Welcome to the June issue of the ACM SIGACCESS newsletter. This issue highlights four articles that have a common theme: **Broadening the Accessibility of the Computing Field.**

**AccessCSforAll: Making computer science accessible to K-12 students in the United States**
*Richard Ladner and Andreas Stefik*

Various K-12 CS curricula have been rolled out over the past ten years, but it seemed that the approximately 7.4 million K-12 students with disabilities were forgotten.

In the first article, Richard Ladner and Andreas Stefik present some of their efforts in bring computer science to K-12 students in the United States (US) and in other countries through AccessCSforAll, a National Science Foundation project.

**Breaking Barriers, Building Understanding: A Multigenerational Approach to Digital Literacy Instruction for Older Adults**
*Kelly Steelman and Charles Wallace*

Older adults face obstacles beyond the more clearly understood physical and cognitive barriers.

Being educators at a rural technologically-focused university, Kelly Steelman and Charles Wallace saw opportunities to bring isolated older adults into a larger digital community, while simultaneously offering students with valuable first-hand experience learning about and addressing the challenges faced by older adults.

**SIGCHI and SIGACCESS Working Together to Improve Accessibility**
*Jennifer Mankoff and Shari Trewin*

The field of computing is one that has a special relationship with disability due to both the many opportunities and many flaws that computers present.

In the third article, Jennifer Mankoff and Shari Trewin summarise the efforts being made by SIGCHI Accessibility Community and SIGACCESS members to update and expand the SIGACCESS accessibility guidelines to the broad range of conference types and sizes found in SIGCHI.

**DSAI 2016: celebrating one decade enhancing accessibility and fighting info-exclusion**
*H. Paredes, L. Moreno and F. Pühretmair*

In the last article, the authors report on the 10th edition of the International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSAI).

*Hugo Nicolau*

Newsletter editor
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ACCESSCSforAll: Making Computer Science Accessible to K-12 Students in the United States

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Abstract
For the past ten years there has been a concerted effort to bring computer science to K-12 students in the United States (US) and in other countries. There is a growing realization that computer science is a fundamental subject like mathematics and sciences. In order to make this effort include the approximately 7.4 million K-12 students with disabilities in the US we created AccessCSforAll, a National Science Foundation project that began in 2014. In this article we review the activities of AccessCSforAll in the professional development of teachers and in tool and curriculum development.

1 Computer Science for All
On January 30, 2016, President Obama announced the Computer Science for All initiative. It is summarized in this statement.

“Computer Science for All is the President’s bold new initiative to empower all American students from kindergarten through high school to learn computer science and be equipped with the computational thinking skills they need to be creators in the digital economy, not just consumers, and to be active citizens in our technology-driven world. Our economy is rapidly shifting, and both educators and business leaders are increasingly recognizing that computer science (CS) is a ‘new basic’ skill necessary for economic opportunity and social mobility [1].”

This announcement was the culmination of the efforts over about ten years by the National Science Foundation (NSF) to support K-12 computer science education to create a new Computer Science Principles (CSP) framework for a new Advanced Placement (AP) course [2] and a new introductory course called Exploring Computer Science (ECS) [3], both of these at the high school level. The efforts accelerated when organizations like Code.org, Project Lead the Way, and others began creating curricula and courses not only at the high school level, but from kindergarten upward. This year, for the first time, The College Board offered the Computer Science Principles exam. In all these efforts that has been attention to “broadening participation,” that is, reaching students in historically underrepresented group such as Black,
Hispanic, and Native populations, and to some degree students with disabilities. The question about who is covered by the “for All” pronouncement is discussed in an article by the first author and Maya Israel [10]. To get a perspective of what organizations are involved in the CS for All initiative, visit the CS for All Consortium that currently lists 236 active members and 48 researchers [4].

1.1 AccessCSforAll

As the various K-12 CS curricula have been rolled out over the past ten years, the authors noticed that little attention had been paid to their accessibility. Many of these efforts used tools and curricula, such as Scratch, Alice, Snap!, and App Inventor, that are not screen reader accessible. Almost all efforts were designed to be attractive to girls and students from underrepresented minorities. It seemed that the approximately 7.4 million K-12 students in the US with disabilities were forgotten. This is 15% of the K-12 students, not a small percentage.

In response to this lack of attention to students with disabilities, the authors, together with Sheryl Burgstahler from the DO-IT Center [5] at the University of Washington, wrote a proposal to the NSF in early 2014 titled “AccessCS10K: Including Students with Disabilities in Computing Education for the Twenty-First Century,” and it was funded in September 2014. The grant has two objectives: (1) build the capacity of computer science teachers to serve students with disabilities by helping professional developers include curricular units, online tutorials, virtual communities of practice for teachers in their professional development training and helping teachers directly with real-time, individual teacher support and; (2) create accessible materials, both tools and curricular units that computer science teachers and students can use in their classrooms. Our project was initially called AccessCS10K, but was changed to AccessCSforAll in response to the rebranding of the entire effort after the announcement of “CS for All” from the White House in January, 2016.

In the following sections we will describe our professional development and tool and curricula development efforts funded by the grant.

2 Professional Development

AccessCSforAll held two capacity building institutes (CBIs) in 2015 and 2016. The goal of these CBIs was to help leaders of professional and curriculum development projects for both CSP and ECS. The two institutes brought together about 60 staff from different NSF-funded projects to help them include disability related topics in their professional development activities. We call these “training the trainers” CBIs. Proceedings from those two CBIs are available [6]. Examples of topics at the CBIs included careers in computer science and disability, accommodations vs. Universal Design in K-12 education, accessibility and technology, and introduction to the Quorum language. In addition, there were small group discussions around questions such as: “How can you prepare teachers teaching ECS or CSP to be welcoming to students with disabilities?” and “What resources or tools would be helpful to you or to teachers in order to be prepared for students with disabilities in their courses?”

AccessCSforAll also held two preconference workshops at SIGCSE in 2016 and 2017 for about 70 participants who were interested in developing accessible tools, curricula, and pedagogies for teaching computer science at the K-12 level. These workshops were structured exchanges of ideas from participants who are actively working or planning to work on accessible tools and curricular for K-12 computer science education. In addition to CBIs and workshops, AccessCSforAll has given several presentations and demonstrations at SIGCSE, the Computer
Science Teachers Association (CSTA) conference, and for other smaller venues. AccessCSforAll has produced several videos that can be used as part of professional development [7].

AccessCSforAll has 29 Project Partners and 8 Development Partners. Project Partners have active projects to provide professional development for either CSP or ECS and Development Partners are actively developing accessible tools for K-12 computer science education. Bimonthly partner conference calls help share ideas among partners and keep them up to date on AccessCSforAll activities. We also maintain an AccessCSforAll mailing list of about 60 people that includes partners and collaborators who are all interested in including students with disabilities in computing classes. We maintain a real-time support line (phone number and e-mail address) to help teachers solve pressing problems related to including students with disabilities in their computer science classes. Finally, we maintain an AccessCSforAll knowledgebase that has case studies, promising practices, and questions with answers [8].

3 Tool and Curriculum Development

The major focus of tool and curriculum development is the Quorum programming language [9]. One of the original motivations for creating Quorum was to make an easy to learn text-based language for blind children. As mentioned above, almost languages for children are block-based and not accessible by screen reader users. The scientific methods of using randomized controlled trials were used to create the syntax and semantics of Quorum [11]. Keywords and symbols were not chosen by declaration, but by the use of a statistical procedure known as “Token Accuracy Mapping.” In essence, keywords, symbols, and library designs were derived from evidence, not simply chosen. Some examples constructs from Quorum are:

1. Iteration
   ```quorum
   repeat 10 times
   output “hello world”
   end
   ```

2. Conditional
   ```quorum
   n = 10
   if n > 5
     output n
   else
     output “not large enough”
   end
   ```
These two examples of Quorum code exemplify the simplicity of the language. Notice that there are no curly braces, semi-colons, or other arcane artefacts that are found in most text-based languages, as these decisions did not survive scrutiny in formal experiments with human subjects. The “output” command outputs to the console, however it could be replaced with the “say” command that outputs to the speakers. This makes speech a first-class output in the Quorum language. Although we used traditional indentation in these examples to indicate structure, indentation is not part of the Quorum language, like it is in Python. It turns out that indentation is a visual way of indicating program structure that is not very accessible for screen reader users, for obvious reasons. A simple end statement in the correct places is the organizational technique to indicate structure in Quorum programs. Token accuracy maps show evidence that no equivalent “begin” type statement is necessary for lexical scoping blocks.

Although Quorum was originally motivated by the desire to make an easy to learn accessible programming language, it has turned into an easy to learn and full-featured language for everyone regardless of disability. As it has grown in popularity around largely the United States, it has required us to make engaging content, like games and robotics, both available to everyone, but also accessible.

For example, as part of the AccessCSforAll project, we have created an Hour of Code in Quorum to introduce the language to beginners. To date, 27,000 people have participated in the Quorum Hour of Code and there have been 339,791 page views of the Quorum website since late 2013. We have developed a Quorum alternative to Scratch for the programming unit in ECS and are in the process of developing a Quorum-based curriculum for CSP. Over the past several years, libraries for 2D/3D games, LEGO robots, sounds, and web development have been created. These libraries have appeal to sighted users, but even blind students designing 3D games can do so through tightly linked sonification and speech libraries. In the new release of Quorum (5.0), which is on June 1st, 2017, we will be releasing accessible physics simulation libraries, a digital signal processing library. Further, fulfilling a top request from our community of teachers, Quorum can now compile its programs to be run online in a browser, including games and sonification.

Quorum users continue to provide valuable input on what features to include in the language and which libraries should be developed next in annual focus groups and surveys. Every year there is a professional development conference, Experience Programming in Quorum (EPIQ), where practitioners can learn about Quorum and its accessibility features. EPIQ attendees are also active in setting priorities for new features and libraries for Quorum. In the last year alone, there was 37 teachers from 32 unique school districts that attended the EPIQ conference. EPIQ is in its 8th year.
4 What You Can Do

If you believe that all young children should have the opportunity to learn some basic programming skills and become acquainted the fundamentals of computer science, then please let us know so you can join the AccessCSforAll mailing list. We are also looking for development partners who are interested in developing accessible tools and curricula for K-12 students. Let us know if you are already working or want to work on this.

If you are looking for interesting research related to accessible computer science education there is a lot to be done. Little is known about programming and computational thinking for children in k-5 with any kind of disability. Little is known about the transition from block-based languages to text-based languages for young people with disabilities. There is interest in tangible ways to create programs, but not much is known about their effectiveness. For blind children there are very few programming or computational thinking activities. For example there is only one screen reader accessible Hour of Code, the one in the Quorum language.

Acknowledgments

This article was prepared with the support of the National Science Foundation grant numbers CNS-1440843 and CNS-1440878.

References

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BREAKING BARRIERS, BUILDING UNDERSTANDING: 
A MULTIGENERATIONAL APPROACH TO DIGITAL LITERACY INSTRUCTION 
FOR OLDER ADULTS

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Abstract
In entering the digital realm, older adults face obstacles beyond the more clearly understood physical and cognitive barriers traditionally associated with accessibility. One of these obstacles, technology related anxiety, is particularly problematic because it discourages exploration and wayfinding, two behaviors critical to the development of digital literacy. As educators at a rural, technologically-focused university, we see opportunities to address this issue and bring isolated older adults into a larger digital community, while simultaneously offering our students with valuable first-hand experience learning about and addressing the challenges faced by capable people struggling with unfamiliar technology. Here, we describe our social-cognitive approach to training digital literacy skills, pairing university student tutors with learners from the local community.

The Need
As more and more of the critical functions and services of our society — job applications, health care resources, banking functions — move primarily or wholly online, an ever-growing number of citizens are compelled to adopt digital technology. For many, technology related anxiety (TRA) constitutes a formidable barrier to entry into the digital world [6]. For digital adopters experiencing TRA — many though not all of whom are older adults — the perception of risks, known and unknown, associated with the technology hinder a robust learning experience. These reluctant users are likely to be marginalized as they fail to thrive in an increasingly digital-only world.

Our local area illustrates the dilemma facing many older adults. Michigan Technological University is located in the far northwest corner of the State of Michigan, near the shore of Lake Superior. The proportion of the population over age 65 is significantly higher than the U.S. average, since many young people leave the area due to limited job opportunities. There is a strong sense of personal identification with the area, and this along with financial constraints keeps many older residents here. Because of the larger than average number of elders without family support, many of whom live below the poverty line, there is a strong need for help with digital literacy in this community. Digital technology offers the promise of easy connectivity with family and friends and access to resources that may be difficult to obtain physically.

In supporting the development of our technically adept students – the designers of tomorrow’s digital technology – we face another, different challenge: how to expose these students to the experiences of users who are not like them. In many academic settings, research on user-centered
design follows a path of least resistance: design by students, for students, tested on students [4]. Our local community thus affords a unique and invaluable educational opportunity for our undergraduate and graduate students. By harnessing their expertise to the cause of educating older adults, we can provide students with first-hand experience addressing the issues that many elders confront when engaging with technology.

The Challenge
Since 2011 our Breaking Digital Barriers research group has offered one-on-one digital literacy tutoring in our local community, through the BASIC (Building Adult Skills in Computing) program [1, 11]. Many of our patrons seek our services precisely because they have been forced to adopt a new technology; faced with what are in reality quite surmountable obstacles, they experience anxiety and shut down. Our experiences and research with these patrons suggests that the effects of TRA extend well beyond adoption, stifling the exploration needed to develop digital independence [8, 11]:

- A common concern for patrons is that they may inadvertently “break” their device, software, or even the Internet. Even routine activities may cause anxiety as users fear accidentally going “off script”.
- A shift toward mobile devices with small displays and a shift toward “clean” design have led to a decrease in affordances and other cues in user interfaces. To use these interfaces effectively, the user must be willing to explore the space and uncover the functionality. A change triggered by an inadvertent action makes users feel anxious and out of control.
- Media stories of fraud and identity theft leave some of our patrons wary of going online, visiting certain websites, downloading apps or software, and even accepting important security updates. Without an understanding for how malware and other threats work, they have no model for how to minimize their threat level.
- Anxious learners over-rely on script-based style of learning. Although rote memorization of steps may be effective in the short-term, this strategy fails when learners try to perform a similar task on a different device or after a system update.

These observations suggest that an effective digital literacy program cannot simply focus on rote step-by-step instruction. Interface designs change; operating systems are updated and upgraded; apps and services come and go. Accordingly, we seek a deeper type of learning for our digital newcomers.

What are the higher order skills that we “experts” embody and that we wish to encourage? Mirel asks a similar question in her seminal work on complex computer-mediated problem solving. She defines wayfinding as the “process of organizing and finding a way through dynamic explorations and analyses” [10]. True wayfinding is more than simply reacting to a computer notification with the right mouse click; it involves a deep understanding of the current situation, the desired outcomes, and the possible paths toward those outcomes. While Mirel has focused on experienced, highly confident users working on complex problems, the challenges faced by digital newcomers as they enter the digital world are no less substantial.

In contrast to the deliberate, goal-directed behavior associated with wayfinding, exploration is a heuristic that searches for affordances and traverses functionalities in a breadth-first fashion [14]. While less deterministic in its nature, it is no less purposeful than wayfinding; the goal is to survey
and assess directions that can be used in wayfinding. A key assumption of the activity is the “Safe Exploration” pattern of interface design [13], which affords whenever possible the choice to back out and try other options.

BASIC program patrons and tutors report that wayfinding and exploration can be easily thwarted [1]:

**Jaclyn, Tutor:** It seems that the more significant differentiator is that the tutors are more comfortable exploring the device and trying things to see if they work. Many of the seniors are concerned that they will break their devices, but tutors know that there are not very many settings you can fiddle with that will irrevocably destroy a device and those are usually protected.

**Peter, Patron:** The problem with searching for answers online is that often you do not even know what the options are, so how do you know what to search for? Also, I am not fluent enough with the language to know where to look.

**Judy H, Patron:** I find surprising things like pop ups confusing. You are asked: do you want to do this or do that? What are the options, and will I get in trouble with one or the other? It feels like I am expected to give an answer right away, but I do not have one. I really do not want to get myself into trouble with computers and the Internet.

**Our Approach**

Our BASIC program focuses on the higher order skills that are essential for keeping up with the rapid pace of technological change and transferring knowledge from task to task or system to system. Bandura’s *Social Cognitive Theory* [2, 3] provides a set of guiding principles for our efforts, through its emphasis on the roles of observational learning and behavior modeling, learner-led goal setting, and the development of self-efficacy:

- **Observational Learning and Modeling.** The most basic instructional implication of Social Cognitive Theory is that learners require access to models of the knowledge, skills, and behaviors they are expected to learn. Multiple types of models (e.g., instructors, peers) and various forms of modeling (e.g., cognitive, verbal, mastery, coping) should be used. Instruction must support learners' engagement in observational learning.

  **Keith, Tutor:** When first using a device such as a tablet, there may be a very short instruction on how to use some features, but normally there is nothing beyond telling the user to open an apps menu. This is a greatly overlooked issue, especially because people tend to exhibit a fear of breaking the device, they do not “play around”, so without any instruction it is frustrating to the user [1].

- **Goal Setting.** According to Social Cognitive Theory, instruction should help students set goals that are attainable, clear, specific, and moderately challenging. To facilitate progress and self-efficacy, learning goals should be attainable with moderate levels of effort. Goals that learners set or endorse themselves have a bigger effect on their behaviors than do goals that are assigned.

  **Jaclyn, Tutor:** One good rule of thumb is to always ask why a patron is trying to learn or do something. Like during requirements gathering, people often ask for what they think they want instead of what they actually want. “I want to get to the library site from my Kindle” is very different from “I want to download library
books to read offline while I’m on vacation.” Asking why and what they want to accomplish not only helps identify these confusions, but it also gives you an idea of what the person already knows [1].

- **Perceived Self-Efficacy.** Social Cognitive Theory asserts that people will be more active, effortful, and effective learners when they are confident in their ability to complete tasks successfully. Instruction should be designed to help learners develop and sustain self-efficacy: the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations.

  **Kanak, Patron:** The tutors don’t know everything, but they say, “let’s figure out how to do that”. That gives me confidence that I can do it too [1].

As part of ongoing assessment of our BASIC tutoring program, we have collected data from our more experienced tutors [11]. Using the Critical Decision Method [5], an incident-based cognitive task analysis technique that helps experts tell stories from their field, we interviewed six tutors about both successful and unsuccessful tutoring sessions. Interviews were transcribed and coded to identify barriers to digital literacy and the tutoring strategies that are effective (and ineffective) at breaking these barriers. Results of the analysis informed the development of a five-step model of the tutoring process:

1. **Introduction:** Establish a working relationship between the tutor and the patron, and determine the patron’s motivation for using technology.
2. **Triage:** Gather information to develop a mental model of the patron’s desired task and the patron’s level of digital literacy.
3. **Planning and Preparation:** Develop a plan for helping the patron and determine the information, skills, and resources needed to implement the plan.
4. **Implementation:** Teach the patron how to solve the problem and/or fix the problem for the patron.
5. **Conclusion:** Recap what was accomplished and make a plan for continued learning.

Patron and tutor revisit Steps 2-4 repeatedly, with results from Steps 3 and 4 providing input for reassessment in Step 2.

Analysis of the coded interviews revealed that anxiety is a persistent barrier, impeding progress at almost every step of the tutoring process. To mitigate this anxiety, tutors and patrons adopt numerous strategies, including the following:

- **Probing (Step 2).** Tutors should ask probing “why” questions and encourage patrons to articulate the problem, using their own vocabulary. Through these articulations, tutors try to gauge patrons’ level of digital literacy.

- **Sandbox (Step 3).** After determining the competencies and needs, the tutor puts the patron in a “safe place” for play and practice. Directly working on the patron’s personal data is avoided, since it is potentially anxiety-provoking. Naïve language is still accepted, but patrons’ language is mirrored back, with official technical language added.

- **Stumping the expert (Steps 3, 4).** Although some patrons may be surprised to learn that the tutor does not automatically know the answer to their questions, many seem delighted to see
that even experienced users struggle too. Tutors should be encouraged to tell patrons when they do not know the answer, precisely so they have the opportunity to model their process of finding the solution.

- **Commiseration (Steps 3, 4).** When tutors encounter poor design or clunky solutions, they can express their own frustration. In doing so, tutors can help reduce the patron's stress and anxiety and reassure them that this sort of frustration is common and normal.

- **Taking the wheel (Step 4).** Tutors should encourage patrons to “drive” (manipulate the digital device) as much as possible, with emphasis placed on play, practice, and exploration. In rare occasions, tutors may intervene and perform manipulations—for instance, in the case of a one-time setting change that requires delving into potentially confusing details. In such instances, the tutor must explicitly state why she is intervening. In all cases, either driving or not, the tutor “thinks aloud,” modeling her thought process to encourage independence.

- **User-created instructions (Steps 4, 5).** Let patrons write out step-by-step instructions in their own words. This provides a record for future reference that is tailored to the mental model of the patrons, and the act of writing gives them ownership of their learning. For those patrons who took notes, the tutor may consider reviewing them to check for errors. It is important to avoid embarrassing the patron by calling out errors, but this gives the tutor an opportunity to reinforce the correct steps. The tutor should encourage the patron to practice without the use of the notes, just referring back to them when the patron gets stuck.

**Ways Forward**

Techniques like those above provide benefits, but no single technique is a panacea, and care must be taken with their timing and manner. For instance, although the practice of note-taking was evident in most successful tutoring sessions and absent in unsuccessful ones, many tutors expressed frustration at patrons’ desire to spend more time taking notes than practicing and noted that over-reliance on notes does not support learning the patterns of where functions are typically located, nor strategies to find them. As a result, minor changes to an interface often render learners incapable of independently completing tasks. This suggests that learners are failing to develop a mental model of how websites and applications tend to work.

Anxiety, it seems, is interfering with the learning process itself. If this is the case, what is the cognitive mechanism through which anxiety impairs learning? One possibility is that the anxiety consumes cognitive resources that would otherwise be available for learning digital literacy skills and completing the task at hand. Two prominent theories of instructional design, Cognitive Load Theory [12] and Multimedia Learning Theory [9], posit that meaningful learning requires sufficient cognitive resources to actively process new information and connect it with prior knowledge in long-term memory. To the extent that TRA acts as an additional source of cognitive load, individuals with high TRA should have fewer cognitive resources available for developing and generalizing digital literacy skills. Within the multimedia learning literature, however, neither TRA nor other forms of domain specific anxiety have been considered as sources of cognitive load.

Attentional Control Theory (ACT) [7], like the theories above, assumes that task performance is impaired when resources are consumed by factors unrelated to the task. In contrast, though, ACT specifically identifies anxiety as a source of resource consumption, positing that anxiety consumes executive memory resources. Executive memory resources are essential for the cognitive functions behind online wayfinding and exploration: maintaining multiple goals while
avoiding distractions from pop-ups and irrelevant content. ACT suggests that anxiety must be addressed to release the cognitive resources necessary for the development of higher-order digital literacy skills.

Building upon this work, the Breaking Digital Barriers team is refining and testing a new learning model that seeks to mitigate anxiety and strengthen development of higher order skills, through scaffolded technological assistance. The first objective is to develop a toolkit allowing website developers to implement accessibility functions that encourage exploration, reveal hidden functions, and allow users to create dynamic annotations to serve as memory aids. The second objective is to implement and test these tools in the context of a digital literacy tutoring program, to assess the development of wayfinding and exploration skills and overall technological self-efficacy.

Acknowledgments

The BASIC program would be impossible without our hard-working student volunteers at Michigan Tech. The Portage Lake District Library promotes our program and generously allows us time before official opening hours to conduct our help sessions. Many people in our community and beyond have donated to the Breaking Digital Barriers project through Michigan Tech’s Superior Ideas program.

References


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Kelly Steelman is an Assistant Professor of Psychology at Michigan Technological University. She holds a B.S. in Aerospace Engineering from Illinois Institute of Technology and a M.S. in Human Factors and Ph.D. in Psychology from the University of Illinois at Urbana-Champaign. Her research focuses on understanding human attention in information-rich environments, ranging from airplane cockpits to radar displays to websites. Why do we pay attention to the things that we do? Why do we sometimes fail to notice important content or have difficulty finding information that we need? And, ultimately, how can we design better interfaces to help people perform their work more safely and efficiently?

Charles Wallace is an Associate Professor of Computer Science at Michigan Technological University. He holds a B.A. in Linguistics from the University of Pennsylvania, a M.A. in Linguistics from the University of California, Santa Cruz, and a Ph.D. in Computer Science & Engineering from the University of Michigan. His research focuses on how humans can better understand the software they build and use. He is currently working on educational programs for K-12 students, undergraduate Computer Science students, and senior citizens, and he is studying communication and teamwork patterns in software development settings.
SIGCHI and SIGACCESS Working Together to Improve Accessibility

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The field of computing is one that has a special relationship with disability due to both the many opportunities and many flaws that computers present with respect to disability access. However, despite many successes in this arena, the conferences and digital resources of the Association for Computing Machinery are still not all accessible to people with disabilities.

The SIGACCESS community has tried over the years to lead the way in providing an example of how to do this right. It pioneered the use of HTML in the 1990s and forged agreements with ACM publishers to support conference paper accessibility, and has always had excellent representation among people with disabilities at its flagship ASSETS conference. SIGACCESS maintains a set of accessibility resources for ACM authors, presenters and conference organizers on it’s website (http://www.sigaccess.org/welcome-to-sigaccess/resources/).

More recently (about three years ago), the SIGCHI Accessibility Community formed to begin tackling conference and digital resource access issues within the SIG on Computer Human Interaction (SIGCHI). Thanks to pioneering work by Jonathan Lazar and others (summarized in a recent CACM article on making the field of computing more accessible⁴), many excellent seeds had been planted, and even borne fruit by the time the SIGCHI Accessibility Community formed. Despite this, however, in its 2015 report on the state of accessibility within SIGCHI, summarized in Mankoff, 2016², it was clear that much more still needs to be done before SIGCHI is fully accessible.

Since then, the SIGCHI Accessibility Community and SIGACCESS members have embarked on a joint effort to update and expand the SIGACCESS conference accessibility guidelines to be more relevant to the broad range of conference types and sizes found in SIGCHI (available here: http://www.sigaccess.org/welcome-to-sigaccess/resources/accessible-conference-guide/). Many thanks to everyone who contributed to the conference accessibility guidelines, and to the documents they were based on, especially Erin Brady, Jen Rode, Meredith Ringel Morris, Vicki Hanson and Donal Fitzpatrick.

In the process, we realized that many conference organizers may have little or no awareness of accessibility until faced with a specific question from a prospective attendee, like a request for wheelchair access to the stage. By the time the request is received, it may be difficult to accommodate it. To encourage conference organizers to think about accessibility earlier, and to help them be prepared to answer the typical requests they may receive, we hit on the idea of

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providing a template for a conference accessibility FAQ\(^3\). Lourdes Morales-Villaverde created a simple form that can be filled and used to generate an FAQ on a per conference basis by answering a few key questions. The SIGCHI Accessibility Community has worked with the SIGCHI leadership to establish guidelines for all SIGCHI conferences to fill out this FAQ and include it on their conference websites at /access. These and other areas of need (and success) are summarized in the SIGCHI Accessibility community’s second report, which was recently published for community comment at https://docs.google.com/document/d/1eLqwcS3CpBlzziUwkOxM7KNdGpFy47oEWoPPuljleE

SIGCHI still has a long way to go to meet the goal of treating all members of the community equally regardless of whether or not they have a disability. However, we expect that SIGACCESS and the SIGCHI Accessibility Community will keep working together and we hope to achieve even more in the coming years. Thank you to all the SIGACCESS and SIGCHI volunteers who are spreading accessibility across ACM!

About the Authors:

Dr. Jennifer Mankoff is a Professor in the Human Computer Interaction Institute at Carnegie Mellon University. She earned her B.A. at Oberlin College and her Ph.D. in Computer Science at the Georgia Institute of Technology. Her research embodies a human-centered perspective on data-driven applications. Her goal is to combine empirical methods with technological innovation to construct middleware (tools and processes) that can enable the creation of impactful data-driven applications. Example application areas include sensing and influencing energy saving behavior, web interfaces for individuals with chronic illness, and assistive technologies for people with disabilities. She helped found the sustainable-chi group.

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\(^3\) http://www.sigaccess.org/welcome-to-sigaccess/resources/creating-a-conference-accessibility-faq-page/
DSAI 2016: celebrating one decade enhancing accessibility and fighting info-exclusion

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The 2016 edition of the International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSAI)\textsuperscript{4} – commemorates the 10\textsuperscript{th} anniversary of the conference. Over the last decade, DSAI has been a forum where researchers, from all around the world, share the advances in the domain of assistive technologies and software development for people with special needs.

The 10\textsuperscript{th} anniversary also represents a step further in DSAI history: the organization of the conference in co-operation with ACM SIGACCESS. The DSAI 2016 also brought several enhancements for the community. First, the availability of the proceedings of the conference in an accessible format. Second the publication of the proceeding by ACM International Conference Proceedings Series and its availability in ACM Digital Library. Third, the organization of a project exhibition where several H2020 projects and initiatives related with accessibility were presented. And, finally, the organization of the workshop “Assistive Technologies: Challenges and Opportunities” where the participants have the opportunity to share their past experiences and future research opportunities under this domain.

**DSAI Conference Series**

The Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion (DSAI) conference series is a premier forum for academic researchers and professionals to exchange ideas and experiences about problems and solutions in order to build an inclusive society. The first edition was held at University of Trás-os-Montes e Alto Douro, Vila Real – Portugal, on the 24\textsuperscript{th} March 2006 joining around 40 Portuguese participants. The key persons in the creation of DSAI conference series, were João Barroso, Leontios Hadjileontiadis and Vitor Santos, that, since 2010, are the Steering Committee members of the conference.

DSAI 2007, the first of the international series, was also held in Vila Real, followed by Lisbon (2009), Oxford (2010), Douro (2012), Vigo (2013), and Sankt Augustin (2015). The 7th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion – DSAI 2016, was held at its root location, in the University of Trás-os-Montes e

\textsuperscript{4}http://www.dsai.ws
Alto Douro (UTAD) – Vila Real, Portugal in 1-3 December 2016. The date was also set due to its special meaning to the DSAI community: the International Day of Persons with Disabilities.

**Behind the Scenes**

At the closing session of DSAI 2015 that took place in Fraunhofer FIT, Sankt Augustin – Germany, the 2016 edition of DSAI was announced. The 10th anniversary edition was a return home of the conference to the University of Trás-os-Montes e Alto Douro (UTAD), Vila Real – Portugal. UTAD is located in the Douro region, were the well-known Porto wine is produced, and, therefore, a very popular touristic location for wine lovers. Moreover, UTAD is an award-winning institution for its inclusion initiatives (Portuguese Inclusion Award – applied research category – in 2010), a reference under “e-Inclusion: be part of it!” EU Initiative and one of the few European Institutions providing undergraduate and graduate education on Accessibility and Rehabilitation Engineering (a bachelor and a master program in Rehabilitation Engineering and Accessibility).

The university has the required facilities to organize the conference, given its accessibility infrastructures and on-site restaurant. It is also located near the Porto airport (OPO) with several transfer options for the participants. Paulo Martins from INESC TEC and UTAD served as our local organization chair, managing his team with know-how and experience, for all the required logistics to organize the conference.

The conference announcements and dissemination were shared by email, using the DSAI mailing list, and through the usual dissemination channels: the conference website and social media (Facebook and Twitter accounts). We thank our web team, lead by António Marques from UTAD.

The Program co-chairs, supported by the Scientific Committee members had the important role to bring up the technical program. The call for papers of the DSAI 2016 main track was open for the submissions of full research papers under nine main topics: Software and Web accessibility; Interfaces and interaction; Technologies; Case studies; E-health; Ageing; Universal Education; Communication; and Collaborative Accessibility. The papers were selected by a double-blind review process and assigned by the Program co-chairs to the Scientific Committee members according to their expertise. The Scientific Committee reviewed 27 full research papers from which 16 were accepted. So, we would like to thank the authors in our and nearby communities for submitting top quality papers and the scientific committee members that assisted us with the revision process. Thank you also to the Special Track organizers for their dedication in managing submissions and for engaging in the authors, and Tania Rocha from INESC TEC and UTAD, Special Tracks Organization Chair for managing these sessions. We would like to express our gratitude to Mireia Ríbera Turró from University of Barcelona and Renata Fortes from Universidade de São Paulo, Publication Chairs, for the great effort assisting us arranging the accessible conference proceedings. In coherence with the subject of the conference and for obvious ethical concerns, we wanted to ensure that all proceedings could be readable by any user. Thus, in this edition of DSAI we have taken some important steps towards the accessibility of the papers. The accomplished goals include granting a logical reading order with headings' structure, following good practices for basic metadata (title, author and subject) and making the papers conform to the PDF/UA technical requirements.

**The Conference Program**

On Thursday, December 1st, the opening session of the conference (Figure 1) was chaired by the Chair of DSAI Steering Committee, João Barroso from INESC TEC and UTAD. The Rector of University of Trás-os-Montes e Alto Douro, Professor António Fontainhas Fernandes, had a
welcome speech, followed by the conference opening speech of DSAI 2016 General Chair. The last speech of the session was dedicated to the presentation of DSAI 2016 accessible proceedings preparation by Mireia Ribera Turró from University of Barcelona, representing the Publication

Figure 1. DSAI 2016 Opening session

Chairs. In the first day of the conference five technical sessions took place. The program of the conference also included two keynotes in the opening day. In the morning keynote, Diamantino Freitas from Universidade do Porto presented “Seamlessly Supported Personal Navigation in the City”. The afternoon keynote speaker was Bjorn Eskofier from Friedrich-Alexander-Universität Erlangen-Nürnberg with a communication entitled “Ubiquitous Health: Wearable Computing Systems that Promote Healthy Living and Transform Health Care”. The keynote session was preceded by the presentation of the World Federation of the Deaf (WFD) Expert Group on Accessibility, by Matjaž Debevc from University of Maribor.

On Friday, December 2nd, five technical sessions and two keynote took place. The morning keynote speaker was Anastassios Mikropoulos from University of Ioannina, presenting the “Pedagogical aspects of ICT in learning and communication disorders”. Sylvester Arnab from Coventry University, was the afternoon keynote speaker, with a presentation entitled: “Remixing play for inclusive learning”. The last session of the day was the workshop: “Assistive Technologies: Challenges and Opportunities”, chaired by João Barroso from INESC TEC and UTAD. At the end of the day, the Gala Dinner allowed the participants to continue the discussion in a relaxed environment, tasting the flavours of the Douro region.

Saturday, December 3rd, the International Day of Persons with Disabilities, was the last day of the conference. Two technical sessions took place, one before, and one after the fifth keynote speech. The last keynote speaker was Orlando Fernandes from Universidade de Évora, with a speech entitled: “Technology and Sports Science, Innovative Methods in Movement Analysis”. The conference ended with a closing session, chaired by Leontios Hadjiileontiadis from Aristotle University of Thessaloniki and Khalifa University, a member of DSAI Steering Committee.

DSAI 2016 had 93 registered participants, from which almost 50% were students. During the 3 days-conference, the attendance was very high, with more than 80 participants present everyday on the 12 technical sessions and 5 keynotes. In the project exhibition space 6 projects were demonstrated to the participants: Integrated System for Enhancing the Autonomy of the Blind; Breaking Educational Barriers with Contextualised, Pervasive and Gameful Learning (BEACONING); Intelligent Parkinson eaRly detectiOn Guiding NOvel Supportive InterventionS (i-PROGNOSIS); POLY-stakeholders for integrated CARE for chronic patients in acute phases
(POLYCare); Play for Children with Disabilities – LUDI; and Accessible metaphor for non-text Web browsing (SAMI).

**Special Tracks**

DSAI Special Tracks are sessions organized by high-profile organizers that invite authors in a special podium session as part of the conference program. They intend to extend the impact of the conference and promote its main goals, namely: provide a space for debate on new tendencies and software projects for populations with special needs; contribute to the creation of synergies among public and private entities, namely Industry and Universities; to share experiences and best practices.

In line with previous editions, DSAI 2016 special tracks attracted several submissions. The Special Tracks organization was chaired by Tania Rocha from INESC TEC and UTAD. Nine special tracks were organized by leading researchers in their corresponding fields: Enhancing inclusive societies through digital media: an overview of strategies and solutions to promote universal participation, organized by Ana Margarida Almeida; Accessible Communication, organized by Franz Pühretmair; Smart Destinations technological applications for enhancing accessibility and fighting info-exclusion, organized by João Rodrigues and Celia Ramos; Emergent Technologies for Ambient Assisted Living (ETAAL), organized by Nafaa Jabeur and Ahmed Nait SIDI MOH; LUDI – Play for Children with Disabilities, organized by Pedro Encarnação; Design with Older Adults: enhancing connectivity, organized by Renata Fortes and Paula Costa Castro; Learning Technologies in Special Education and Inclusion, organized by Tassos A. Mikropoulos; Digital Exclusion in the Information and Knowledge Society, organized by Sofia Balula Dias and Jose A. Diniz; and Enhanced solutions for inclusive learning and students dropout prevention in higher education, organized by Emmanuelle Gutiérrez y Restrepo. Jointly with the Special Tracks Organization chair, the special track organizers were responsible for their tracks, and they made acceptance/rejection recommendations.

**DSAI 2016 Partners**

**INESC TEC – Tecnologia e Ciência**
http://www2.inescporto.pt/

**University of Trás-os-Montes e Alto Douro**
http://www.utad.pt

**KI-I – Competence Network Information Technology to Support the Integration of People with Disabilities**
http://www.ki-i.at/

**Universidad Carlos III de Madrid**
http://www.uc3m.es/
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He is a Senior Researcher at Institute for Systems and Computer Engineering, Technology and Science – INESC TEC. His main research interests are in the domain of Human Computer Interaction, including Collaboration and Accessibility topics. He is a member of the J.UCS board of editors, was guest editor of three Special Issues in journals indexed by the Journal Citation Reports and collaborates with the steering committee of the DSAlt International Conference. He has authored or co-authored more than 100 refereed journal, book chapters and conference papers. He is one of the inventors of a granted patent and a patent pending request. He participated in thirteen national projects and three international projects, eight of them with public funding and six with private funding.

Lourdes Moreno (F) is Visiting Associate Professors in the Computer Science Department at Carlos III University of Madrid, Spain (UC3M), and researcher at the LaBDA Research Group in UC3M. Moreno held a PhD in Computer Science and Technology at UC3M and earned a Bachelor of Science Degree in in Mathematics at Complutense University of Madrid, Spain.

Her research is focused on the design, development, and validation of accessible technology targeted to users with disabilities in different application domains. She has experience and know-how in technology in the different user groups with disabilities. Moreno has co-authored several journal publications and she has participated in prestigious academic publishing presses. All these publications and contributions are in the field of disability and technology. For years, she has been working with organizations doing a transfer of technology and disseminating the best practices of the research carried out.

She is a Board Member of the AIPO (Spanish Human Computer Interaction Association), a member of ACM and a Board Member of the Spanish ACM chapter of ACM SIGCHI. She belongs to the Working Group AEN 71/5C36/GT 12 of the Spanish Association for Standardization and Certification (AENOR), for the development of standard UNE: Quality of digital educational materials, PNE 71362, dealing with quality based on accessibility.
Franz Pühretmair (M) is scientific and managing director of the Competence Network Information Technology to Support the Integration of People with Disabilities (KI-I). He studied computer science at the Johannes Kepler University in Linz, Austria. From 1996 to 2003 he was researcher and project manager at the Institute for Applied Knowledge Processing at the Johannes Kepler University Linz. In 2003, he received his PhD and started his work to set up the newly founded Competence Network KI-I with the aim to improve the life situation of people with disabilities and elderly people by the use of information and communication technology. During his work, he was involved in numerous projects directly with industrial and business partners as well as national research projects and European Community founded projects in the areas of technologies for people with disabilities, accessibility and usability of modern IT, e-government, medicine and tourism applications. He was speaker at various international conferences (AAATE, CAiSE, DEXA, DSAI, ICCHP, iiWAS, ENTER, etc.) and is lecturer at several universities and educational institutions. His current research work is related to the use of information and communication technology to enable the integration of people with disabilities that concerns the field of assistive technology and accessibility and usability of modern IT, software, documents and the Internet as well as accessible communication that ranges from understandable information (Easy-to-Read) to Augmentative and Alternative communication (AAC).