, the view of personalization as a process taking into account the necessary changes, not only in technology, but also in organizational and human aspects, is needed. (Sunikka & Bragge (2008)

### 3.3 Discourse Analysis

Discourse Analysis is not a unified body of theory nor a unique, simple methodology with straightforward recipes to be followed. The study of language, as it is presented in multiple forms of text such as oral, written, or signed languages, entails enormous challenges: from the identification of multiple genres of language to the selection of assessment criteria, which can limit researcher’s interpretations (Gee et al., 1992). As Gee et al. (1992) suggest:

“The term “discourse analysis” covers many dissimilar enterprises and analytic purposes. Ethnomethodological studies of conversation (Sacks, 1974; Sacks, Schegloff, and Jefferson, 1977; Schenkein, 1978), for example, or analyses of speech events within the tradition of ethnography of speaking (Hymes, 1962; Gumperz, 1982; Ochs and Schieffelin, 1983) similarly entail the microanalysis of discourse.” (Gee et al., 1992, p. 231)

Despite this multiplicity of approaches, the study of “the structures of discourse” and language use can reveal crucial aspects about how particular users perceive and experience their work or their interaction with information systems. It also highlights some underlying principles; particularly, the social and organizational discourses that shape these work practices. As Gee et al. (1992) point out, discourse is “produced by speakers who are ineluctably situated in a sociohistorical matrix whose cultural, political, economic, social, and personal realities shape the discourse.” Further, “discourse itself constitutes or embodies important aspects of experience and, at the same time, constitutes important parts of that sociohistorical matrix.” (Gee et al., 1992, p.228)

For the purpose of this research, this fundamental aspect of discourse analysis is particularly relevant: text is socially situated. In other words, the use of language is inherently dialogic. This perspective is grounded in the works of Bakhtin, Vygotsky, and Wittgenstein who emphasize that even forms of discourse considered “private” are often dependent on common agreements and categories; they only occur as co-constructed understandings. “When a monk meditates alone in the desert, when one reads or writes privately, it is still a culturally grounded, social activity.” (Gee et al., 1992, p.235).
3.4 Data Sources

In order to conduct this type of analysis, two major sources of text were used:


2) The text resulting from interview transcripts.

The ISO Standard AccessForAll contains general principles about how accessibility is conceptualized as a requirement for the design of ICT. A review of the standard was crucial for providing initial understanding of the technical and theoretical challenges of conceptualizing user requirements and the role of Personal Needs and Preferences (PNP) profiles (Nevile, 2008).

In the case of interview transcripts, it is crucial to mention that text was not static or given, as in a book or document where the researcher’s work is to analyze a pre-existing text. Rather, this study assumed that the interview process entailed a co-construction of meaning—where both interviewer and interviewee constructed data as the interviews unfolded. This co-construction is particularly implied in the constructivist approach. As Mills et al. (2006) explain:

“Epistemologically, constructivism emphasizes the subjective interrelationship between the researcher and participant, and the co-construction of meaning [Hayes & Oppenheim, 1997; Pidgeon & Henwood, 1997]. Researchers, in their “humaness,” are part of the research endeavor rather than objective observers, and their values must be acknowledged by themselves and by their readers as an inevitable part of the outcome (Appleton, 1997; de Laine, 1997; Guba & Lincoln, 1989; Stratton, 1997).” (Mills et al. 2006, p.2)

3.5 Participants

3.5.1 Selection criteria

A total of 10 participants were interviewed for this research. The selection criteria was developed in consideration of major findings in Requirements Engineering (Jirotka & Goguen, 1994) and Participatory Design (Asaro, 2000; Clement & Van den Besselaar, 1993). It was assumed that the design and development of accessible e-learning environments contained not only a diverse group of participants, but complex organizational and personal interactions among the stakeholders. Furthermore, the pertinence for a diverse inclusion criteria became visible after a preliminary review of the scope and purpose of the AccessForAll Framework. As the specification suggests, assessing the accessibility of technology and information resources requires examining the complex relationships between the structure of information, controlling devices and content modalities.

The study of these relationships implied that different stakeholders were involved in the creation of accessible learning environments. At the level of design, it seems required to study several types of
interaction among designers and software developers, as well as hardware engineers. At the level of use, there were many other stakeholders involved, such as content creators, instructors, students, as well as people utilizing assistive technologies. This wide spectrum of potential participants allowed the researcher to select a sample as representative as possible, while keeping the constraints of time and scope of the research project in consideration. It was evident, nonetheless, that interviewing a diverse group of stakeholders was needed.

Some of the participants were selected based on the researcher’s pre-existing knowledge about their role and area of expertise. Although pre-existing relations with some of the participants contributed to selection of a diverse and representative group of stakeholders, some ethical considerations were carefully addressed. Particularly, where pre-existing relations with participants existed, they did not involve positions of power or authority that could influence participants’ voluntary decision to take part of the study. However, in order to minimize any possible power relationships or constraint, the researcher clearly stated in the recruiting Email Letter (Appendix A), the Informed Consent Form (Appendix B), as well as in the verbal agreement preceding the interviews, that this study was an independent thesis project and not affiliated to the participant’s organization.

At the most general level, participants were selected in adherence to at least one of the following criteria:

- Familiarity with and/or expertise with the AccessForAll Framework (ISO/IEC 24751, 2008)
- Current or previous participation in the design, development, and implementation of Information and Communication Technology – including the development and/or design of accessible components for Learning Management Systems
- Experience in the use and customization of e-learning environments

The following table presents specific requirements for each stakeholder:

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Number</th>
<th>Inclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant/Researcher</td>
<td>2</td>
<td>Advisors, researchers, and experts participating in the implementation of the ISO Standard AccessForAll and/or accessibility guidelines</td>
</tr>
<tr>
<td>Designer</td>
<td>2</td>
<td>Designers involved in the creation of information systems allowing customization; including graphic user interface and/or functional features</td>
</tr>
<tr>
<td>Software Developer</td>
<td>3</td>
<td>Software developers involved in the computer programming of customizable web-applications – including modules, plug-ins, or database models. Preference was given to software developers with experience in the implementation of Personal Needs and Preferences Profiles</td>
</tr>
<tr>
<td>Course Content Creator/Instructor</td>
<td>3</td>
<td>Individuals associated with the process of creating courses for learning managements systems. Instructors creating closed captions and descriptive video or Instructors creating content for audiences with special needs or learning styles.</td>
</tr>
</tbody>
</table>

Table 1 – Inclusion Criteria for Each Stakeholder
3.5.2 Recruitment Procedure

For the recruitment of participants, an email (Appendix A) was sent to potential participants providing detailed information about the requirements and purpose of the research and an Informed Consent Form (Appendix B).

3.6 Designing Interview Questions

The methodological strategy for this research shares a major principle with Grounded Theory: the search for emergent themes from collected data (Mills et al., 2006). However, the approach adopted was not a pure grounded theory, as the researcher began with some pre-set themes that influenced the design of research questions. The following categories were developed using open-coding of some challenges identified in the literature review (e.g. gathering user’s requirements, trade-offs criteria, etc) and key definitions found in the AccessForAll Framework. Although their selection was based on previous research, the researcher assumed themes would evolve throughout the study.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants’ Background</td>
<td>Participant’s professional background, experience with the design and/or use of ICT</td>
</tr>
<tr>
<td>Perceived Requirements</td>
<td>What participant’s considered as requirements to facilitate access to information and the role of customization</td>
</tr>
<tr>
<td>Design and Implementation Challenges/Benefits,</td>
<td>What challenges/benefits arise during the design and implementation of the AccessForAll Framework</td>
</tr>
<tr>
<td>Trade-offs Criteria,</td>
<td>What, if any, were the trade-offs and/or criteria used for customization of ICT, and particularly, LMS</td>
</tr>
<tr>
<td>Arguments for/against Customization,</td>
<td>Based on participants’ experience, what were the arguments for or against customization</td>
</tr>
<tr>
<td>Design/development (Best Practices for Accessibility)</td>
<td>What if any, were the best practices in the design and development of accessible information systems</td>
</tr>
<tr>
<td>Critical Assumptions/Concerns,</td>
<td>What concerns, critical perspectives, and assumptions were explicitly stated by participants</td>
</tr>
<tr>
<td>Awareness of the implications for other stakeholders</td>
<td>How participants perceived their role, and how this role may affected the work of other stakeholders</td>
</tr>
</tbody>
</table>

Table 2 – Initial Interview Themes

---

8 When interviewing designers, software developers, and accessibility consultants, the questions about trade-offs and criteria focused on inquiring about the justifications for including or excluding a particular customizable features. The questions targeting instructors and course content creators were focused on the process followed, when designing an online course and the customization features used and expected from the LMS.
3.7 Conducting Interviews

All interviews started with questions about the participant’s professional background and their self-reported familiarity with the design and/or use of information technologies. Moreover, when designing the interview questions, the researcher anticipated that the diversity of participants required participant-specific questions. On one hand, it was expected that designers and software developers would provide responses on how to actually model and build customizable systems. On the other, questions targeting course content creators would provide perspectives on the previous use of these information systems; clues for understanding the types of adjustments conducted, the benefits of these and any difficulties encountered. This methodological strategy involved paying close attention to the language that participants used and the ways in which they dealt with the notion of access to information and customization.

Although most of the analysis was based on transcripts, in some cases non-textual responses (e.g. body language, tone) noted throughout the interview process affected the researcher’s identification and interpretation of data. For example, when assessing the principles and pertinence of Universal Design, or the distinction between Functional and Non-Functional Requirements, the participants tone sometimes indicated strong agreement and/or disagreement with researcher’s statements.

3.7.1 Probing and Follow-up Questions

The purpose of probing and follow-up question questions was to set up the stage and allow the researcher to prepare the direction of the interview. Probing and background questions allowed identification of the language and context of use familiar to each participant. In particular, becoming familiar with the participants’ background and expertise greatly assisted in selecting adequate language to introduce questions about access to information resources, the scope of customization and the role of personal needs and preferences (PNP) profiles. Follow-up questions tried to be very cautious in allowing participants to express their views in language and terminology familiar to them. They also allowed the researcher to ask for clarifications and formulate deeper questions; for example, on how the criteria for customizable features were decided upon.

3.7.2 Strategies for Clarification

Designers and software developers, as well as accessibility consultants, were quite familiar with both the AccessForAll framework and the term PNP. In these cases, the researcher encouraged participants to describe in their own words the meaning and motivations behind these terms. Conversely, when participants were not familiar with the terminology used by the standard AccessForAll (e.g. instructors and course content creators), the researcher provided examples and explanations so that participants could
present their opinions about customization and evaluate its pertinence and applicability to their own work practices. In order to obtain contrasting responses, participants were asked to respond to some well-known issues (e.g. the challenges of excessive customization options or the learning curve for mastering information technologies). Finally, the researcher utilized rhetorical questions such as “If you were a… designer/software developer/instructor, etc.” to invite participants to think about the roles of other stakeholders and how these influence their own practice and decision-making.

**3.7.3 Introducing Issues in the IS design Literature**

In addition to open-ended questions, the researcher introduced statements about well-documented issues. For example, literature in Requirements Engineering commonly introduces a distinction between Functional and Non-Functional Requirements. This distinction was presented to participants in order to assess where would they situate accessibility. Participants were asked to describe, based on their experience, what type of requirement accessibility is and how it relates to their work practice.

In cases where participants were not familiar with the implications (conceptual or practical) of the issues presented, the researcher provided the necessary context and again selected familiar terminology. In some cases, well-known issues (e.g. the challenges for the user when excessive customization is provided) were also introduced in the form of hypotheses or problems. Participants were then asked to express their opinions and assess whether the researcher was really pointing to a relevant issue. Care was taken to match discussion with participants’ area of expertise. For interface designers and web developers, the researcher led the discussion towards the meaning and benefits, as well as the challenges entailed in the creation of systems that enable adaptation and flexibility. When interviewing content developers, the researcher did not assume any technical knowledge about customization or previous knowledge of the ISO standard AccessForAll.

**3.8 Categorizing Emerging Themes**

As outlined earlier (section 3.6), the review of technical and conceptual issues in IS design literature guided the initial classification of interview questions. However, during the analysis of interview transcripts this initial list evolved significantly (see Appendix G for a list of all emerging themes). These themes were compared with the classification scheme developed by Fan & Pole (2006).

As a reaction to the focus on “how to do personalization”, and the lack of attention to who does the customization, Fan & Pole (2006) introduced a classification scheme for the implementation of personalization/customization. As they explain this scheme is comprised of three high level categories:
(a) The aspect of the information system that is manipulated to provide personalization (what is personalized), (b) the target of personalization (to whom to personalize), and (c) who does the personalization (i.e., the user or the system). (Fan & Pole, 2006. p. 185)

This classification scheme was useful to identify these three aspects that have been considered in current studies in customization/personalization. This scheme was key in the identification of actors and the role each play in the customization of IS. Nonetheless, based on the critical purpose of this research – that is, the emphasis on the conceptualization of customization and personalization - one important question seemed to be missing in Fan & Pole’s (2006) scheme: the why of customization. For this reason, adapting their classification scheme, the following three questions were used as classification categories for the analysis of interview transcripts:

- What can be customized? (technical features, primarily)
- How is it customized? (benefits and challenges for customization)
- Why is it customized? (justification for customization)

It is important to mention that these high-level categories (What, How, and Why of customization) were not considered as mutually exclusive categories for the aggregation of the more than 50 emerging themes found in the interview transcripts. The grounded approach used in the coding process required developing four new meta-themes that could consolidate the overlaps among the emerging themes. The following table presents these four meta-themes and the acronyms used in the codification.

<table>
<thead>
<tr>
<th>Meta-Theme</th>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
</table>
| AccessForAll Framework            | A4A     | Themes about specific aspects of the AccessForAll framework, including:  
  - Benefits  
  - Limitations  
  - Future Evolution/Additions  
  - Purpose  
  - Components  
  - Actors  
  - Scope |
| Educational Framework/Practices   | EDU     | Themes both about educational framework and practices, including:  
  - Learning and Teaching  
  - Pedagogical Frameworks/Theories  
  - Learning Objects  
  - Learning Preferences  
  - Role of customization in learning |
| Information Technology            | TECH    | Themes specific to Information Technology but not necessarily restricted to the context of AccessForAll, including:  
  - Automation  
  - Requirements Gathering  
  - Participatory/Inclusive Design  
  - Content Packaging  
  - Content modalities  
  - Definitions of Metadata |
Philosophical Challenges | PHILO | Themes related to conceptual issues (epistemological and ontological), including:
- Universal vs. Inclusive Design
- Form vs. Content separation
- Tacit/Explicit knowledge
- Limitation in Formalization
- The Individual as the Unit of Analysis

Table 3 –Meta-Themes Used for Coding

3.9 Methodological Limitations

The methodological strategy presented here is of exploratory research, and not intended to formulate a definite framework. Instead, the objective of this methodological approach is to pay attention to the challenges that arise when high-level principles/frameworks disregard the perceptions of those key stakeholders actually implementing and conducting crucial decisions in the design of ICT.

Number of participants: a total of 10 participants were interviewed for this research. This relatively small number can be considered a limitation of the study. Although the aim of the research was to seek an in-depth understanding of participants' perceptions, the researcher is fully aware of this limitation. Future studies utilizing discourse analysis and participatory design initiatives would be required to allow broader generalizations.

Group of participants: Most of the participants in this study were stakeholders familiar with the AccessForAll Standard and accessibility issues. This limitation was only partially addressed by including three participants who did not know the standard, but were instructors with long experience in the use and adaptation of e-learning environments. For this reason, the diversity of the group of participants is also a limitation of this study. Future research may be conducted including students as a major stakeholder. Interviewing a different group of participants would likely reveal different aspects and new insights in the role of customization.

Manual coding: Only the researcher conducted the coding of transcript data. This is certainly a major limitation. It is well-recognized that the use of two or more independent coders can provide different results, as well as increase accuracy and reliability. In particular, more than one coder would have provided additional discussion about the roles and discourses of customization in IS design.
4. Findings

This chapter analyzes the two sources of data considered in the study: the ISO standard AccessForAll specification and interview transcripts. The chapter is organized in four thematic categories. It is crucial to mention that these categories are not mutually exclusive. On the contrary, each of them addresses different aspects of the three research questions of this study. The structure of the findings is designed to address the high-level categories used to aggregate the emerging themes in interview transcripts: 1) AccessForAll Framework, 2) Information Technology (the Conceptualization of Access and the Scope of Customization), 3) Educational Frameworks and Practices, and 4) Philosophical Challenges. It should be clear that these categories are only an analytical distinction and there is a great deal of overlap, as Figure 5 illustrates.

The sections of the chapter address the following themes:

The AccessForAll Framework
The first section introduces the AccessForAll Framework, selecting the key concepts that define the purpose of the standard and contribute to understanding the scope of access and the role of customization. Additionally, this section analyzes the high-level components of the standard: Personal Needs and Preferences (PNP) and Digital Resource Descriptions, and the matching principle between PNP and DRD.
Conceptualizing Access
The second section presents a synthesis of participants’ responses regarding the conceptualization of access. The contrasting and complementary responses analyzed in this section address the following themes: Equal Access, adaptability, interoperability, and standardization.

The Scope of Customization
The third section addresses the scope of customization by examining the challenges and benefits involved during the implementation of users’ needs and preferences profiles. This section highlights how customization relates to what is technically feasible and how participants perceived the value and the limitations customizable systems.

Educational Frameworks and Practices
The fourth section reviews and expands on the relationship between education and information technology. It provides additional perspectives and details about key issues raised in previous sections in order to highlight some important implications and challenges in the conceptualization of e-learning and the role of information technology.

Philosophical Challenges
This last section introduces some of the conceptual challenges participants raised during the interviews: limits of formalization, separation between content and presentation and the challenges that customization brings to the assessment of learners’ performance.

4.1 The AccessForAll Framework

4.1.1 Purpose
In the first part of the AccessForAll Framework, Access For All Framework and Reference Model, the purpose of this specification is described as follows:

“ISO/IEC 24751 is intended to facilitate the matching of individual user needs and preferences with educational digital resources that meet those needs and preferences. It is intended to address mismatches between personal needs and preferences caused by any number of circumstances, including requirements related to client devices, environments, language proficiency or abilities. ” (ISO/IEC 24751 – 1, 2008, p.vii)

In order to understand the purpose of the AccessForAll Framework, three concepts deserve special attention: 1) Users needs and Preferences, 2) Digital Resources, and 3) Matching. Each of these terms has quite technical definitions. Personal Needs and Preferences (PNP) descriptions are “associated with the user’s functional abilities and the assistive technology or other non-standard technology in use” (ISO/IEC
Digital Resource Descriptions (DRD) are “any type of resource that can be transmitted over and/or accessed via an information technology system” (ISO/IEC 24751 – 1, 2008, p.5). The notion of match/mismatch defines the criteria for assessing the success of the interaction with information services and resources. As suggested in the *Access For All Framework and Reference Model*, facilitating adequate access requires an adequate match between users’ needs and information resources. In this context, matching is not a binary category as implied by traditional notions of a ‘digital divide’. The emphasis on addressing the mismatches stresses that access to information is constrained by several different factors such as devices, environments or language proficiency.

Furthermore, in order to deliver an information resource it is crucial to identify the characteristics of both the users (needs and preferences) and the information resources. This relational notion is one of the principles in Inclusive Design initiatives. The AccessForAll Framework not only shares this relational approach, but it presents specific requirements for technologies supporting educational practices. As stated a few paragraphs below:

> “Accessibility is determined by the flexibility of the learning environment (with respect to presentation, control methods, structure, access mode, and learner supports, for example) and the availability of adequate alternative-but-equivalent content and activities.” (ISO/IEC 24751 – 1, 2008, p.vii).

This statement about how accessibility is determined introduces two crucial points. First, access depends on the “flexibility of the learning environment” and this flexibility requires taking into consideration several different dimensions, including: how information is presented and controlled, how information is structured and how the learner perceives information. As defined in the standard, *access mode* refers to “human sense perceptual system or cognitive faculty through which a user may process or perceive the content of a digital resource” (p.12). Second, in order to facilitate access, it is imperative to examine the “alternative-but-equivalent content and activities” provided by the learning environment. In other words, successful access does not depend exclusively on the abilities of the learner, but on providing alternative content and activities. Thus, the AccessForAll framework points to a careful examination of the actors and the relationships among them. *Access* takes place in the relationships between the learner and multiple layers of interaction with the information system (e.g. control methods, structure, and access mode).

Figure 5 provides a basic conceptual map developed by the researcher illustrating the major actors (Learners/Users and Information Resources) and dimensions involved in assuring flexibility and adaptability of the learning environment.
4.1.2 Matching PNP and DRD

The AccessForAll Framework provides a formal definition of the actors and dimensions involved in accessing information resources: Type A: user specifications, and Type B: resource descriptions. The former refers to the diverse abilities, needs, and preferences of an individual user. The latter refers to the characteristics and potentialities of information resources. A question that follows from these definitions is what makes Type A and Type B capable of an adequate matching. As presented above, the purpose of the AccessForAll framework is to facilitate flexibility of a learning environment in terms of providing adequate matches between Type A and Type B. Hence, it is crucial to examine what the characteristics in each of these types are. As stated in the AccessForAll Framework, Type A and Type B are two complementary sets of information, comprising:

“A) the description of a learner’s accessibility needs and preferences, including

1) how digital resources are to be displayed and structured,
2) how digital resources are to be controlled and operated
3) what supplementary or alternative digital resources are to be supplied;

B) the description of the characteristics of the resource that affect how it can be perceived, understood or interacted with by a user, including:
1) what sensory modalities are used in the resource,
2) the ways in which the resource is adaptable (i.e. whether text can be transformed automatically),
3) the methods of input the resource accepts, and
4) the available alternatives.” (ISO/IEC 24751 – 1, 2008, p.vii) [Emphasis added]

Matching Type A and Type B therefore entails a functional description of both a) users’ needs and preferences and b) digital resources. A fundamental principle in the AccessForAll Framework is that users (or eventually automated agents) can define Personal Needs and Preferences (PNP) profiles carrying information about their unique characteristics in a particular setting. Likewise, Digital Resource Descriptions (DRD) constitute a set of statements defining how a digital resource can be accessed, adapted or transformed. Then, what is expected from an information system implementing the AccessForAll Standard is that it provides an adequate match between PNP and DRD. In other words, the information system should be able to make inferences about what the users want, need or prefer (using the information encoded in the PNP profiles), then evaluate what resources better suit those needs (using information encoded in DRD) and finally, deliver the information resources. Figure 2 presents an UML diagram of the abstract model of the AccessForAll Framework.

![Access For All Abstract Model](Source: ISO/IEC 24751 – 1, 2008)

“Readers not familiar with UML class diagrams should note that lines starting with a block-diamond should be read as “contains a” or “has a” (for example “a needs and preferences has zero or more contextual descriptions”). Other relationships are labelled appropriately.” (ISO/IEC 24751 – 1, 2008, p.24)

**4.1.3 The Functional Approach**

As stated in “Access for all” Personal Needs and Preferences for Digital Delivery (ISO/IEC 24751 – 2, 2008) the descriptions of users needs and preferences (PNP) do not follow a “medical approach” (ISO/IEC 24751 – 2, 2008, p.12) based on specific human impairments like blindness, deafness or mobility impairments, among many others. Instead, the process of matching PNP with DRD adopts a “Functional Approach”. A key aspect in this approach is the re-definition of disability. Disability is taken
not as an essential human condition, but as heterogeneous and relational phenomena. The traditional (medical) perspective defining and categorizing disability has profound ethical and political consequences. The very concept of “disabled” implies stigmatization and discriminatory practices. As it is explained in the AccessForAll Framework:

“A medical approach would exclude many of the details that the system would require. One example would be a user with a learning disability: because learning disabilities are so varied that classification does not capture the range of options that can be offered in a functional description.”

4.2 Conceptualizing Access

4.2.1 What are we really accessing?

What does the term access mean in the expression Access For All? What was the motivation of the standard? Is the role of the standard to enhance user’s experience and interaction with ICT? What is the role of adaptability? What is it that you are granting access to? These were some of challenging questions discussed with participants.

Designers, software developers and the consultants contributing to the development of the AccessForAll framework were asked particular follow-up questions that could reveal the interpretations, as well as specific decisions, made in the implementation of the standard. The responses were diverse and overwhelmingly rich. In fact, exploring the idea behind the creation of the standard and the decisions made by software developers and designers during the creation of IS revealed several aspects about how the notion of access is conceptualized, and what role customization plays in adapting the interaction with technology and information resources. When the above questions were introduced to participants not familiar with AccessForAll, such as course content creators and instructors, the responses complemented other participants’ views. Interestingly, these particular dialogues also at times took quite different directions: from strong reactions to standardization practices in the design of information technologies, to major discussions about the nature of learning and teaching.

“What are we accessing?” is certainly a difficult question. In order to address the complexity of this question, the following sections analyze four closely interrelated emerging themes: equal access, adaptability, interoperability, and standardization.

9 Examining the discourses defining and inferring needs and preferences based on a specific ability is a subject of great debate in accessibility studies. The history of discriminatory practices has been always associated with the very definitions used to describe and classify differences and commonalities among people. Addressing this discussion about the history and evolution of the definition of disability is clearly beyond the scope of this presentation. Nonetheless, it is crucial to mention that the AccessForAll framework emphatically avoids a “disability-specific” notion of access to information resources. Some recent studies related to the redefinition of disability and its implication can be found in Nevile (2008), Treviranus & Roberts (2006), and Treviranus (2009).
4.2.2 Equal Access

The AccessForAll Framework has a long history that shaped its purpose and scope. The two accessibility consultants interviewed provided extended descriptions about previous research on accessibility, assistive technologies\(^{10}\) and the historical context within which AccessForAll was initially developed. These participants explained that several multiparty and worldwide research projects in accessibility preceded the AccessForAll Framework. In the context of this previous research, a salient observation was that AccessForAll started with a major commitment: to provide *equal access*\(^{11}\) to technology and information resources. It was also noted that equal access entails crucial questions about inclusion, social justice, democracy and empowerment of those using information technologies.

One of the participants explained that when the standard was initially conceptualized (in the early 1990s) a well-spread concern was to address the challenges brought by the “information age”. With the pervasive and rapid development of the Internet, the Canadian government like several other institutions worldwide, embarked in the construction of large-scale technological infrastructures. In this context, the demand for equal access implied a social concern about how accessible these infrastructures would and could be. Workstations available in public places such as libraries and community centres were “required to be usable and accessible”, the same participant emphasized. There was a need to design information technologies that could include as many people as possible. This demand entailed, in particular, the inclusion of people with disabilities and other minority groups.

After reviewing for the first time the AccessForAll Framework (ISO/IEC 24751, 2008), the researcher had the idea that the purpose AccessForAll was mainly to enhance users’ experience when interacting with ICT. However, when an accessibility consultant who contributed to the creation of AccessForAll was asked whether the standard was aimed to enhance user experience, the participant explained:

> “I don’t know if it [the standard] is meant to enhance the experience. You could use what’s there. For example, I cannot hear so I want the text caption of the video as well. You could use this as form of enhancement. However, the goal was not so much of enhancement but about equal access.”

\(^{10}\) The term Assistive technology (AT) refers to several different tools that enhance or facilitate modes of interaction. Some of the most common AT include, for example, screen readers and display magnifiers, Braille devices, voice recognition systems, and alternative keyboards.

\(^{11}\) The history and development of the notions “equal access” and “equal service” has been extensively studied by Martin Dowding (2002) in his doctoral dissertation: “National Information Infrastructure Development in Canada and U.S.” It is worth mentioning that equal access is pervasive discourse that still occurs in the development of ICT. Nonetheless, as Dowding suggests, careful and critical examinations of this discourse is required.
4.2.3 Meaning and Role of Adaptability

Adaptability plays a prominent role in enabling access to information resources, but also in the creation of opportunities for learning. Providing alternative information modalities was a major concern for participants familiar with AccessForAll. In the context of the AccessForAll framework, adaptability constitutes a major strategy to overcome the diverse circumstances that can place a person in a ‘situation of disability’: a mismatch between the person’s needs and the information environments. The relationship between adaptability and equal access is surrounded by some challenging questions that require detailed examination. This section explores the meaning of adaptability by analyzing how participants conceptualized the relationships and differences between AccessForAll and other accessibility guidelines, such as the Web Content Accessibility Guidelines (WCAG).

Four questions are addressed:

- What is adaptability?
- What features can be adapted? (interface and content)
- Who is the target of adaptability? (users or assistive technologies)
- What is the role of adaptation? (understanding and meaning-making)

What is Adaptability?

In the AccessForAll framework, the adaptability of information resources has a quite technical definition. It is defined as the:

“ability of a digital resource or delivery system to adjust the presentation, control methods, structure, access mode, and user supports, when delivered”

When participants use the term adaptability, it often relates to other expressions such as content modality, content adaptations, or content alternatives. Exploring these expressions became necessary in order to understand the meaning of adaptability and its role in the conceptualization of access. An accessibility consultant explained that content adaptations and content alternatives could be considered in many cases as synonymous. As she noted:

“The notion of content adaptation and alternatives are almost interchangeable. The adaptation is the resource that can be used as an alternative for a resource”.

What Features can be Adapted?

A software developer provided an additional clarification about the meaning of adaptability that reveals some of the key features already implemented. The participant explained that in the context of LMS, current implementation of the AccessForAll framework entails two aspects of adaptability: interface and content. As the participant noted:

“Right now, what we really implemented are the user interface adaptations. That is changing the font colors and sizes and presentation features – things like that; and the content adaptation aspects of the
standard. So you can replace either text or visual adaptations with audio content, [or] with another form that is audio, visual, text or sign language.” [Emphasis added]

In the above, the participant suggests that interface adaptations comprise the transformations that can be applied to a given content; for example, changing the colour, size or other styles in the presentation. Content adaptations refer to additional information resources in a different modality (e.g. text, audio, video, or sign language), which are provided as alternatives and/or replacement for another resource.

Who is the target of adaptability?

Interface and content adaptations play an important role when understanding the meaning of access to technology and information resources. Both AccessForAll, as well as some other approaches to accessibility such as the WCAG, emphasize this crucial role of interface and content adaptation. Nonetheless, the differences and complementary elements between these approaches highlight an emerging topic of debate among accessibility consultants, designers and software developers. While AccessFor conceptualizes access by emphasizing the learner and the relationships between the learner information resources, WCAG seem to provide much more emphasis on specific features of the content.

A software developer presented one key difference in the following terms:

“If someone has a reading disability, or difficulty with text, in terms of WCAG [Web Content Accessibility Guidelines] text is as much accessible as you can get. But, within AccessForAll, text can be a problem too for some people.”

This statement introduces a difficult issue in the conceptualization of accessibility. Among the different information modalities, text is commonly considered the “most” accessible. This is precisely the approach that the participant attributes to the WCAG. To a certain extent, text can be considered one of the most accessible information modalities - since it can be transformed or adjusted much more easily with the support of assistive technologies. For example, a blind person can access a website using a screen reader which transforms text to audio. An additional example presented by some of the participants was that text is much more adaptable and can be formatted or re-styled using CSS. Thus, people with low vision or colour blindness can easily adjust or transform the presentation of text. Differently, an image or an audio file cannot be easily transformed into another modality; therefore, these media formats would not be accessible for a larger audience (e.g. blind or deaf users) unless a text description was provided (e.g. captions or descriptive video).

Interesting subtleties differentiate AccessForAll from the WCAG. When the participant states “in terms of WCAG text is as much accessible as you can get”, what he is addressing seems to be a quite different issue than the value of text description and its compatibility with several assistive technologies. When asked for further explanation, the participant noted that AccessForAll implies a different
conceptualization of accessibility. Interface and content adaptations should not be linked to any particular
disability or information modality. Such an approach would constitute a great simplification of what
access to information resources really entails. This simplification is present in several accessibility
guidelines (including WCAG) as it tends to not only identify text with the most accessible information
modality, but also emphasizes compatibility with assistive technologies as a major definition of
accessibility. As the same participant explained:

“WCAG focuses more on the technical aspects of accessibility. Making sure that website and contents are
accessible to assistive technologies, primarily, whereas AccessForAll is more about the person, and their
ability to use different forms of content.”

A major issue with the WCAG’s approach is at stake in this participant’s response. WCAG tend to
underestimate the fact that text does not necessarily mean “accessible”. Text also sometimes introduces
challenges to those interacting with information technologies in particular scenarios. As the participant
noted, “text can be a problem too for some people”. He explained that some people may have difficulties
reading and would rather prefer the text to be read aloud or presented in a different modality. What is
quite important here is that pairing information modalities with specific abilities or disabilities might not
fully address the evolving and contextual nature of the interaction with technology and information
resources.

An additional side of this discussion is the complementary aspects between AccessForAll and
accessibility guidelines such as WCAG. An accessibility consultant pointed out:

“They [AccessForAll and WCAG] are complementary. They address different purposes.”

“WCAG are guidelines for creating content. It tells you how you make content accessible, whereas
AccessForAll is a metadata standard for describing the content.”

“WCAG are guidelines for people creating content that is accessible. They are about what people can do
instead, in order to make content accessible. The AccessForAll comes after that. Once you have some
content, the metadata is used to describe the content. Then the preferences are used to explain what a
person needs out of the content. They [AccessForAll and WCAG] are not alternatives but complementary
towards the same goal”. [Emphasis added]

The description provided by the consultant above illustrates the complementary yet different “purposes”
of AccessForAll and WCAG. The first point that deserves attention in these responses is the apparent
contradiction between “addressing different purposes” on one hand, and “complementary towards the
same goal” on the other. The participant, however, explains this further. “Accessibility” is that high-level
goal shared by both AccessForAll and WCAG – the “same goal”. Their “purposes” are rather different, in
terms of how they conceptualize what should be conducted in order to achieve such a high-level goal. As
presented earlier, a software developer stressed that WCAG were primarily focused on the technology;
mainly, on whether interface and content aspects are compatible with assistive technologies. On the
contrary, AccessForAll is “more about the person”. The consultant’s response adds an interesting point.
AccessForAll is a metadata standard. It provides a way to “describe” both information and assistive technologies. This strategy is what both participants seem to agree on.

A second important note in the consultant’s response is that AccessForAll “comes after”: after you have some content, technology or information resources, only then you start understanding how all these aspects can be put together in order to enable users to make sense of the what they are interacting with or having access to. Indeed, one software developer put it quite sharply:

“[…] AccessForAll is more about adapting the content to the learner.” [Emphasis added]

**What is the role of adaptation?**

Understanding the role of adaptation requires examining both the meaning of adaptability and its target - for whom or what should be adapted. An additional point that remains unclear is how the role of adaptability is conceptualized. In other words, what are the benefits of adaptability?

One software developer pointed toward a response to the above question by highlighting at least three benefits of multiple information modalities: 1) access to the “same information” 2) the ability to understand “something” and, 3) a wide audience can use the system. The following responses illustrate this:

“[…] providing alternatives to the text perhaps, if you are describing something you may want to include along with it. Someone that has difficulty reading can look at the image and get the same information.”

“I think the standard [AccessForAll] assumes them [content modalities] as equal. I agree that switching modalities may not be the best approach, but providing **multiple modalities** certainly increases the chances that a learner is going to learn something. With multiple modalities, the chances are that you are going to understand with one of them.

“So the whole idea behind AccessForAll is to make this particular piece of content adaptable in a bunch of many different forms so that as broader as possible audience can use it” [Emphasis added]

A few remarks are relevant in these responses. Although the participant acknowledges that there might be issues with the translation from one modality to another – content modalities probably do not constitute the “same information” – there are benefits to having different modalities. Namely, they expand the possibilities for “understanding”, while also taking into consideration that a wide audience should be able to use the information systems. In terms of sense and meaning-making, the role of information modalities may be better understood in reference to the value they add when provided simultaneously - “along with it” as the participant explained - rather than by an “alternative-but-equivalent” framework (ISO/IEC 24751 – 1, 2008, p.vii). The notions of **translation** and **content modalities**, as well as the separation between of **content** and **presentation**, have important conceptual implications and will be addressed later in the chapter (Section: 4.5 Philosophical Challenges).
Finally, participants’ comments and reactions to the approach adopted by the WCAG introduce an important point for the conceptualization of access and its relationship with adaptability. If accessibility is mainly defined by features of the information resource, such as compatibility with assistive technology, access becomes a success criteria defined by a fixed list of principles. This checklist approach is the “wrong approach”, a designer sharply emphasized. The perspective is grounded in a major limitation: accessibility does not depend only on features of the information resource. What makes a resource accessible is dependent on particular contexts, including questions like for whom, when, and how relevant is the content for individual users.

**4.2.4 Interoperability**

Among participants, the definition and role of interoperability, as well as its role in defining the meaning of accessibility is a heated and interesting theme. Interoperability is broadly defined as the ability of a system to interact and communicate with other systems. In context of the AccessForAll Framework, improving and facilitating the interoperability among information systems and assistive technologies is a clearly stated purpose. As presented in Section 4.4: *The importance of interoperability and consistent implementation*, the AccessForAll Framework notes:

> “Many individuals with a physical sensory or intellectual impairment are dependent on assistive technologies to use an IT system. From an information technology developer’s perspective every individual using an assistive technology potentially represents an external system that needs to interoperate.”

When asking participants to explain the meaning and the challenges entailed in the design of interoperable systems, several interesting and complementary points were raised. The very idea of creating the AccessForAll standard started with quite practical and technical challenges, as an accessibility consultant pointed out:

> “There were a lot of different assistive technologies out there,—proprietary and commercial systems and they all work in a different way. So, taking the idea of the systems we developed and creating a standard out of them was to improve interoperability between different systems”.

A demand for interoperability becomes evident when a user needs to interact with several different hardware and software solutions. Almost unanimously, participants agreed that they observed a common practice among ICT’s vendors and manufacturers: they tend to develop their own standards and provide closed solutions. A popular example of this practice is present in learning and content management systems. Proprietary LMS (e.g. Backboard LMS) as well as open-source solutions (e.g. Atutor, Moodle, Sakai) implement standards and apply particular rules and strategies for structuring and archiving information, a software developer explained. However, these rules and strategies are not always compatible with one another. Although most of LMS (proprietary and open-source alike) can indeed
import and sometimes export information from and to other systems, these features do not necessarily address users’ needs and preferences about visualization or controlling devices.

Interoperability was certainty a term triggering quite mixed reactions among accessibility consultants, designers and software developers. For example, when asked about the meaning of interoperability, an interaction designer who had also a great deal of experience with assistive technologies, commented that standards used by proprietary hardware manufactures tend to reduce interoperability. As the participant explained, “if they [hardware manufacturers] do have standards, they are not necessarily open standards”. The participant was referring to complex pieces of hardware, such as power wheelchairs and head-tracking devices. He emphasized that those technologies have the ability to do much more than they were designed for: they could eventually communicate with many other devices, but unfortunately, the standards by which they operate are not publicly known. They are “closed”; the standards are not available to the public, and most of the time are protected under strict copyright laws that strongly discourage any reverse engineering12.

The relationships between interoperability and copyright patents are a delicate subject. It was evident during the interviews that disentangling the discourse and the implications of these intricate relationships was challenging, and different participants had quite strong positions. A designer, for example, explained that for many companies developing learning management systems, the notion of interoperability usually means the consumption of content. As he put it:

“What is interoperability is a hard question to answer. […] I would say that interoperability is such a huge responsibility. One of the things you see with commercial vendors is that often they use the word open and interoperable to talk about how they can consume content in some standard format.”

This participant was referring to the ability of LMS to import course content packages; for example, course materials that instructors used in one semester can be easily packaged and further imported into a new class in the following semester. The participant’s concern, however, was that consuming content does not fully address the scope or diverse challenges of accessibility. He stressed further that interoperability entails much more, it implies “bi-directionality”: a two-way communication where LMS should be able to send their content to other systems as well. As the participant emphatically stated:

“A crucial question to the vendors is: ‘are you willing to share your information back?’”

“Just consuming content or just producing content is not interoperability”

12 “Reverse engineering is the process of discovering the technological principles of a device, object or system through analysis of its structure, function and operation.” http://en.wikipedia.org/wiki/Reverse_engineering
4.2.5 Standardization

The notion of interoperability presented above has opened a discussion about the role of standardization. When understanding the challenges and the need for interoperable systems, some questions emerged during the interviews: what is the role of standards? Does standardization facilitate or prevent access? Can standardization promote diversity? These questions may seem counter-intuitive from a layperson perspective. It is common to think that the word “standard” implies fixed principles and classifications. Indeed, this was the notion the researcher had in mind when approaching participants. In order to introduce this notion, the researcher asked the following question: *A major principle of AccessForAll is to promote diversity and inclusion, but creating a standard seems to me like creating a fixed thing. How do you understand this relationship?*

Several reactions followed this question. One of these was particularly inspiring: “standards and inclusion should not be at odds”, an interaction designer pointed out. The participant explained that standards are a common language, and sharing a common language in the design of information technologies is precisely how different systems can communicate with each other. This perspective was also addressed by an accessibility consultant. While commenting on the evolving nature of standards, the participant emphasized the need for communication among standards:

> “Standards evolve. They get updated: you have version 1, 2, etc. Because, even if you standardized, technologies change. So you go back and you revise your standard to reflect the changes. So, standardization is not writing a stone forever, but it is promoting interoperability. [for example] If one proprietary system comes up with a new interface, but it only works with itself but not with anything else, that doesn’t encourage broad adoption.”

In this response, what seems to be key when assessing the role and challenges of standardization are questions about the *evolution* and *openness* of standards. HTML, for example, is one of the oldest Internet standards and the dominant markup language for displaying and organizing content on a web page. In fact, as the same participant noted, today, almost two decades after its first release, HTML is launching its fifth version\(^\text{13}\). The evolution of the HTML standard prompted an interesting issue: if standards evolve, how do they do so? In other words, what triggers the evolution of standards? The accessibility consultant suggested that standards evolve because they are publicly available and under permanent discussion and revision. The following response presents this idea:

> “If you have a publicly available standard and everybody agrees to use the same standard, then all these different systems can all communicate with each other, on the basic assumption than that standardization will be there.”

This statement introduces a slightly but complementary perspective about the role of *open* and *public* standards. Standards, and particularly standards in IS, are developed not only based on previous

agreements (e.g. the selection of valid HTML tags), but evolve on the basis of its use and adoption. Thus, standards are subject to strict agreements, which most of the time involve quite technical levels such as the naming conventions and the structure of the standard. However, the evolution of a standard and its establishment as a “common language” is also driven by its adoption and implementation. The response from a software developer was revealing in understanding how the implementation of a standard actually provides feedback and further refinements:

“We realized that many of the standards we use aren’t perfect but they are important. And after we realize and implement them and find the issues we submit the issues and they get introduced into the standard, with corrections or adaptations to the existing standards. It evolves.”

First, the standard is implemented and tested. Then, the issues found are submitted to the creators of the standard, and this stimulates its evolution. The participant addressed the question about standardization and the promotion of diversity, explaining that standards are needed in order to provide content adaptation that match specific user’s needs and preferences. In this context, standardization is conceptualized as a precondition for the distribution of learning materials across several different platforms. Another participant presented this idea in the following response:

“One of the major ideas [in the AccessForAll Framework] is that there has to be standards in order to make content or learning materials to work across very different systems.”

“The main issue here is that on top of standards like Common Cartridge and content packaging, which allows systems to share the content, there needs to be a standard to create content that is adaptable and allows users to define preferences when they are using different systems.”

“Otherwise everybody is going to come up with their own [standard] and nothing is going to work with anything else.”

Two major points are stressed in the statements above. Standardization is key in providing consistency in the distribution of information, and particularly, in the distribution of learning materials. Furthermore, although popular standards for content delivery such as Common Cartridge\(^\text{14}\) (IMS Content Packaging, 2009) have indeed advanced the creation of a common language for this purpose, “the main issue [...] on top of” such standards is that there is a need for standards in the creation of adaptable content. This last point resembles one of the major arguments in AccessForAll about the role of standards and interoperability when addressing learners’ needs and preferences (as presented earlier in this chapter).

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\(^{14}\) Common Cartridge is a standard created by IMS Global Learning Consortium (IMS) for sorting, structuring and delivering learning materials across several learning management systems. As explained at the IMS’s website: “Common Cartridge is the first of three major standards that comprise a new generation of Digital Learning Services standards to support a new generation of learning technology. These are:
  * Organized and distributed digital learning content;
  * Applications, systems, and mash-ups; and
  * Learner information: privileges and outcomes.
Some of the other reactions to the question about role of standards and the promotion of inclusion led to quite political and economic arenas. An interaction designer, who had much experience with accessibility standards, explained that the design of standards and their implementation entails several “institutional” challenges. He explained that the actual refinement and evolution of several standards, including the Common Cartridge standard, “have been driven by open-source initiatives”. This might seem to be a “contradiction” he later added, since some of these standards are not free. They cannot be accessed without “paying fees”, while many of the tools actually implementing the standards are freely available.

A contrasting perspective about standardization came from instructors and creators of online courses. One of the instructors who was not familiar with the AccessForAll standard, but had several years of experience using LMS, suggested that the standardization of content is in fact very important. As a researcher in archives and library science, the participant emphasized how important standardization is in this area. Consistency has great implications in providing accuracy of what is stored and archived. However, when asked about the role of standardization of learning materials in the preparation and the conduction of her classes, several points were raised about standards in the educational context. The participant first described the process followed in the preparation of a course, as follows:

“I tend to go through previous PowerPoint slides. So what do I do? I tend to go through the readings set for that week. And I’ll make notes about what’s in on the readings. You know, I’ll add to my slides or whatever. So, I will use all the readings they’ve [the students] read. I’ll probably use maybe other readings.”

Later, the participant addressed the notion of content re-use and provided an interesting point about the challenges of standardization. As she explained, the content in her class not only evolves, but in many cases is not the most important part of her teaching. As the participant pointed out:

“In one way though, I believe strongly in preservation, I don’t care much about preservation when I’m about to teach a class. I care about whether the last time I taught this class, what I used, so I can re-use it. But I really don’t care about the next time I’m gonna use this class.”

This instructor’s response introduces a challenging perspective on standardization. The emphasis on content re-usability common to many of the LMS she had used, might not be the major issue or the most useful tool for her teaching style. As the instructor emphasized: “I obviously like much more the performance mode. I like to see that instant reaction”. With this expression, the instructor was referring to her preference for live in-class interaction, when she can “see” students’ reactions and respond accordingly. As explained later, it is quite common that professors change the direction of the class and the learning materials based on students questions.

The implications of standardization were also addressed by a different instructor, who had extensive experience migrating content among many different LMS. For this participant it was clear that transferring her class content from one system to another proved quite useful, in particular when
designing course contents for adult education at different institutions. The participant pointed out that “packaging and zipping content” was a common practice. However, when using these functions for importing and exporting “class packages”, there are also great differences among LMS, including for example naming conventions and presentation. As the participant explained noted:

“There are issues with the categorization each system uses to store and define the content. Some systems don’t agree on the naming, the position of headings for example. […] Sometimes, the process of moving course contents from one system to another may require more or the same amount of time spent when creating it the first time.”

This section has outlined some of the most diverse reactions to standardization. It is clear at this point, that in the context of the AccessForAll framework, standardization has strong arguments as it assures crucial agreements for the creation of a common language in IS design. Additionally, there were several other reactions that extended beyond strictly “technical” dimensions of standardization. The comments and responses from instructors and those creating content for online courses pointed to issues of assessment and some of the implications in teaching styles, as well as learning preferences, that come with the introduction of e-learning environments. Participant’s comments and reactions related to teaching/learning practices and the tensions between pedagogical models and e-learning, are addressed later in this chapter.

4.3 The Scope of Customization

As presented earlier (section 4.1.1), in the context of the AccessForAll framework a PNP profile refers to descriptions “associated with the user’s functional abilities and the assistive technology or other non-standard technology in use” (ISO/IEC 24751 – 2, 2008, p.12). This functional approach includes a great number of customization features (see Appendix J for a complete list).

When analyzing participants’ responses it became evident that although the AccessForAll specification provides a comprehensive description of what can be customized, the standard does not include detailed explanations about how these features are implemented. This challenge, of course, is not one of the stated purposes of the standard and it would be unfair to raise critiques based on this demand. However, the purpose of the following sections is precisely to explore this how of customization. It analyzes how participants actually perceive and interpret the AccessForAll framework. In particular, it examines participants’ descriptions of their work practice and how customization is conceptualized during the implementation of PNP profiles. Some of the questions that led discussion with participants about the scope of customization included:

a) How do you create a PNP profile?
b) What can be stored in that PNP profile?
c) How does the system use this profile?
4.3.1 Creating PNP Profiles

When addressing these questions, one of the software developers interviewed started by presenting a diagram explaining the core mechanism he had developed for the implementation of the AccessForAll framework. He explained:

“[The system = LMS] is actually here [ participant draws a circle around the two lists.] 1) preferences, 2) content options. Because it is a system, there is a gate, the login system. When you login, you connect to the system and it maps the profile for any content the user wants to see. Once the user logs-in the profile will be set for the whole duration of your session. And the system will recognize what type of media it is and will replace and fit to content to the user needs.”

![Figure 8 – Matching users needs and content options](image)

Note that the figure above is an adaptation of the diagram constructed by the software developer and the researcher.

The emphasis on the log-in mechanism triggered two additional questions. The researcher asked the participant to explain what he meant in the statements: “it [the system] maps the profile” and “the profile will be set”. The participant further explained that the PNP profiles were already stored in the LMS. During the log-in process, the system would read this profile and adjust the appearance of the LMS and deliver the content modalities according to user’s preferences.

When the two software developers interviewed were asked about the process of creating a PNP profile, they both explained that there was already a “wizard” or assistant for this purpose. One of the software developers noted that the “PNP wizard” is comprised of a series of questions that allow the user to decide several features about content alternatives, as well as the visualization layout of the LMS.

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15 The design of this wizard for collecting users’ needs and preferences came out of the projects and research conducted preceding the design of the AccessForAll framework. The choices were based on what users “tend to customize” when using assistive technologies, as an accessibility consultant explained. (The rationale for the development of the questions and customizable features is presented later in this section)
Figure 7 presents the first set of preferences that can be stored in the PNP profile. It is important to mention here that this PNP does not comprise the implementation of the entire AccessForAll specification. (Appendix I includes a complete set of images presenting all the steps and preferences that can be set in the creation of a PNP profile).

In the first step of the PNP Wizard the scope and type of preferences include: “Make text easy to see”, “enhance navigation of the content”, and preferences for either replacement or addition of content modalities if available (text, audio, visual).

4.3.2 Rationale for the Identification of PNP

In order to understand the decisions made about what can/should be customized when implementing the AccessForAll framework, participants (primarily accessibility consultants, designers and software developers) were asked to addressed the following questions: How were PNP wizards designed? What is PNP? What does a PNP profile look like?

How were PNP Wizards designed?

Responding to this question, software developers and consultants pointed to previous research conducted on users of assistive technologies. They referenced projects such as TILE (2004) and Web4All (2006) as examples of how the wizards for the creation of PNP profiles were developed. The selection of specific features was grounded in observations that accessibility experts had made of people using assistive technologies. As one of the participants pointed out:

“[…] it [the creation of wizards] was based on knowledge about what technologies we needed to configure. We consulted with [accessibility experts - names omitted], and we worked with people with disabilities that tried to use the technologies, and learnt about what aspects of these technologies people tend to
An interesting aspect of this quote is that by basing the identification of features on what people “tend to customize”, designers and developers may limit the horizon of what is customizable. On the one hand, identifying what people actually customize brings attention to practices in the use of technology; for example, the assistive technologies currently used (e.g. screen readers, display magnifiers) and the known features being customized (e.g. speech rate, maximum or minimum display magnification, among many others). On the other hand, however, the difficulty of asking people is that in many cases they do not know what features are available for customization. Furthermore, people may want to customize all sorts of things, but may not be able to do it. Thus, these features would not be reported in the list of things people “tend to customize”. Some of these issues became clear when listening to the challenges faced by instructors and content creators and will be addressed more thoroughly later in the chapter (section: 4.4 Educational Frameworks and Practices).

**What is PNP?**

When asked to explain in simple terms what a PNP profile is, and how these profiles translate into users’ decisions, one of the software developers provided the following description:

> “The Profile Preferences I set up, to say, “I prefer to have…”, for example, when there is a visual representation, I want it to be replaced by text. So, that is my preference. So, audio I wanted to be replaced, say, by sign languages or visual or other things. It is like a replacement of the actual content.”

An additional description from an accessibility consultant provides some insight about what type of decisions users can encode in a PNP profile and how they interact with DRD:

> “The PNP profiles are statements such as “I want French captions”. And the DRD on the other hand says: “This resource has French captions”.

> “The content area of DRD and PNP use exactly the same vocabulary, there is a one-to-one match”

**What does a PNP profile look like?**

Figure 10 presents an example of how the multiple features comprised in the AccessForAll standard can be represented using an xml scheme. It is important to note that the AccessForAll framework will be eventually implemented using different languages (e.g. html). An accessibility consultant explained that international bodies such as the IMS Global Consortium had already adapted the initial AccessForAll ISO standard (ISO/IEC 24751 2008) and provided specific XML representations like the one presented below.
4.3.3 Stretching the "Normal" User

One of the major issues discovered in the IS design literature is the conceptualization of users’ requirements. This challenge was introduced to all participants, but particularly to designers who had experience in “collecting” information about users’ needs in order to design new or enhance existing technologies. The purpose here was to listen to the ways in which participants described the design process and the methods used in “gathering” users’ requirements and how accessibility is translated into specific design decisions. Some of the questions asked to participants included: *Can you describe, briefly, the steps that you follow when designing a new interface?* Additionally, follow-up questions were also introduced to invite participants to think about the implications of customization, for example: *Where do you think customization really starts? Does customization have any implications for your design?*

An interaction designer pointed out:

“We don’t have such a thing like algorithms for design like [they] do in software. Some people say that design is a black art, you either have the sense for it or you don’t. And that is one school of thought. So there is a trend which tries to formalize interaction design.”

The participant later described extensively the multiple difficulties that designers usually face when attempting to *know* what users really want or need. The following two lists present a summary of the key facets that the participant associated with 1) User-Centered Design and 2) Participatory Design.
User-Centered Design

“We rely on User Centered Design, and we use the User Centered Design cycle.”

“You start with analysis, requirements gathering, talking to the users and all stakeholders. You try to find what are their needs and gaps. How do they use the current systems? Whether they like the systems they have or not. […] “You analyze other products and companies” […] “You use ethnographies and contextual inquiry”

“Then you move on to design conceptualization. You create a vision. What your design will actually look like for the users”

“Only after this conceptualization we get into the design of interfaces, and actually start drawing, sketching, wire-framing, or creating mock-ups etc.”

“The purpose of this drawing stage phase is to get a sense what the system will look like and how it will behave.”

“This stage comes necessarily after you have talked to stakeholders or subject matter experts, after you have done your research. Ideally, you would be talking also to users before you get to that drawing stage”

Participatory Design

“We strongly believe in participatory design.”

“They [users] come in early and often.”

“As I said before, we first go to talk to the users and only then, we start our designs.”

“Right after we do our designs we go to the users again, we show it to them. We ask them to go through it.”

“All their feedback includes things like indirect and direct feedback. Indirect feedback means like watching them using it [the application] and looking at the struggles they had, etc. Direct feedback are comments or suggestions or ideas the users had.”

“All the feedback goes right back into the design and the next iteration.”

“This back and forth process between users and designers continues through several iterations depending of the project.”

In these quotes, there are key references to the possible interactions between users and designers. User’s requirements seem to emerge not from a linear, but an iterative process. A theme that came forward during the discussion was the multiple communication challenges that take place in these dialogues between users and designs. The participant stressed that although Participatory Design and User-Centered Design provide valuable principles guiding designers’ role, “We don’t have such a thing like algorithms for design”. The participant explained further about these challenges entailed in “gathering users’ requirements” with the following statement:

“There are additional micro and macro challenges. You have for example a high level goal like: “you want to create an engaging museum experience that reuses some of the content”. Then you have to ask yourself “what do you mean by that?” What content? Are you referring to the artefact itself or its history? Are we talking about what happens in the museum or in a classroom? Are you thinking about using the artefact at
home, on your laptop or on your mobile phone, etc. It gets into all sorts of different really big questions, before you can actually narrow down the design into specific functionality. (e.g. play a video, display a description, including audio, etc)"

The complexity of the design process entails several mediations - “micro and macro challenges” – as the participant suggests. However, in the participant’s statements there is also an assumption not so well recognized: a sharp distinction between users and designers. In context of the Participatory Design initiatives (as presented in Chapter 2), a critical perspective refers not only to the “process of mutual learning, where designers and users learn from and about each other” (Löwgren & Stolterman, 2004: 152), but also to deeper questions about how such a learning process occurs and what role communities play in facilitating it. These questions merit further analysis and will be discussed in Chapter 5. For the moment, it is crucial mentioning that there is a well-established division of labour: the separation between designers and users. In the context of customization, this same division is usually present between those who decide what can be customized (designers) and those who actually customize (users). Thus, this division of labour remains a prevalent discourse and common to several initiatives in IS design.

**Pros and Cons of Personas**

After extensive descriptions and explanations about the multiple actions taken to include users in the design process, the same interaction designer introduced a particularly relevant theme: the challenges and benefits of using Personas in the conceptualization and elicitation of users’ needs and preferences. As the participant explained:

“Personas involve the creation of fictional or archetypical, prototypical groups of users. Groups of users have several similar characteristics. So a persona is a prototypical user created out of a group of users. The group of users represents particular demographic or other criteria that define the group. Personas are not only used in design, they are used a lot, especially in marketing.”

During the interview, it emerged that the use of personas is a common strategy for gathering and formalizing user requirements. It seemed that the use of personas could provide a concrete example of designing and promoting inclusion. This hypothesis was then presented to the participant. His response was surprisingly self-critical (reflective). As the participant pointed out:

“The beauty about personas is that it is trying to make a group, kind of compact into one individual, but you lose the nuances of individual characteristics.”

When the participant was prompted for further explanation, it became clear that Personas have both great advantages as well as serious difficulties. On the one hand, the use of Personas can be translated into quite specific design decisions. As the participant described, you can assign specific behaviours and goals to this hypothetical character. For example: “Lucy likes x”, or “Lucy needs a screen reader to access the web”. On the other, Personas introduce a limitation based on the loss of detail and characteristics of the
target population being represented. The designer not only misses the “nuances”, but also can fall into discriminatory practices while stereotyping and labelling a particular group.

The participant noted that Personas can evolve, grow or shrink in terms of the “level of granularity” the designer wants to go in defining the details of Personas. This of course, he added, depends on the scope and limitations of a particular project:

“You can keep on going down into more and more granularity, but then eventually you will be talking about actual people [a particular individual].”

An important conclusion that followed this dialogue was that an inclusive approach to IS design requires “widening the demographics”: not designing for a predefined or single user.

“The easiest way is to design to one demographic: a single user, only one type of user, one type of need. I'm not going to deny it, that is the easiest way. To pretend that there are no users with visual impairments or no users with agility difficulties (e.g., using the keyboard or mouse) is both easy and naive.”

“We don't believe that one-size-fits all solution. We know that every user has different needs, but we do try to start with the very basic [requirements]. We are not going to create an interface where all the text is super tiny and small and only people with the best eyes will be able to see it.”

A comment from a different designer addressed a major principle in Inclusive Design Initiatives, introducing a comparison with the “one-size-fits all” characterization of Universal Design. As he sharply stated:

“Universal Design it is not possible. It does not exist. You can never optimize for everything. If you design for everything/everyone, it [the system] is optimal for nothing”.

The implications of such bold statements will require further discussion. In section: 5.1.3 Universality vs. Inclusion (Chapter 5), the researcher will address some agreements and disagreements present in Universal and Inclusive Design initiatives.

### 4.3.4 When is Customization “too much”? 

The question *When is Customization “too much”*? was intentionally introduced to all participants; though the researcher was aware of the biased implied in the question, since “too much” may suggest a negative connotation to customization. Nonetheless, this rhetorical strategy proved to be quite inspiring and provided overwhelmingly rich responses from all participants; both from those familiar with the AccessForAll framework, but also from instructors whose frustrations exposed their emphatic discontent when customizing LMS.
**Built-in vs. User Controlled: What is a “Good” Design**

Participants were asked open questions like: *What can be customized? or How do you assess what features should be customized?* Addressing such questions was in fact challenging, even for those familiar with the AccessForAll Framework and computer savvy using LMS.

A strategy the researcher followed then was to ask participants to provide both examples of what can and what cannot be customized; when features are built-in and when is time to hand control to the users.

A software developer, who was creating a photo gallery with the ability to add descriptive text to every image, provided an interesting example of built-in features:

“[…] for the “Photo Gallery” that I was working on, what I wanted to do was to “slide” [effect], so, when you have like ten pictures or more. What you want to do is you have Previous and Next [buttons or labels]. So it is like slide and show the next set.”

The participant explained that the “slide effect” is a feature common to many photo galleries. This “slide” is a visualization effect that moves the current set of images when the user clicks on the Next and Previous buttons. It looks like as if the user were using a finger to go to the next set. The software developer explained that this feature was not really “accessible”, because blind users for example, would not be able to use the mouse in order to access the comments or navigate to the next set of images. Thus, the strategy used by the software developer was to add a built-in and fixed feature to the Photo Gallery. This feature would allow any user to go through the images and comments without using the mouse. As the participant further explained, in many cases providing accessibility depends on making these “decisions” in the computer program, while not expecting the user would select or prefer the feature.

The participant presents additional details about how his solution is actually compatible with screen readers:

“So, for the screen readers, what I did was: the “previous” and “next” [buttons] are still there, but when you “TAB” [press the TAB key in the keyboard] they will go through all the pictures. So, in their mind is kind of “sliding”, but the pictures are all there. So when they [the blind user for example] “TAB”, they will go to the next set in images”.

**Customizing the appearance of a banking application**

One of the interaction designers presented an example where excessive customization proved to be unnecessary. As he stated: “I believe that too much customization is too complicated and unnecessary”.

“Allowing the customer to customize the appearance of a website, a banking application for instance, allowing the user to change the contrast of the website is a good thing. But it doesn’t need to be so nuanced that they have 40 different options of contrast: black and white, or white on black is sufficient in most of the cases. But having contrast options such as yellow on blue, purple on yellow.. etc. for whatever reasons: both the contrast and re aesthetics it is not necessary”.

The participant concluded his example with quite strong arguments about why designers should pay careful attention when assessing the need for customization and giving control to the users.
“I’ve always believe that designers should not allow the customization of an application that will lead to stupid decisions – for lack of a better word. There are applications out there that are so customizable, so flexible that you are practically asking the user to program it. And they [the users] could very well make [the interaction with ICT] more difficult for themselves.” [Emphasis added]

The researcher ask the participant to explain what those “stupid decision” could be, and what where their implications for designers. The participant stressed that when the user is provided with too many options for customization, designers are offering options that add to much complexity. Such complexity is not helpful for two main reasons, the designer explained:

“A) The user is liable to making bad decisions on the customization, and b) even if they are all good decisions, it is like the candy shop problem. You are bringing a kid to a candy shop and he can't decide which candy he wants to buy. There are just too many options.” [Emphasis added]

**Instructor Reaction: “when customization is too much”**

One of the instructors interviewed complemented quite accurately the “candy shop” scenario presented above. The instructor’s response also stresses a new aspect of excessive customization options: the time needed to learn about such options.

“I don’t want to set any preferences. I want the system just to know what I want and the way I work best. […] I don’t know how to use my cell phone, because it is way to complicated. Way too many options. But you know, my own home phone, the one I grew up with: real simple. […] I don’t want the bells and whistles, because I don’t want to spend time to learn it.

The responses presented in this section reveal a tension with customization and complexity. On the one hand, customization allows users to have their “own solution”, but on the other hand, it creates more challenging environments where users have to learn and configure. Extreme customization is thus undesirable and in many cases may undermine the goals it is trying to achieve.

**4.4 Educational Frameworks and Practices**

Previous sections of this chapter have introduced references to the role of technology in educational practices. In section 4.2.3, for example, the role of alternative information modalities was revealed as an important factor in facilitating the interpretation of information resources. Moreover, section 4.2.5 presented a discussion about standardization in delivery of learning materials. Some of the participant’s reactions to standardization initiatives included the evolution of class contents, the performance mode characteristic of the interactions between instructor and students, and issues with the categories and structures used by prominent content packaging technologies (e.g. Common Cartridge).

The following sections now turn to review and expand these references to the relationship between education and information technology. The purpose here is to provide additional perspectives and details
about the contexts in which these references arose, in order to highlight some important implications and
correlates in the conceptualization of learning and the role of information technology.

4.4.1 Technology vs. Learning?

One of the most common themes among instructors is the relationship between learning and technology.
This was a difficult question approached at several stages during the interviews. Participants were asked
to think about how technology supports their work practices, how they would like technology to adapt to
their needs and to provide examples in which technology did or did not support their teaching styles and
goals. This section presents different but complementary scenarios put forward by the instructors
interviewed.

E-learning and on-site classrooms

One intriguing statement was presented by an instructor who, on one occasion, had used a
videoconferencing technology in combination with a LMS. The instructor was conducting a course
simultaneously at three different locations. She reflected:

“I think the technology was way too much of a detriment. And the three cultures were so different. For
example [in one location] people would get off and leave the class and come back later in 15 min” etc. “you
could see the class physically and there will be nobody there”.

After explaining about some other difficulties that arose due to technical issues such as setting up
equipment and coordinating among different time zones, the instructor emphasized that the relative
“failure” of that class was much more related to the different cultures. One of the “additional
characteristics of the culture in this location”, she explained, was that some students used to leave and return to class during the lecture. The lecture model used by the instructor in this particular case proved
difficult to implement and perhaps not very relevant for some students.

The same instructor presented an additional example of technology use that had quite successful results;
a “hybrid” course using both an online journal and “on-site” teaching. In this case, technology was used
to support a practicum course in which students were ask to go into the field, interview practitioners
(archivists and librarians), take notes and finally, post their experiences in the online journal. This
experience, the participant explained, was quite successful and surprising. “The use of online technologies
forces each student in the class to participate”. As she noted later:

“You [the instructor] actually get to know the students much better because you are reading every single
line. You are reading it in their own voice and you can know what they are doing and feeling”.

[on the other hand] “When you are on-site in a classroom, you don’t get that. It’s a performance mode.”
One of the interesting conclusions the participant emphasized was that preferring e-Learning versus on-site class has to do with the preferences and abilities of both students and teachers.

**Pedagogical Models and the role of E-learning and on-site classrooms**

The experiences with LMS described by different instructor introduced additional and complementary perspectives on the role on technology and learning. One of the first statements during the interview put forward quite challenging arguments:

> “Learning scientists use technology to address their questions about learning. So, when I have a model for learning, in my case it is a complex pedagogical model for how communities of people can develop knowledge. Then, I don’t need technology for that model. Technology isn’t anywhere in that model. But, some of these models are very hard to implement without technology, for example scientific simulations and visualizations”

There are important points that deserve further analysis. On the one hand, the participant brings attention to the design of pedagogical models and whether the presence of technology is part of the conceptualization of those models. As the participant explained technology “isn’t anywhere in that model”. On the other hand, the participant also stresses the difficulties entailed in implementing these complex models “without technology”. In a follow-up question, the researcher asked the instructor to comment on how he perceived current trends in e-learning. His response included:

> “The concept of e-Learning was a joke 5 years ago, it was a joke 10 years ago, and it was a joke 15 years ago. But it is not a joke anymore. Some of the most important forms of learning now are e-learning.”

After this puzzling statement, the researcher asked the participant to expand on what “important forms of learning” he considered to have emerged with the development of new technologies. He was also requested to comment on whether those new forms of learning were related to the ability that information technology has to deliver content. The instructor responded in the following way:

> “I think that old e-Learning was pushing the lecture model of a course through the web, there is still a lot of that happening. I don’t even think that deserves much consideration. But, e-Learning, where we start to see widely wikis and wiki-based courses massively online; courses where I have 3000 people in one course, Peer-to-Peer university: new kinds of models are emerging and unfolding.”

**4.4.2 Learning Styles vs. Learning Preferences**

There was a unanimous agreement on individual differences among the participants. These differences were not only stressed as needs and preferences for interacting with technology and accessing information resources; the conceptualization of these individual and unique needs extend to learning practices. “Everybody learns differently” as one of the participants put it. Throughout the interviews, almost all participants provided comments on this “uniqueness” and used different expressions to stress the
individual needs of the learner. This notion of “individuality” and uniqueness in the way people learn was usually conceptualized as well-defined styles for learning such as “visual learner”, “oral learner” and “textual learner”, among others.

However, several critical perspectives also became evident. For example, when asked to think about whether detailed profiles (e.g. PNP and DRD profiles) could eventually be created to capture specific learning needs, one instructor’s response cast doubt:

“I would first question the ability to...[pause] You can ask some people what is their preferred method of learning, and they won’t be able to tell you. Many people wouldn’t. Furthermore, there is a difference between your preferred method of learning and [that] by which you learn the most.”

“What I think e-Learning does is that it allows different modes of delivery that suits some students much better than the on-site class.”

An additional and complementary perspective came from different instructor who had a background in psychology, but no familiarity with the AccessForAll framework. When asked to comment on the role of personal needs and preference profiles, and the possibility of eventually extending these functional profiles to capture “learning styles”, the participant noted emphatically:

“There is no evidence about learning styles: visual or audio learner, etc.”

“I do believe in learning preferences, so I do believe that there are people that don’t like to sit in lecture. I also believe in physiological stuff like dyslexia that keeps people from being able to learn in certain ways. The only point I want to stress is that right now in my mind there is no good reason to believe that you have learning styles: oral, visual, etc.” [emphasis added]

The discussion about needs and preferences for accessing technology and information resources is closely related to the discourses about learning styles. Some of the questions that demand further discussion include: 1) Are there such things as “learning styles” and to what extent highly codified profiles can capture such preferences? 2) If what learners identify as their preferred learning method is not necessarily the method by which they would learn the most, how would personalized models for education delivery account for this?

4.5 Philosophical Challenges

4.5.1 The Limits of Formalization

“If it looks like a button, it talks like a button, and acts like a button, is a button”. [Participant response]

The statement above, provided by an accessibility consultant, is indicative of one of the enormous challenges implied in formal definition of both PNP and DRD. The participant made this comment when explaining some of the challenges with markup languages like HTML. He pointed out that although the
HTML language has well-defined tags (syntax) for defining every component in a document, (e.g. buttons, images, checkboxes, radio buttons, tables, etc), current extensions provided by new languages such as CSS and Javascript can transform any of those tags. For example, a button is usually defined in HTML language as:

<table>
<thead>
<tr>
<th>HTML Code</th>
<th>Visual Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;input type=&quot;button&quot; value=&quot;name&quot;&gt;</code></td>
<td>name</td>
</tr>
</tbody>
</table>

*Figure 11 – HTML: Button Tag*

Images, for instance, are inserted into a webpage with the `<img>` tag as:

<table>
<thead>
<tr>
<th>HTML Code</th>
<th>Visual Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>&lt;img src=&quot;brain.jpg&quot; alt=&quot;this is a brain&quot;&gt;</code></td>
<td><img src="brain.jpg" alt="Image" /></td>
</tr>
</tbody>
</table>

*Figure 12 – HTML: Image Tag*

However, computer-programming languages such as CSS and JavaScript can redefine and redefine both the appearance and the functionality of any HTML tag. The same visual representation and the behaviour in the examples above can be achieved using other HTML tags, such as list elements (e.g. `<ul>` and `<li>`).

This is what the participant was referring to in the quote opening this section. Someone using CSS and Javascript can make virtually any HTML tag look and behave as something else. Thus, the challenge of formalization noted by the participant’s statement: “If it looks like a button, it talks like a button, and acts like a button, is a button” brings an interesting question about the limits, scope and accuracy of metadata representation such as PNP and DRD.

A designer assessing the current state of development of the AccessForAll framework offered a complementary perspective:

“It may be ironic because it [AccessForAll] is a standard but it is very young. I think it is, in the best sense of the word, a very experimental technology. And the incentive of AccessForAll isn’t there yet. In other words, as the sceptical developer would say: ‘why would I want to do this? ‘What does AccessForAll give me?’ Simply an information model for representing preferences and metadata doesn’t give you anything because you have to write a whole lot of code to understand those metadata and preferences and then do something with them.”

The implementation of highly formalized statements about people’s needs and preferences entails great additional challenges. In addition to the accuracy and/or restrictions imposed by the language use in the formalization, there is a great deal of extra work: coding on the one hand, and decision making and
inferences about what might be convenient or better suited for any user with a given needs and preferences profile.

4.5.2 Content vs. Presentation

One of the conceptual and philosophical challenges underlying not only AccessForAll, but the very conceptualization of access to information, is the separation between content and presentation. It was quite interesting how instructors and interaction designers alike referred to this distinction, while sometimes not addressing the conceptual challenges at stake. When explaining the notion of access, a participant used an interesting example in the context of education:

“In order to learn something, students need access to the educational message, to the information you are supposed to learn, you need access to that information. And in terms of content, the content needs to be accessible”. [Emphasis added]

One of the challenges in this description of accessible information is the assumption it introduces about the nature of learning. The “education message”, as the participant puts it, is equivalent to information - and learning consists precisely in the assimilation of this predefined “message”. In order to learn we need access to the content. Thus, the content for learning needs to be delivered in a way that finally provides the “same information”. In the commitment to equal access there seems to be such assumption: content is “interchangeable”, “transformable”, and its translation seems to preserve the “message” that is being transmitted. This was also the case in one of the participants responses analyzed earlier (Section 4.2.3), where a software developer stressed that: “Someone that has difficulty reading can look at the image and get the same information.”

These perspectives emphasizing a sharp separation between the content and the presentation contrast with comments provided by an interaction designer:

“Giving users control over the data they are accessing: enabling transformation, adjustment, and migration of the data to other systems introduces a great challenge in the definition of the content being delivered.”

When the participant was asked to expand on this notion of “content being delivered”, it became clear that when the scope of customization extends throughout several different layers (e.g., interface, system architecture, controlling devices, and information modalities) a quite challenging question arises: is it the same “content” or “message” that is being delivered? He described how current technologies such as CSS, JavaScript and JQuery provide unprecedented flexibility. These technologies allow manipulations in the interface, the architecture, but also the modality in which the content is delivered. As the interaction designer noted, technologies such as OCR (Optical Character Recognition) can transform something that is visual into text.
The challenge of separating content and presentation was also addressed by one of the instructors. When discussing why the content of her class was never static but rather in constant flux due to the interaction with students, she put it sharply:

“The content is not independent of the delivery. […] Nothing that you archived is the same. I mean you archive something as evidence. But evidence lies on the context. So, the more you know about the context, then the more you can understand what took place. […] But because you would be always out of context, you can never ever, truly understand it.

One of the interesting points in the response above is that the separation between content and the presentation or delivery implies a question about the context of use. “Truly understanding” the content (archive) is never possible. The participant mentioned that this is the case with court records or history books. “Archives are the trace”, she said, but we will never know “what really happened”. The separation of content and presentation is certainly a common discourse in IS design, and particularly, perceived by several participants as one of the “advantages” in the design of almost every Learning Management System.

4.5.3 Customization and Challenges in Assessment

An additional challenge that stems from the presumed separation between content and presentation is the assessment of learning and performance in highly adaptable and customization e-learning environments. The ability to transform not only the information modalities but the very structure of an information resource brings with it a deep philosophical question about the assessment and the authority of the source.

As one of the participants expressed:

“If one student gets the content in one modality, such as audio or visual, and another gets access to the text version or the same lecture, an assessment challenge arises. […] what is the official version? What is the message and what method an instructor will use to assess such adaptation?” [Emphasis added]

These insightful comments from a designer bring attention to the challenges entailed in the assessment of learners’ performance. Both the authority and the meaning of assessment are here at stake. The participant suggested that customization and adaptability of current information technologies raise serious questions about how “we have traditionally measured and assessed learning.” Of great interest here also, there seems a close relation between these reflections and the experiences reported by the instructors earlier (Section 4.4.1 and 4.4.2).

“Every learner is different and that is an interesting idea. […] What if we think about the pedagogy we are using and the design. It becomes a design problem. I want to recognize that everyone is using that object [learning object] in a slightly different way. So the mistake is to say let’s make them all a normal curve and assume that there will be a variation around the mean.”
4.6 Summary

The AccessForAll Framework stresses that the customization and adaptation of information environments entails at least three crucial dimensions: Display, Control, and Content. Display refers to how information is presented (e.g. layout, font type, colour, size). Control includes all the possible input and output devices used in the interaction (e.g. mouse, keyboard, screen readers, magnifiers). Content relates to the information modalities available (e.g. images, text, audio, video). In this framework, customization is revealed to be dependent on a complex network of actors and relationships. Access is not assured by fulfilling one of these dimensions. Meaningful access to information occurs in the orchestrations of the perceptual modalities involved, the control devices that can be used, and the way in which they are structured and presented to the learner.

After analyzing the interview data resulting from the dialogues, the implications as well as the challenges for future developments of the AccessForAll framework became clearer. The scope of this framework not only extends to the interactions with physical devices (e.g. assistive technologies), but addresses the complex layers of interaction that arise when matching learners’ personal needs and preferences with information resources. Participants’ comments and challenges faced during the implementation of AccessForAll, also provide insight on possible future direction.
5. Discussion

“Where the struggle for new ideals succeeds in restructuring society around a new culture, it will not be perceived as trading off wealth against morality, but as realizing the economic potentialities associated with its ethical claims.” (Feenberg, 1999, p. 99)

Customization practices in IS design take place in a context of varied and sometimes quite problematic discourses. Some of these include: the separation between form and content, the notion a “normal” user, principles of universality, and individualistic and commodified models of information delivery. While customization initiatives tend to focus on what (what to customize) and how (how to implement customization), less attention is given to the why of customization. The goal here is to critically examine these discourses. It is an attempt to uncover some of these discourses and re-assess its pertinence.

5.1 The Pertinence of AccessForAll

5.1.1 There is no “normal” User

In the AccessForAll framework access is always open and dependent on people’s diverse abilities and contexts of use. A major contribution of this framework is to resist the definition of a “normal” or prototypical user. This is also a principle shared with User-Centered Design: the person should be the main target and the purpose of IS design. Hence, rather than creating a stereotyped, aggregated or representative abstraction of “the user”, the AccessForAll Framework adopts a relational and non-essentialist characterization. One of the contributions of this approach is then to assume neither “normal users” nor fixed user’s needs and preferences preceding the design of an information system. The strategy introduced by the AccessForAll framework is to provide a common language to express the unique user’s abilities in the form of metadata statements. Then, once statements are codified in structured profiles (e.g., PNP profiles and DRD), information systems can use these to transform the learning environment and provide alternative interactions with information resources.

5.1.2 Extending the Interface

Considering accessibility as a relational requirement implies a re-examination of the classic notion of user graphic interface (GUI) and its separation from the internal logic (“business logic”) components. AccessForAll provides a critical examination of well-established distinctions in the conceptualization “information” interfaces. The interface cannot be conceptualized as a “simple” visualization or display component. Rather, the re-configuration of the system according to, and suitable for, the needs of the learner requires that information systems be designed in such a way that both the interface and the software architecture can be adapted on demand; according to evolving mismatches between the learner
and the information environment. Although customization and personalization are perceptible in the “interface”, and as some argue: the application is the interface, the diversity of controlling devices for input and output imply that the interface is much more than visual. In fact, designing accessible information systems demands extending not only the notion of “user” but the predominantly visual understanding of the interface.

5.1.3 Universality vs. Inclusion

One of the major motivations of the AccessForAll framework is to understand how information technologies can be designed to accommodate diverse audiences; thus providing customized matches between the users’ needs and the information resources available to particular information systems. This was the main argument in chapter 2, where the notion of one-size-fits-all, implied in universal design, was questioned in relation to its limitations to respond to unique and individual needs and preferences.

One of the important discussions that must be addressed is whether the principle of universality is technically feasible. Universality has led to the development of a great variety of generic ICT, from word processors, email applications and web browsers, to numerous Content and Learning Management Systems (CMS and LMS). However, the design of these applications neither always serves all “types” of users, nor responds successfully to changes in users’ abilities or in the environment. Quite often designers and developers ignore people’s different abilities and learning preferences, as well as the need for adaptation in information technologies in order to deal with continuously evolving organizational settings.

The promise of Universal Access is ethically desirable while ontologically and epistemologically challenging. If Universal Access is conceived from a rationalistic perspective, the conceptual assumptions are huge: can we design what is suitable for everyone? Here again, the expectations appear as a fixed and final formalization of “users” and their “requirements”, where the evolving and contingent scenarios are likely to be underestimated. A major difficulty with this principle is that it is not static but relational –and this means that access is always open to interpretation. It is not binary but demands clarification and most importantly, is requires a context of use and concrete examples against which they can be assessed.

The question about inclusion, at the foundation of the AccessForAll standard, not only addresses the crucial barriers faced by people with disabilities. It introduces a major philosophical perspective, challenging the “universal” principle and re-assessing the meaning of access to information resources and services. In the AccessForAll framework, customization is understood as the ability that both users and information systems have to adjust themselves in order to match particular needs and in particular contexts. There are, however, several practical challenges in the construction of Personal Needs and
Preferences “profiles”. Some of these are: a) who creates the profiles, b) how do these get updated, and c) what is the degree of choice embedded in the standard itself?

These questions present important challenges for “universal” solutions. The pertinence of the AccessForAll framework can be better understood when it is assessed against a constructivist philosophical approach to human practice and interaction with ICT. That is, understanding that what is key in accessing information is not a simple transmission or assimilation, but a complex meaning-making process that is historically and culturally mediated. In this context, the criteria for assessing the success and the effectiveness of accessing information cannot be measured against universal and fixed standards. A sharp distinction between the medium and the message, or that of form and content, are but a few examples. Such a dualistic model of communication may not fully address the constitutive role that the context and information modalities play when interacting with ICT.

What has become evident in the analysis of the diverse interpretations of customization and participants’ reactions is that though this concept can be defined in analytical terms, in relative independence from who does the implementation and for what context, the relationships between what (e.g. display, control, structure) are in an intimate relationship with the domain and purpose (why) of customization.

5.2 Challenges in the AccessForAll Framework

5.2.1 Content vs. Presentation?

Whether or not content and presentation are entities that can be detached from one another is a statement with deep philosophical implications. The discussion about what separates the content from its presentation entails difficult debates about the nature of language and human cognitive activity. As introduced in the literature review (Chapter 2), a rationalistic orientation in the design of IS has been predominant. Quite often, this perspective led to the conceptualization of users and their requirements as entities that can be formalized in fixed propositional forms. The major difficulty identified in this approach was precisely the risk of underestimating the evolving interactions between users and their environments.

A question that remains open is then, to what extent is the AccessForAll framework committed to this rationalistic approach? This is certainly a difficult question, but with no simple or binary answer. The aim here is not to highlight a “deficiency” in the AccessForAll framework, but to highlight the contribution of this framework in understanding those interactions with technology and information resources. It is evident that in the AccessForAll specifications there are some conceptual tensions (epistemological and
ontological questions) between a relational approach to access, on the one hand, and definitions such as “content modalities” or “adequate alternative-but-equivalent content”, on the other. Nonetheless, throughout this study, it became clear that the AccessForAll framework provides a redefinition of the notion of access to technology and information resources. This approach stresses not only the crucial role of information modalities (e.g. text, video, audio, sign language), but illustrates how these modalities are dependent on controlling devices as well as the structure of information resources. Thus, what is being accessed, is in not a simple content, but rather a complex interaction among multiple dimensions and agents; an interdependency that has not been usually considered in IS design initiatives.

A common challenge to AccessForAll and major IS design initiatives is a challenge about whether the conceptualization of content modalities assumes that content and presentation are in fact detachable. To certain extent, the AccessForAll framework shares some of the rationalistic discourse about information as an entity that can be transferred to the learners. This is particularly the case with the use of the term content. As some of the participants pointed out, allowing alternative content modalities aims to provide multiple forms of representation, particularly, when different circumstances can situate a user in a condition of disability (mismatch). What seems to be assumed by many of the participants is that the goal of access is either access to system functionality or to content. Yet both of these perspectives are difficult to reconcile with models of learning that involve participation and community interaction as primary goals.

5.2.2 The Limits of Formalization

The very formalization of needs and preferences, a purpose common to requirements engineering and the AccessForAll Framework, remains a difficult task. Is it possible to fully formalize what learners need and prefer? Can learners, instructors or automated agents know, or figure out, what learners need and prefer? How accurate are formal distinctions, or rather, to what extent do they differ from what is presented to the learner as tacit and commonly non-verbal forms of knowledge?

A thought experiment can help here to illustrate these challenges. Imagine a person trying to understand the demonstration of the Pythagorean Theorem: \[a^2 + b^2 = c^2\]. At certain point, the learner stops and tells the instructor: “Professor, I don’t understand what happens here” – a particular step in the demonstration. The instructor asks in response, “Well, what is it that you don’t understand?” The student insists, “Well, I don’t know. I just don’t understand”. After a pause, the student replies once again: “How can I know what is that that I don’t understand, if I don’t understand it?”.
The challenges in the example above are not trivial, nor uncommon for learners. As Polanyi (1962) and others (Tsoukas, 2005) have pointed out, the cognitive challenges involved in mastering a new skill or knowing about a particular task demands a great deal of knowledge running in the background. Polanyi refers to this as tacit knowledge. What we know cannot be separated from what we know with. Polanyi’s exemplar case is an apprentice doctor learning to read X-Ray images. The apprentice doctor has not mastered the knowledge that will allow him or her to interpret the blacks, whites or many different gradients of grey presented in the X-Ray image. This of course, Polanyi stresses, is not a lack of visual skill. The apprentice doctor can perfectly see what is being displayed on the X-Ray image. There are, however, many other things that the apprentice cannot see. Being able to see in this sense is not about the apprentice’s vision at all; it does not depend just on the ability to distinguish gradients of grey or black from white. Becoming an expert X-Ray reader, being able to interpret the white or dark spots as indicators representing a lung cancer or other dangerous disease, does not depend solely on what is being shown in the X-Ray itself, but on the background knowledge the expert doctor has achieved.

The limits of formalization apply particularly when we are asking about the nature of learning and meaning-making. As some developmental psychologists like Lev Vygotsky argue, learning and meaning-making do not occur in a vacuum. They occur in a background; an “horizon of meaning” (Gadamer, 1986) from where they are interpreted. As illustrated in the previous example, if the apprentice X-Ray reader does not have the background knowledge he or she will never master the skill; and therefore, will never be able to provide accurate diagnoses. The point is that understanding occurs within a background that is known, but most of the time not known explicitly. Actually, it should not be explicitly present. This is not a deficiency or lack, but rather the very nature of human understanding and learning.

Understanding the limits of formalization is one of the major challenges that the AccessForAll framework, as well as any other initiatives in IS design should carefully examine. Some of the challenges and examples provided by the participants of the study (e.g. cognitive demands of excessive customization) resemble the two examples presented above (the learner studying the Pythagorean Theorem and the apprentice X-Ray reader). Thus, interacting with technology and information resources requires a great deal of “background” or tacit knowledge. In this context, one of the challenges for the

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16 In knowledge management literature (e.g., Nonaka, 1995; Tsoukas, 2005), there has been a great debate about multiple forms of knowledge, and how many forms can be distinguished. At the same time, a major concern is how these different forms of knowledge (e.g., tacit, explicit) relate to each other, and whether they can be translated. In particular, if tacit (knowledge that remains in the background) can be translated into explicit and propositional forms. A major epistemological challenge is implied in “formalizing” user’s needs and preferences in the form of metadata statements (e.g., PNP profiles). Following Polanyi and Heidegger, Tsoukas (2005) suggests that the most interesting characteristic of tacit forms of knowledge (e.g., driving a car, baking a cake) is that they need to remain in the background for a cognitive task to be successful.
AccessForAll framework is to address the limits entailed in formalizing both Personal Needs and Preferences profiles, and Digital Resource Descriptions (DRD).

5.2.3 Customization Beyond Personalization

On the one hand, designers and software developers tend to associate customization with the ability of a system to adjust to individual and personal needs. As it presented earlier (Chapter 4), the principle underlying the AccessForAll framework is to provide metadata descriptions about both users’ needs and preferences (PNP) and information resources (DRD) in order to allow a system to adequately “match” between these two metadata sets. This principle became clear, for instance, when designers described how users can modify the visualization or the behaviour of interface components. Likewise, this principle became clear when software developers explained the algorithms required to interpret PNP profiles and provide alternative content (e.g. text descriptions as an alternative modality for images or video). In short, customization was used as a term to describe a relationship between users and the information resources delivered by the system, constrained by both the formal language used to represent the PNP and DRD as well as the capabilities of the matching algorithms.

On the other hand, responses from content and course creators suggest that when customizing a LMS, what is at stake does not exclusively entail a relationship between the system and the individual, but rather adjustments between the students and the instructors as well as relationships among students. This is certainly a quite different notion of matching that includes teaching styles and learning preferences. It also involves scenarios in which the content of the course is not necessarily fixed from the beginning of the course.

5.2.4 Predominant focus on Content Delivery

The AccessForAll Framework has raised awareness of the value and the complexity of adaptations in three interrelated layers of the interaction with ICT: content, display and control. However, in the context of LMS, the implementations of this framework have been focused, particularly, on the adaptation of content repositories. Content not necessarily created by users but for the users. Content created quite often by instructors or accredited authorities. What deserves further discussion here is that the predominant discourse of interoperable content resembles the traditional lecture paradigm of teaching and learning, but translated into the digital realm. Learners are consumers of structured and pre-established content-knowledge. Information is therefore, seen as something waiting to be transmitted, under the premise that meaning will occur somehow in the transfer. The value of adaptation and the scope of customization are yet in early exploratory stages. Many more adaptations will be certainly needed in order to design information systems that support the construction of meaning and creation of
opportunities for learning. Not the individual but rather the collective and the distributed nature of human cognition is yet to provide further inspiration for innovative implementations.

5.3 Customization and Learning

5.3.1 Getting Serious About Access and Learning

Based on the constructivist framework inspiring this research, getting serious about access and learning demands not only overcoming a binary ‘Digital Divide’, but also thinking beyond the individual as the major target or recipient of complex adaptations among human and non-human agents: Meaning-making is not a personalized or isolated phenomenon. When analyzing the findings to this research, it became clear that metadata (e.g., PNP profiles and DRD) can help individuals achieve meaningful access to information resources. Nevertheless, what has remained unclear is how the AccessForAll framework conceptualizes the nature of collaboration; the empowerment and engagement that take places in communities of practice.

I suggest a new challenge for customization and adaptation initiatives: Reverse Customization. I call this the ability of a system to allow learners to become active designers of their own learning process as well as the ability to learn from and with others. The customization of technology is certainly crucial, but adaptation to the communities that support learning constitutes a greater challenge. I believe that we need both systems that adapt to learners, and adaptable users that can surpass over themselves and engage in construction of Knowledge Communities (Scardamalia & Bereiter, 1993a, 2006). This latter requirement demands from information systems an active role. The ability to “push” so to speak, the learner towards, to behave as scaffolds of cognitive development and provide open-ended and challenging dialogues to the learners, which, as suggested by social constructivist perspectives, are at the foundation of knowledge creation (Vygotsky, 1978; Engeström, 1987; Scardamalia & Bereiter, 1993a).

A demand for reverse customization at the foundation of knowledge creation can be understood as mutual adaptability of both technology and learners: 1) technologies should be capable of registering learners’ needs and preferences, and 2) at the same time, information systems should be designed to promote the evolution of those needs and preferences. Such a demand is consistent not only with the experiences reported by participants in regards to the increasing learning curve required when higher levels of customization are enabled, but also by an understanding of human cognition that stresses the reciprocal co-construction of cognitive abilities and tools of mediation (Vygotsky, 1978; Vygotsky & Luria, 1994; Wertsch, 1985, 1991; Clark, 1997).
If learners’ needs and preferences are about understanding; recognizing different values and belief systems, or sustainable life-styles that can take place within current socio-technical networks, mutual adaptability becomes particularly relevant. Finally, although adaptability and learning can be considered as “normal” or inevitably occurring when interacting with any technology, the challenge of knowledge creation – the formation and development of knowledge communities, becomes a major requirement in design decisions (Scardamalia & Bereiter, 1993a). I believe that we do need systems capable of even higher levels of adaptability and customization. However, I also believe that if we are to support inclusion and increase sociability: as the common understandings among people with diverse cultural backgrounds, cognitive, and physical needs and preferences, we need information systems that go beyond individualized and personalized interactions, beyond emphasizing only self-development. We need, I suggest, collective and socially inclusive forms of collaboration. In short, we need customizations that do not reinforce individualistic and consumer-centered models of information delivery.

5.3.2 Giving Learners Control Over their Learning

A contradiction seems to lie under the high expectations placed on “intelligent systems” and what such systems can and cannot do (Dreyfus, 1972). On the one hand, it is expected that information systems will learn about the learners, that they will know what learners need and prefer, so that resources can be delivered in personalized ways. On the other hand, major issues remain open: Why do you need adaptable systems? What type of adaptation is desirable? Do learners want or need systems that help, encourage, and facilitate adaptations that challenge them to evolve and develop new skills? In short, how much control is given to the learners and how much is given to automated agents remains open and deserving further discussion. Assessing the trends towards customization in IS design seem to require addressing deep questions about how information systems can encourage learners to take control over their own learning; systems that support learners in “learning to learn”.

5.3.3 From Individual to Collective Needs

We need sophisticated profiles describing needs and preferences, adaptations and customization. These profiles are crucial not only because they can help to improve the communication and interaction between humans and computer artefacts, but also because they can facilitate new understandings among humans. This is a much more challenging demand. Indeed, we need customizations; those that can contribute to helping us understand who we are and those that can challenge learners – lead them to evolve beyond who they are. This is what I believe a genuine critical study can provide: to point out to the discourses within which we are so accustomed to living, as the means of changes that contribute to the betterment of society; changes towards the design of engaging environments in which both technology and people can
evolve and create knowledge. Ultimately, information systems design approaches that facilitate learners to create meaning out of meaningless information.

I know that I am not alone in calling for an emphasis on the collective, rather than the individual. As Manuel Castells has critically pointed out, “we are building a world of individuals”. This means that the design of information technologies has reinforced and facilitated the priority on individual agents. Such designs have privileged information networks that include and deal with diversity, but only as means to support a notion of sociability that does not necessarily contribute to the construction of shared values and meanings. Instead, it is a “sociability” that quite often focuses on creating “networks of individuals” (Castells, 2001) and in doing so, “creating sociability as individuals”. Castells thinks that education is more important than ever, but not education in the traditional way. The challenge, he says, is that students must:

“develop self-programming capabilities, and that is the ability to adapt, learn to learn, and to learn how to use the knowledge in the implementation of their projects and their tasks, throughout their life. So, building on the one hand, the knowledge capability: not to have lots of information, but to know how to find information, how to recombine this information.” (Castells, 2001)

5.4 The “Act of Sharing”: Methodological Challenges

We are in a multicultural world, but the question about what are we sharing might not be so clear. What we share, Castells says, is the “act of sharing”; an act that is mediated by information technologies. This “act of sharing” is relevant because the models and structures we use to examine, answer and solve problems – this a major goal in IS design, are part of and develop within a much more complex phenomenon: language-games and meaning-making interactions between human and non-human agents. This implies that identifying the problems, conceptualizing the designs and developing information solutions all depend on situated cognitive processes/practices. These processes are dependent on language structures and the selection of apparently distinct categories. The categories used for structuring this thesis are one example: literature review, methods, frameworks, or findings. The difficulty is that methodological models are not neutral, and they convey meaning on their own. Researchers commonly do not select these categories, or critically examine the broader institutional and socio-political contexts that affect them.

In IS design some of the discourses that have greatly influenced the trends towards customization are the notions of accuracy, efficiency, or even effectiveness. However, questioning how these discourses propagate into the design of information technologies broadly implemented in the education practice is a delicate matter. This critical note does not imply though, that the research methods in IS design are to be condemned to an epistemological relativism in which there is no ultimate criteria for success or
improvement – this is certainly one of the “bad” sides of radical constructivism (Phillips, 1995). What being part of a discourse means is that both the evidence and assessment criteria are inter-related and evolve based on the language constructs we use to conceptualized them. I believe that current IS design approaches supporting educational practices have not examined sufficiently the discourses that shape the meaning of access to information, and justify the role of customization. Difficult questions remain to be addressed:

- What is the role of adaptation and customization for learning?
- Are we designing for individualized or collective learning?
- To what extent are predominant trends in customization really facilitating innovation and knowledge creation?

These are indeed challenging questions that extend far beyond the scope of this study, and its inability to fully respond to these challenges is clearly a limitation. This study indicates, however, that the design of IS capable of customization demands serious attention to the situated nature of cognition, the evolution of physical and psychological abilities as well as the diversity of contexts of use. The constructivist approach adopted in this research is not only relevant for learners, but also for designers and software developers. To great extent, what all these stakeholders share is that they are part of a situated and linguistically mediated activity.

### 5.5 Customization Discourses

The discourse underlying the notion of customization reveals a predominant focus on the individual as well as on content delivery. When the goal of customization is conceptualized as the delivery of individualized solutions, (e.g. either focused on content or presentation, the interface or the software architecture) a great risk remains: underestimating the constitutive and evolving interactions between learners and information environments. This risk has both practical and philosophical implications. Some of the practical implications are overemphasized efforts in the design of technologies targeting the individual, and thus, not necessarily engaging in designs fostering collaboration and construction of meaningful knowledge. A major conceptual implication is the reduction of customization to individualization. This major limitation reduces as well the scope of possible adjustment and adaptations.

The term customization is part of a complex and commonly unquestioned universe of additional discourses: mass customization, customized access, customized learning, and many others have been perhaps over-used, disregarding the great challenges that come with it. (E.g., learning challenges, decision-making, ethical and political questions about inclusion, economic strategic advantage vs. real empowerment, ontological and epistemological assumptions).
Although customization is commonly used as a positive quality or principle, it has not been carefully examined in all of its facets. Customization design has sometimes forgotten the “custom” – the habitual and traditional; and it has been reduced to individualization and personalization. This shift, I argue, is not only a reaction to the commodification of information, but has introduced even more problematic assumptions. Throughout this research, I have attempted to show that there is a positive side of customization, justified by the very nature of human learning and understanding, which is a process of adaptations, re-purposing and extensions. A constructivist approach has proved to be a valuable ally. The very meaning of such entities like information or content is at stake when we expand the unit of analysis; when the very object of study transcends the individual and extends to the multiple dimensions and actors involved in the interaction with information technology.

In this context, the future of customization in IS design would certainly benefit from the AccessForAll initiatives. As it is presented in the AccessForAll framework and stressed by the responses of diverse stakeholders, adaptations and extensions of the learning environment are crucial for the meaningful engagement with technology and information resources. As one of the participants stated:

“The concept of e-Learning was a joke 5 year ago, it was a joke 10 year ago, and it was a joke 15 year ago. But it is not a joke anymore. Some of the most important forms of learning now are e-learning.”

It is clear that unprecedented layers of adaptation and customization enabled by current information technology are creating the infrastructures for new and innovative scenarios of cognitive development. In fact, I believe that today there is an enormous amount of work to be done in the field of IS design. I am hopeful that this research has presented a valuable contribution indicating the pertinence of the practical and conceptual initiatives introduced by accessibility and usability studies – and the AccessForAll framework in particular. For the first time, in decades, I see that the dialogues between highly structured representation models (as those used in computer programming) and evolving practices of those using and interacting with technology are being created. Increasing awareness is rising towards the cognitive challenges entailed in accessing and customizing information technology.
6. Conclusion

Throughout this study, I attempted to make visible the implications that accessibility requirements and customization strategies bring to the design of IS. I discovered that carefully considering the meaning of access to information is not, as many tend to believe, solely a matter of ethical commitments or a mandate for inclusion and the empowerment of unprivileged populations – whether people are excluded due to physical, social, or linguistic differences. Getting serious about the meaning of accessibility and the role of customization has philosophical as well as practical implications for IT designers, analysts, and all information professionals. Of course, there are indeed several ethical and political arguments at stake – as participatory design (PD) initiatives, critical information studies, and science and technology studies (STS) have demonstrated for decades. Exclusion leads to a reduction opportunities, and in some cases to the complete absence of means for social participation. The purpose here, however, was not to examine thoroughly these political and ethical implications that take place when ICT designers and software developers narrow down, in excess, their target demographics.

Although there is a great deal of proximity and overlap with PD and STS, the purpose here was rather different. This purpose, I believe, has not yet been fully understood nor examined in its philosophical implications: facilitating access to information is about the creation of meaningful interactions, and this is the heart of creating opportunities for learning.

When accessibility of information resources is understood as relational phenomena, defined by a mismatch between the learner and the environment, an intrinsic cognitive dimension becomes visible. This psychological or rather phenomenological dimension does not simply shift the attention to the human side to the interaction with computer artifacts – as User-Centered Design does Rather, it stresses the intricate and inseparable dependencies among interface, software architecture, and controlling devices. The interaction with information technology cannot be captured by binary distinctions that fall into the Cartesian dualism of mind and body, form and content, subject and object. Functional and non-functional is also a difficult distinction that might have to be extended and re-examined when conceptualizing the scope of accessibility as a requirement in IS design. The challenge with a distinction between functional and non-functional is that they are both closely interrelated and mutually interdependent. Researchers in RE have pointed out that quality or soft requirements are defined as the “assessment criteria” by which the success of IS can be measured. Non functional requirements such as security, easy to use, or maintainability can be postulated as high level goals IS must achieve. In order to do so, they need to be operationalized in a set of specific functional decisions. However, high-level goals, benchmarks, as well as best practices in IS design should be developed bringing the communities
involved: the people using particular IS are to be considered into the equation. Success and efficiency do not hold in the vacuum. They are not valid on their own either. They are dependent on much more “primary” and crucial “requirements”: access to meaning making. If we are to create information environments that facilitate such opportunities for meaning-making, understanding the overlaps and mutual dependencies between functional and high-level goals will demand further explorations. From a cognitive and relational perspective, access is not a goal but the very nature of human computer interaction. Thus, high-level goals such as efficiency, security or even usability may not be properly conceptualized or assessed if it is not in the context of access to meaningful interactions among humans and non-human (Suchman, 1987; Latour, 1988, 2005); human and “computer artifacts” (Ehn, 1988).

Despite the critical and yet unexplored dimensions of the AccessForAll standard examined in Chapter 5, AccessForAll is a framework capable of asking deep philosophical questions: re-conceptualizing the notion of access to information, challenging the separation between content and presentation, and highlighting the crucial role of flexible and adaptable learning environments. In short, a framework capable of uncovering, re-framing and expanding the discourse and the challenges of customization in IS design.

6.1 Limitations

The limitations of this study have been presented in different sections throughout this research. In addition to the methodological limitations (addressed in section 3.9 and section 5.4), there are some other limitations in this study. The implementations and assessment of the ISO standard AccessForAll are currently in its early stages. This implies that although awareness about the need for flexible and adaptable learning environments is rising in the field of information systems design, large-scale information systems providing a full implementation of this standard are still ongoing projects. Due to these early stages of implementation, the few examples and stakeholders’ experiences comprise a limitation of the research. An exhaustive assessment of these initiatives, the impact and response from the larger community of participants will demand further study, additional data collection and analysis that exceed the time constraints of this project. Nonetheless, the researcher is confident that this research provides the initial steps towards understanding the crucial role of customization in educational practices and the construction of empowering and stimulating e-learning environments.

An additional limitation that became evident during the interviews and discussion with participants was the initial criteria for the selection of participants. The term “key stakeholders” turned to be quite challenging. The separation between accessibility consultants, designers, software developers and instructors was not easy, revealing these categories to be not mutually exclusive. The participants had
sometimes common and professional formations that overlapped or may not be accurately expressed by a single category or label. In this respect, future research on must pay careful attention to the challenges entailed the classification as well as the criteria used for the selection of participants.

### 6.2 Recommendations and Future Research

Community-centered-design seems to be a promising next step in IS design: where interaction with others, much more than with static resources, are the foundation of innovation and knowledge creation. If we are in a knowledge society, we better design our technologies to support the collaborative process of meaning-making that is the primal mechanism of its creation. Further research in IS design entails a critical assessment of the traditional conceptualization of users and requirements. Although several advances have been made in the classification of requirements for both users and information systems, the very definition of requirements entails an entity carrying with it an ontological discourse – commitments that respond to quite different purposes and values. Among of these values, Feenberg (1999) suggests, is the notion of efficiency. The crucial question is when analytic distinction can bring “value” to the design. Despite its popularity in the world of software engineering, the very entities (e.g. requirements, users, needs, preferences) and the analytic distinctions separating them might not be interesting or stimulating. For many design scenarios – education is probably one of them – the nature of the phenomena resists such binary distinctions.
Appendices

Appendix A: Recruitment Email Letter

Hello (insert name of contact),

I am a second year Master’s student at University of Toronto, conducting my thesis research project under the supervision of Prof. Stephen Hockema at the Faculty of Information. (Insert name of referee) was kind enough to provide me your name and e-mail address.

My master thesis research is called, “The Challenges of Customization: Conceptualizing the emerging relationships between users and e-learning environments”. As the title suggests, my research aims to understand how information systems in educational environments can deal with personal and contextual factors. Particularly, I am analyzing the benefits as well as the difficulties that arise when implementing users’ profiles (user needs and preferences) in order to deliver customized information services and resources.

I would like to invite you to participate in this research project. The purpose of the interview is to gather information about your opinions, knowledge and unique experience using and/or designing e-learning platforms. As a participant, you will be interviewed only one time for approximately 1½ hour. If you agree, the interview can be scheduled to take place any time between March and April 2010. The interview can take place in one of the meeting rooms available at the Faculty of Information. However, if it is convenient for you I could meet you in a location of your preference.

My study involves interviews with a varied group of professionals, including web developers, designers, university professors and consultants informing the implementation of inclusive and accessible information technologies. The results of this study will provide valuable perspectives about how to better understanding the customization of e-learning platforms.

I would like to make explicit that this is an individual research project and your involvement is completely voluntary. Your choice to either accept or decline participation will be strictly confidential and will have no effect on your working personal relationships.

I encourage you to take a day or two to think about whether you might be interested in participating in this study. For further details about this study, please see the consent form that has been attached to this email.

If you are interested in participating in this research, or would like to further discuss the details of my study, please contact me at antonio.gambabari@utoronto.ca, or by phone at (416) 554-8300. Alternatively, you may contact my supervisor, Prof. Stephen Hockema (steve.hockema@utoronto.ca).

Thank your consideration,

Antonio Gamba Bari

Master of Information Studies Candidate 2010
Faculty of Information
University of Toronto
Appendix B: Informed Consent Form

**Study Name:** The Challenges of Customization: Conceptualizing the emerging relationships between users and e-learning environments

**Investigator:** Antonio Gamba Bari

**Affiliated Institution:** Faculty of Information at the University of Toronto

**Purpose:** This research seeks to inform understandings of how information systems in educational environments can deal with personal and contextual factors. Particularly, this study analyses the benefits as well as the difficulties that arise when implementing user profiles (user needs and preferences) in order to deliver customized information services and resources. For this purpose, the study focuses on assessing the implementation of the ISO standard AccessForAll.

**Participant Responsibilities:** This study will involve the commitment to participate in a one and a half hour (1½ hour) interview with the researcher.

**Participant Rights:** Participation in this study is voluntary, and participants may choose to withdraw from the study at any time, and for any reason, without reprisal. Any data collected during the study will be kept anonymous and confidential, and will not be sold to a third party. The participant has the right to request the investigator not to be audio-recorded during the interview.

**Risks:** There is no personal risk to participants in this study.

**Benefits:** Although participating in this study will not entail any monetary compensation, participants will contribute to study the role of Personal Needs and Preferences profiles in the creation of accessible and customizable e-learning environments.

**Participant Consent Statement:**

I have fully read and understood this informed consent form. The study described has been explained to me, and my questions have been satisfactorily answered. I agree to participate in this research study, and can withdraw from the study at any time without reprisal.

**PARTICIPANT’S NAME:** (please print)  
**INVESTIGATOR’S NAME:** Antonio Gamba Bari

**SIGNATURE:**  
**SIGNATURE:**

**DATE:**  
**DATE:**
Hello (participant’s name),

Thank you for considering participating in or contributing to my research project.

As I noted in my previous email, I am scheduling interviews between March and April 2010. I would like to know what are your availabilities in this period and the location of your preference for the interview.

I am also attaching a letter of consent that I will ask you to sign on the day of our meeting. Please read the letter carefully. Keep in mind that if you have any questions regarding this study, you can contact me, or my supervisor Prof. Stephen Hockema (steve.hockema@utoronto.ca).

I appreciate your interest in my research project.

Sincerely,

Antonio Gamba Bari

Master student Candidate
Faculty of Information
University of Toronto
Appendix D: Verbal Consent Script

Note: This script will be read to all participants before starting the interview. Having discussed any doubts or questions the participant may have, the investigator will ask the participant to sign the Consent Form.

Mr/Mrs. (use interviewee name here), I want to thank you for your time and participating in this interview. Before we get started, I want to run you through your rights as a participant.

This interview session will last approximately 1½ hour. Please remember that you may decline to answer any question or request further explanation at any time. You may also withdraw during or after this interview. If you decide to withdraw during this interview, the data I’ve collected from this session will not be used and immediately destroyed. It is pertinent to mention, that if you decide to withdraw later, for example in a couple of weeks; it is possible that some of the data will have been analyzed and therefore it will be used in the study.

The information gathered from this interview will be considered confidential and your name or any personal information that may allow to identify you or your organization will not be sold or disclosed to any business organization, nor will it be used in any future publication.

You can decide not to be audio recorded, but I may also take notes throughout the session. Do you feel comfortable if I audio record this interview?

I have sent you the letter of consent some time ago via e-mail. Did you read it? Do you have any concerns or questions you want me to answer?
Appendix E: Introductory Script and Guidelines for Semi-Structure Interviews

**Note:** Semi-Structure Interviews were designed to suggest insightful questions leading to deeper and comprehensive understandings. Thus, the questions here provided were considered as a general guide, and susceptible to adaptations based on participants' responses during the interviews.

**Introduction script and questions for all interviewees**

Mr/Mrs. (use interviewee name here), thank you for participating in this interview and contributing to my research project focused on the challenges of customization and the role of personal profiles in e-learning environments.

Mr/Mrs. (use interviewee name here), I have prepared some questions pertaining to my research, but please do not hesitate to ask for clarification or add any comments you consider are pertinent.

So, let's start the interview with some background questions:

- What is your experience with Learning Managements Systems (LMS)?
- For how long have you been working with LMS?
- Can you tell me a bit more about your experience with accessibility standards regarding online content? For example, are you familiar with the ISO standard *AccessForAll* or the *Web Content Accessibility Guidelines 1.0* (WCAG)?
- What do you think is the major role of these guidelines and standards?

**Specific questions for Consultants/Researchers**

- As a consultant/researcher how would you explain the role of the ISO standard AccessForAll? [please imagine that you are explaining this to a layperson]
- How do you understand the differences, if any, between the ISO standard AccessForAll and other accessibility standards such as the Web Content Accessibility Guidelines 1.0 (WCAG)?
- Based on your personal experience, how do you think the AccessForAll standard can contribute to improving the accessibility of information and communication technologies (ICT)?
- Do you see any particular benefits of the AccessForAll standard in enhancing user experience in e-Learning? [If yes] can you please provide some examples?
- Is there an apparent contradiction: standards to support diversity in education? How does the standard actually facilitate inclusion and diversity?
- Can you explain some of the motivations that led to the creation of the standard?
- Are you familiar with the concept personal profiles – or more specifically, Personal Needs and Preferences Profiles (PNP)?
- How would you define a PNP profile?
- What are the features that can be defined using a PNP profile?
- How do you actually create a PNP? (Explain the origin/justification of wizards’s questions in Access4All)
- Based on your personal experience as a [Consultant/Researcher], do you have any thoughts about the challenges for the implementation of this ISO Standard?
- Do you foresee any technical difficulties in the implementation of the standard? (for example, if you were a web designer or developer, what type of problems do you imagine they will encounter, if any?)
- What will be your advice for designers and developers implementing the AccessForAll Standard?
- The AccessForAll standard emphasizes a “Functional Approach”, rather than “medical approach” when conceptualizing accessibility and disability. The Standards states, I quote:
“The information collected as an Access For All Personal Needs and Preferences (PNP) description is associated with the user’s functional abilities and the assistive technology or other non-standard technology in use as well as other user needs and preferences (a functional approach), rather than with the name and other details of a human impairment (a medical approach). If the structure were based on information about users’ impairments, it would still need to address their functional abilities at some stage, as it is this information that is needed by learning systems to adapt content and navigation. A medical approach would exclude many of the details that the system would require.” (AccessForAll, 2008, p. 12)

- What do you think will be the future of the ISO standard AccessForAll? For example, what can be the next steps to improve and expand it?
- What are your thoughts about the best strategies for increasing the adoption of the standard?

Specific questions for Web Designers

- Would you please describe the typical procedure followed by a designer when creating a new web-application?
- Based on your personal experience, what are the best practices for gathering user requirements? For example when designing a new web application?
  - If the interviewee does not recall: suggest some of the well-known methods such as iterative design, creating personas, wire-frames techniques, etc. and ask the following questions:
    - Have you used any of these methods?
    - What do you consider are the benefits and the limitations of these techniques for gathering user requirements?
- Have you designed or contributed to the design of a Learning Management System? What do you think are the specific challenges, if any, implied in the design of e-learning applications?
- Are you familiar with the notion of “customization”? [Introductory question]
- From a designer’s perspective, how do you understand the role of customization? For example:
  - What is needed in the design of a web application to make it customizable?
  - What do you think are the benefits of customization? If any? Please provide some examples.
  - Do you see any particular benefits of customization in enhancing user experience in e-Learning? [If yes] can you please provide some examples?
  - What do you think are the drawbacks, or challenges of customization? If any? Please provide some examples.
  - How does the ability of users to customize web tools affect the job of the designer? For example, how does it make it easier or more difficult?
  - How does the ability to customize a web application affect the user? For example, some users say that: “too much customization can make things quite complicated”. What is your response to this comment?
  - What do you think are the design principles and/or strategies that can help users in the customization of web applications?

Specific questions for Software Developers

- What has been your role in the development of Atutor?
- What has been your role in the implementation of the ISO standard AccessForAll?
- How do you understand the differences between the ISO standard AccessForAll and other accessibility standards such as Web Content Accessibility Guidelines 1.0 (WCAG)?
- Are you familiar with the concept Personal Needs and Preferences Profiles (PNP)?
- How would you define PNP?
- Can you explain (briefly) how does the matching between Personal Needs and Preferences Profiles (PNP) and Digital Resource Description (DRD) actually work?
- What are the procedures by which users create their PNP profiles?
- What are the features currently implemented? In other words, what are the preferences that the users are currently able to customize?
Is it possible to extend the functionality, for example, by adding new features and preferences?
In your opinion/experience, what type of customization will be ideal for a learning environment?
Do you see any correlation between customization and allowing different learning and teaching styles?
How does the ability of users to customize web tools affect the job of the web developer? For example, how does it make it easier or more difficult?
Do you think that allowing customization introduces additional technical requirements? If any, can you provide some examples?
How does the ability to customize a web application affect the user? For example, some users say that: “too much customization can make things quite complicated”. What is your response to this comment?
What do you think are the design principles and/or strategies that can help users in the customization of web applications?
If you were to assist final users in the creation of content for e-learning environments, what will be your advice, of the steps you will recommend?
In your opinion/experience, is the ISO standard AccessForAll scalable and interoperable? Why?
Have you experienced significant challenges implementing the standard? (YES/NO, please explain)
What do you think are the benefits and limitations of the ISO standard AccessForAll?
What do you think will be the future of the ISO standard AccessForAll? For example, what can be the next steps to improve and expand it? And what are your thoughts about the best strategies for increasing the adoption of the standard?

Content Developers / Instructors

- The benefits/challenges of LMS
  ■ Have you used ATutor (Learning Management System) or similar web applications?
  ■ In your opinion/experience, how will you characterize the benefits of these applications? For example, benefits for instructors, students and the administration of educational resources.
  ■ What do you think are the challenges of developing content for a Learning Management System?
  ■ Have you found difficulties or limitations in the design of a LMS that prevents you from conducting you course or using your own teaching style? If any, can you provide some examples and describe the alternatives you used?

- The Process of Creating Course Contents
  ■ Can you describe the process for designing course content? What are the dimensions or aspects involved in this “design”?
  ■ What are the sources of information that you use? Are there any particular criteria that you take into consideration? (e.g. accessibility, cost, quality, availability, etc.) And, how do you prioritize among these criteria?
  ■ In particular, how do you determine the requirements of each piece of content, and how do you assure it is accessible for all the students?
  ■ Have you identified or encountered difficulties in the process of creating content suitable for different audiences, for example, providing a text version for audio or video content? Do you recall a remarkable case?
  ■ Once a course is created, do you anticipate any challenges when delivering these contents in the future, for example, in a different context, or when delivering this course to users with different abilities?
  ■ What are the strategies and/or procedures you use to deal with individual needs and contexts, if any?

- Conceptualizing the role of customization
  ■ Are you familiar with the notion of customization in the context of information systems? (introductory question)
  ■ What do you think are the benefits of technologies like Personal Needs and Preferences Profiles (PNP) that allow high levels of customization? [if the participant is not familiar with this technical concept, provide a brief description, so that he or she can respond to the expected benefits of customization]
    o The core principle of technologies is that a user can define Personal Needs and Preferences (PNP) profiles with information about their own unique abilities within particular settings and contexts. The information system can then use these profiles for selecting, combining, and finally delivering
adequate information resources that match the user’s needs for a particular environment (AccessForAll, 2008)

- Have you used the customization and personalization features in a LMS? Which ones?
- Do you know what features you can customize?
- Do you find these customizable features necessary or useful?
- Can you mention some customizable features you expect from a LMS?
- Do you know of any students who use PNP profiles? Why do they use them?
- Does consideration of these profiles ever affect the content or what content is used for the courses you have developed? If yes, how?
- If you think about an ideal information environment that adapts to your personal needs, are there any features you think will be valuable to customize and personalize, specifically for the context of education? Which ones?
- Among these customizable features, do you see any conflict between what is usable and/valuable for the instructor/content developer and the students; for example, regarding extra work or the expected benefits?

Closing questions for all participants

- In your opinion/experience, how will you summarize the challenges and benefits of customizing LMS and in general, any information technology?
- Do you have any additional comments or recommendations that may assist web designers and developers in the creation of customizable features?
Appendix F: Researcher’s commitment to confidentiality

Commitment to confidentiality

Research project title: The Challenges of Customization: Conceptualizing the emerging relationships between users and e-learning environments

Research team:

Principal investigator: Antonio Gamba Bari  
Master student, Faculty of Information, University of Toronto  
416 554 8300  
antonio.gambabari@utoronto.ca

Faculty Supervisor: Dr. Stephen Hockema  
Assistant Professor, Faculty of Information, University of Toronto  
416-978-7110  
steve.hockema@utoronto.ca

Confidentiality agreement:

We, the undersigned, Antonio Gamba Bari and Stephen Hockema, formally agree to:

- Ensure the protection and security of the collected data by keeping the data in a secure location for at most five years before destroying it.
- Only discuss confidential information collected through documents, verbal exchange or otherwise with the members of the undersigned research team.
- Only use the data collected for this study as stated in the research project description that has been approved by the University of Toronto Research Ethics Board.
- Not use, in any given way, data that individual participants or organizations will specifically ask to be excluded from the study.
- Take the necessary dispositions to protect the identity of the individual participants and organization that the information concerns and ensure that they will not be identified during the handling and analysis of the data, nor when the research results will be published. Individual participants and organizations will only be identified if they give the investigator express permission to do so.

Signature of the research team members:

_______________________________ __________________________
Antonio Gamba Bari   Date (dd/mm/yyyy)

_______________________________ __________________________
Stephen Hockema     Date (dd/mm/yyyy)
<table>
<thead>
<tr>
<th>Theme Name</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access, Definition/scope</td>
<td>AFA</td>
<td>Comments addressing the meaning and scope of access: content, display, controlling devices, interaction, community of learners, participation, Meaning Making</td>
</tr>
<tr>
<td>AccessForAll vs. the WCAG</td>
<td>AFA</td>
<td>“Unlike WCAG, AccessForAll does not provide a checklist that makes information resources accessible”. “WCAG focuses more on the technical aspects of accessibility.” “AFA is more about the person, and their ability to use different forms of content”</td>
</tr>
<tr>
<td>AccessForAll: Adoption</td>
<td>AFA</td>
<td>“What we did by narrowing it [the AccessForAll Standard] down to key modalities, was to simplify it, so that, the gist of the standard could be implemented by others based on what we did.”</td>
</tr>
<tr>
<td>AccessForAll: Equal Access</td>
<td>AFA</td>
<td>References to the commitments of the AFA: (e.g. empowerment, social justice, equal access, inclusion)</td>
</tr>
<tr>
<td>AccessForAll: future of the standard</td>
<td>AFA</td>
<td>Description of interface components; including the multiple forms these component can be interacted with</td>
</tr>
<tr>
<td>AccessForAll: Implementation</td>
<td>AFA</td>
<td>“It would be helpful to have recommendations from other designers, more examples.” “Compartmentalize the standard in components that are ready to use”</td>
</tr>
<tr>
<td>AccessForAll: interpreting the standard</td>
<td>AFA</td>
<td>“A major challenge is to interpret and select the aspects of the standard that are relevant”</td>
</tr>
<tr>
<td>AccessForAll: PNP, limitations/benefits</td>
<td>AFA</td>
<td>Whether one definition of users’ needs will fit any system. Issues with the evolution of needs and preferences.</td>
</tr>
<tr>
<td>AccessForAll: purpose</td>
<td>AFA</td>
<td>“AccessForAll is about adapting the content to the person. As opposed to WCAG that is about adapting the content to the technology.”</td>
</tr>
<tr>
<td>AccessForAll: the Semantics of Interaction</td>
<td>AFA</td>
<td>Challenges defining how information resources can be accessed; whether conceptual definitions facilitate accommodating different abilities</td>
</tr>
<tr>
<td>Accessibility, Motivations/Commitments</td>
<td>AFA</td>
<td>Statements about the perceived purpose and motivation of the AFA Framework</td>
</tr>
<tr>
<td>Accessibility, politics of</td>
<td>AFA</td>
<td>Standards involve political dimensions: lobbying for representation, voice of minority groups, Intellectual Property, policy-making, investment agendas. To what extend these factors compromise adaptability, extension and repurpose</td>
</tr>
<tr>
<td>Accessibility/disability, definition of</td>
<td>AFA</td>
<td>“Accessibility it is not a physical impairment; it is a mismatch between the person and the environment. Access is about “enabling”, is making sure that you have access to the information is there in a way that works for you”</td>
</tr>
<tr>
<td>Automation vs. user-controlled</td>
<td>TECH</td>
<td>Should the adaptation of the learning environment eliminate user’s control, when/why? Issues pointed out by instructors and accessibility consultants about the &quot;what should be left&quot; to users’ control</td>
</tr>
<tr>
<td>Automation, hide complexity</td>
<td>TECH</td>
<td>“A sort of AI [artificial intelligence] can help instructors and learners to fade technology in the background, so learning becomes the center”</td>
</tr>
<tr>
<td>Automation, role in learning</td>
<td>TECH</td>
<td>Participants’ comments on the role of automation in learning: what automated agents can do, what they cannot. Are they useful in educational practices?</td>
</tr>
<tr>
<td>Content Adaptation, a role in learning</td>
<td>TECH, EDU</td>
<td>“Switching modalities may not be the best approach, but providing multiple modalities certainly increases the chances that a learner is going to learn something”</td>
</tr>
<tr>
<td>Content Adaptation, definitions</td>
<td>TECH</td>
<td>Synonyms and expressions referring to translation/augmentation/extension of content</td>
</tr>
<tr>
<td>Content Adaptation, Many-to-many vs. one-to-one</td>
<td>TECH</td>
<td>Observations about extensions to the AFA. Whether replace or append content modalities</td>
</tr>
<tr>
<td>Content Packaging/migration</td>
<td>TECH</td>
<td>Instructors’ descriptions/comments on the process of migrating course content from/to different LMS</td>
</tr>
<tr>
<td>Content Structure, Breath vs. Depth</td>
<td>TECH</td>
<td>Participants comments on how information is organized/displayed</td>
</tr>
<tr>
<td>Content vs. Presentation</td>
<td>TECH, PHILO</td>
<td>Participants’ comments and/or statements using the word content. strategies/features for re-styling text (e.g. font-size, colour, contrast.)</td>
</tr>
<tr>
<td>Content, Authority the Source</td>
<td>PHILO</td>
<td>Accessibility consultants’ comments on the &quot;authority of source&quot;. Providing alternative content modalities and transforming display/control.</td>
</tr>
<tr>
<td>Topic</td>
<td>Scope</td>
<td>Notes</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
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</tr>
<tr>
<td>Content, Modalities</td>
<td>TECH</td>
<td>References to the notion of multiple content modalities, (e.g. text, audio, video, sign language)</td>
</tr>
<tr>
<td>Control, Assistive Technologies</td>
<td>TECH</td>
<td>Definition/issues: what is an assistive technology? Emerging trends: mobile phone have more or equivalent computational power than &quot;medical technology&quot;</td>
</tr>
<tr>
<td>Control, Interfaces</td>
<td>TECH</td>
<td>Comments on the wide scope of the term &quot;interface&quot;. Input-output devices</td>
</tr>
<tr>
<td>Customization, challenges/issues</td>
<td>TECH, EDU</td>
<td>Software developer’ role. Challenges in programming matching algorithms.</td>
</tr>
<tr>
<td>Customization, Criteria for</td>
<td>TECH, EDU</td>
<td>Technical and pedagogical arguments for/against customization</td>
</tr>
<tr>
<td>Customization, human side</td>
<td>PHILO</td>
<td>What learners prefer vs. how learners lean best; physical abilities; psychological/cognitive dimensions</td>
</tr>
<tr>
<td>Customization, Scope of</td>
<td>TECH, EDU</td>
<td>What layers of software architecture are entailed, hardware, software, configuration,</td>
</tr>
<tr>
<td>Customization, training challenges</td>
<td>TECH, EDU</td>
<td>Learning curve, information overload, length of content. Contrasting perspectives form designers and instructors about learning and training when there is too much customization.</td>
</tr>
<tr>
<td>Education: Creating Course Content</td>
<td>TECH, EDU</td>
<td>Instructors’ descriptions about the process followed in the creation of online course. Includes: technologies they used and pedagogical justifications the use of a particular technology, (e.g. blogs, wiki, forums)</td>
</tr>
<tr>
<td>Education: e-Learning vs on-site class</td>
<td>TECH, EDU</td>
<td>Instructors’ comparisons between e-learning and in-class (face-to-face) interactions. Examples of success and failure.</td>
</tr>
<tr>
<td>Education: Learning Objects, issues</td>
<td>TECH, EDU</td>
<td>Comments on whether learning can be set in a programmed path, what learning objects are, how they relate/support learning</td>
</tr>
<tr>
<td>Education: Learning/teaching Preferences</td>
<td>EDU</td>
<td>Instructors and students preferences. Critical points raised by instructors about the term &quot;learning styles&quot;</td>
</tr>
<tr>
<td>Education: Pedagogical Frameworks</td>
<td>EDU</td>
<td>Instructors’ references to pedagogical theories (e.g. constructivism). Teaching methods and activities: including wiki-based classes, lecture model, sequential learning.</td>
</tr>
<tr>
<td>Education: Technology vs. Learning?</td>
<td>TECH, EDU</td>
<td>When technology is in the background vs. in the forefront. Instructors expectations and difficulties with interacting/customizing LMS. “When you are designing different systems, like LMS, you want the system to be intelligent, and to be able to understand how learners are using the system and adapt accordingly”</td>
</tr>
<tr>
<td>Inclusion, levels of awareness</td>
<td>PHILO</td>
<td>Comments from designers, software developers, and consultants about how the aware inclusion, and individual needs and preferences.</td>
</tr>
<tr>
<td>Metadata, definitions/scope</td>
<td>TECH, EDU</td>
<td>Multiple definitions of &quot;metadata&quot;. What constitutes information &quot;about&quot; information.</td>
</tr>
<tr>
<td>Metadata, Role/Affordances</td>
<td>TECH, PHILO</td>
<td>Technical aspects of metadata. What is its role in matching information resources and users’ needs and preferences profiles. Enhancement of interaction/experience/access. Metadata add cues to interpretation and allows automation</td>
</tr>
<tr>
<td>Requirements, Accessibility as a Requirement</td>
<td>TECH, PHILO</td>
<td>Participants’ reactions to the distinction between Functional and Non-Functional requirements. Where accessibility should be placed?</td>
</tr>
<tr>
<td>Requirements, Accessibility vs. Usability</td>
<td>TECH</td>
<td>What is &quot;easy to use&quot; really means? For whom, when,</td>
</tr>
<tr>
<td>Requirements, Gathering</td>
<td>TECH</td>
<td>Examples/descriptions designers and accessibility consultant about gathering eliciting users’ needs and requirements</td>
</tr>
<tr>
<td>Requirements, Interoperability</td>
<td>TECH</td>
<td>Comments on the meaning and scope of interoperability. For some it means ingestion of content. implications in IS design.</td>
</tr>
<tr>
<td>Requirements, Interoperability issues</td>
<td>TECH</td>
<td>Encapsulation of knowledge and logic common in Object Oriented Programming. Issues in describing interaction, the need for a common language (e.g. ARIA)</td>
</tr>
<tr>
<td>Requirements, Normal User</td>
<td>TECH, AFA</td>
<td>Issues with homogenization, people with disabilities are one of the most heterogeneous groups. Who else should be included</td>
</tr>
<tr>
<td>Standards vs. Inclusion of diversity</td>
<td>TECH, PHILO</td>
<td>“There has to be standards in order to make content or learning materials to work across very different systems.” reactions to the question: how standardization relates to the promotion of diversity</td>
</tr>
</tbody>
</table>
| Standards, Close vs. Open | TECH | Standards, hardware, and IS: how do they expose functionality to other systems? Challenges of “Liberating encapsulated data” to the users” “open
<table>
<thead>
<tr>
<th>Standards, evolution of</th>
<th>TECH</th>
<th>Standards evolve due to several factors: Technological change, changes in users needs, changes in context of use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal vs. Inclusive Design</td>
<td>TECH, PHILO</td>
<td>Designing for everything is optimal for nobody. When is a good design good enough?</td>
</tr>
<tr>
<td>Web 2.0 - richness of the web</td>
<td>TECH</td>
<td>The web becomes richer, adaptable, multiple possibilities for interaction are introduce with technologies such as CSS, JavaScript</td>
</tr>
</tbody>
</table>
Appendix H: AccessForAll: Matching Process Diagram

Source: (ISO/IEC 24751 – 1, 2008)
Appendix I: Customization Wizard for the Creation of PNP Profiles

This appendix presents a customization wizard for the creation of PNP profiles. The figures below were obtained from Atutor LMS (www.atutor.ca). Atutor is an open source Learning Management System currently implementing a subset of the AccessForAll Framework.
Appendix J: AccessForAll: PNP Customization Features

In the AccessForAll framework, customization features are classified in three major categories: display, control, and content. This appendix provides an adapted version of these features reported in Part 2: “Access for all” personal needs and preferences for digital delivery (ISO/IEC 24751 – 2, 2008). Only the classification names are presented and several technical details have been omitted.

<table>
<thead>
<tr>
<th>1. Access For All User</th>
<th>Attribute</th>
</tr>
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<tbody>
<tr>
<td>display</td>
<td>highlight colour</td>
</tr>
<tr>
<td>control</td>
<td>link colour</td>
</tr>
<tr>
<td>content</td>
<td>cursor size</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.1. Display</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>screen reader</td>
<td>cursor colour</td>
</tr>
<tr>
<td>screen enhancement</td>
<td>cursor trails</td>
</tr>
<tr>
<td>text reading highlight</td>
<td>invert colour choice</td>
</tr>
<tr>
<td>braille</td>
<td>invert images</td>
</tr>
<tr>
<td>tactile</td>
<td>tracking</td>
</tr>
<tr>
<td>visual alert</td>
<td>magnification</td>
</tr>
<tr>
<td>structural presentation</td>
<td>personal stylesheet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.1.1 Screen Reader</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
<td>highlight</td>
</tr>
<tr>
<td>link indication</td>
<td>speech rate</td>
</tr>
<tr>
<td>speech rate</td>
<td>pitch</td>
</tr>
<tr>
<td>pitch</td>
<td>volume</td>
</tr>
<tr>
<td>volume</td>
<td>highlight</td>
</tr>
<tr>
<td>application</td>
<td>speech component</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.1.2 Screen Enhancement</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
<td>highlight colour</td>
</tr>
<tr>
<td>font face</td>
<td>link colour</td>
</tr>
<tr>
<td>font size</td>
<td>cursor size</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.1.3 Text Reading Highlight</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
<td>speech component</td>
</tr>
<tr>
<td>speech rate</td>
<td>reading unit</td>
</tr>
<tr>
<td>pitch</td>
<td>application</td>
</tr>
<tr>
<td>volume</td>
<td>application</td>
</tr>
</tbody>
</table>
### 1.1.4 Braille

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>braille grade</td>
</tr>
<tr>
<td>number of braille dots</td>
</tr>
<tr>
<td>number of braille cells</td>
</tr>
<tr>
<td>braille mark</td>
</tr>
<tr>
<td>braille dot pressure</td>
</tr>
<tr>
<td>braille status cell</td>
</tr>
<tr>
<td>application</td>
</tr>
</tbody>
</table>

### 1.1.5 Tactile

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>application</td>
</tr>
</tbody>
</table>

### 1.1.5 Visual Alert

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>system sounds</td>
</tr>
<tr>
<td>system sounds caption</td>
</tr>
<tr>
<td>application</td>
</tr>
</tbody>
</table>

### 1.1.6 Structural Presentation

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>content density</td>
</tr>
<tr>
<td>components shown</td>
</tr>
<tr>
<td>window layout</td>
</tr>
<tr>
<td>application</td>
</tr>
</tbody>
</table>

### 1.1.7 Font Face

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>font name</td>
</tr>
<tr>
<td>generic font face</td>
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</tbody>
</table>

### 1.2. Control

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>input requirements</td>
</tr>
<tr>
<td>keyboard enhancement</td>
</tr>
<tr>
<td>onscreen keyboard</td>
</tr>
<tr>
<td>alternative keyboard</td>
</tr>
<tr>
<td>mouse emulation</td>
</tr>
<tr>
<td>alternative pointing</td>
</tr>
<tr>
<td>voice recognition</td>
</tr>
<tr>
<td>coded input</td>
</tr>
<tr>
<td>prediction</td>
</tr>
<tr>
<td>structural navigation</td>
</tr>
</tbody>
</table>

#### 1.2.1 Keyboard enhancement

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>alphanumeric keyboard layout</td>
</tr>
<tr>
<td>alphanumeric keyboard layout custom</td>
</tr>
<tr>
<td>sticky keys</td>
</tr>
<tr>
<td>repeat keys</td>
</tr>
<tr>
<td>slow keys</td>
</tr>
<tr>
<td>debounce keys</td>
</tr>
<tr>
<td>application</td>
</tr>
</tbody>
</table>

#### 1.2.2 Onscreen Keyboard

<table>
<thead>
<tr>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>usage</td>
</tr>
<tr>
<td>alphanumeric keyboard layout</td>
</tr>
<tr>
<td>alphanumeric keyboard layout custom</td>
</tr>
<tr>
<td>key height relative</td>
</tr>
<tr>
<td>key width relative</td>
</tr>
<tr>
<td>key spacing relative</td>
</tr>
<tr>
<td>key selection sound feedback</td>
</tr>
<tr>
<td>point-and-click selection</td>
</tr>
<tr>
<td>Attribute</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td><strong>point-and-dwell selection</strong></td>
</tr>
<tr>
<td><strong>automatic scanning</strong></td>
</tr>
<tr>
<td><strong>inverse scanning</strong></td>
</tr>
<tr>
<td><strong>directed scanning</strong></td>
</tr>
<tr>
<td><strong>code selection</strong></td>
</tr>
<tr>
<td><strong>application</strong></td>
</tr>
<tr>
<td><strong>1.2.3 Alternative Keyboard</strong></td>
</tr>
<tr>
<td><strong>Attribute</strong></td>
</tr>
<tr>
<td>usage</td>
</tr>
<tr>
<td>alphanumeric keyboard layout</td>
</tr>
<tr>
<td>alphanumeric keyboard layout custom</td>
</tr>
<tr>
<td>sticky keys</td>
</tr>
<tr>
<td>repeat keys</td>
</tr>
<tr>
<td>slow keys</td>
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<tr>
<td>debounce keys</td>
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<tr>
<td>resizable keys</td>
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<tr>
<td>key selection sound feedback</td>
</tr>
<tr>
<td>application</td>
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<td>1.2.15 Point and Dwell Selection</td>
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<td>1.2.16 Automatic Scanning</td>
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### 1.2.22 Dwell Select

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### 1.2.23 Command And Control

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### 1.2.24 Code Termination

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### 1.2.25 Switch Assignment

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### 1.3. Content

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### 1.3.1 Adaptation Preference

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References


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