ISSUE 91, JUNE 2008

Accessibility and Computing

A regular publication of the ACM Special Interest Group on Accessible Computing

Inside This Issue

A Note from the Editor

Dear SIGACCESS member:

Welcome to the new look of the online edition of the SIGACCESS Newsletter – with new layout, the use of sans-serif and larger font throughout, left-justification, and the inclusion of authors' short biographies and photographs (so that you can say hi when you meet them in meetings and conference).

Following the tradition of including a variety of work from around the world, this issue encompasses a variety of topics, from a report from Italy and Czech Republic on the use of non-verbal vocal input to control an RC car to Web-based system for helping stroke survivors and their caregivers in Malaysia. This issue also includes a report on two workshops aimed at identifying important and emerging research areas and trends in Human-Centered Computing, in which accessibility is a part of the agenda.

Sri Kurniawan

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We encourage submissions as word-processor files, text files, or e-mail. Postscript or PDF files may be used if layout is important. Ask the editor if in doubt.

Finally, you may publish your work here before submitting it elsewhere. We are a very informal forum for sharing ideas with others who have common interests.

Anyone interested in editing a special issue on an appropriate topic should contact the editor.

Vocal Control of a Radio-controlled Car

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Introduction

Increasing participation of the community of computer users with special needs in computer entertainment brings about the need for understanding the benefits and drawbacks of different assistive input techniques and devices that can be used for controlling the entertainment experience. Especially challenging is the support of the control of the arcade games, such as *Tetris* [7] or *Breakout* [2], where while only a limited number of game commands is required, the users must issue these in a rapid response to the evolving gameplay – and many assistive devices are unable to cope with this problem. A promising set of techniques is provided by employing the voice as an input device.

Generally speaking, the vocal input is based on engaging the user's voice into the input pipeline of a system. Typically, the voice is registered by a microphone, digitized, and converted into a discrete signal. The signal is being analyzed in an application-dependent way. A traditional instance of vocal input is the automatic speech recognition, where the voice signal is analyzed for words contained in it. The recently introduced non-speech input is based on analysis of the user-produced sounds like humming or whistling [6]. The non-speech input has been reported for example also in [1], [4], and [5].

One particular type of the non-speech input is the input by pitch of tone. It is based on the analysis of the development of the pitch of a tone produced by the user, regardless on the type of the sound the user chooses to use, i.e. whistling, or humming. The input by pitch offers various benefits, including language independence and a very low computational cost.

The Study

In our previous study [11] we have demonstrated how the user's voice can be used to control the game of *Tetris*.

In the present study we compare the usability of the speech recognition and the non-speech sound input for a direct control of a simple model of a car. It is another instance of a system in which the real-time control of the input is needed. The performance of both methods was compared on a series of three simple steering tasks. The car is a simple radio-controlled model with a BlueTooth interface and a dedicated API, shown in Fig. 1. Two user interfaces have been created: One with the speech recognition, and one using the non-speech sound input.

Procedure

Participants. 7 people (6 M, 1 F; 26 years old, SD = 1.61) took part in the study. They all were students of the CTU in Prague. Five of them had a previous experience using both speech recognition technology and the non-speech sound input, gained during the *Tetris* study [11].

Aparatus. The BlueCar [3] was used in this experiment. The BlueCar is a mobile robot with BlueTooth interface. The architecture of the experiment set-up is shown in the figure 2.

Depending on which method is being used at the moment, the input audio signal is routed either to the non-speech sound input or speech recognition interface. The speech recognition interface has been based on one of the industry standards, the Microsoft Speech API. The pitch detection has been based on a simple autocorrelation technique. Both interfaces are supposed to recognize commands in the user's input. The commands are then directed to the BlueCar device via BlueTooth connection. The authors of BlueCar also provide a simulator tool which is supposed to demonstrate the function of BlueCar. In our set-up we decided to ask our participants to use the simulator tool as a training platform.

Fig. 1: BlueCar; from [12]

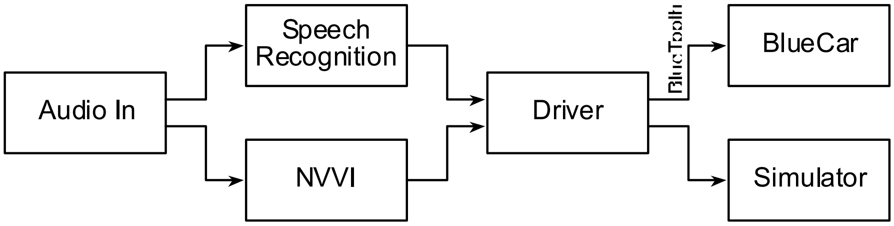

Fig. 2: Voice Control of BlueCar -- Prototype Architecture.

The commands supported by the speech recognition were „forward", „backward", „stop", „left", and „right". The non-speech sound input gestures are displayed in Fig. 3, and cover the equal range of functions. To enable simultaneous control of the direction of movement (forwards or backwards) and the steering, we decided to use a similar approach to the mouse cursor control, as described in [12]. For BlueCar control, the initial pitch of the tone determined whether the car would move forward or backward, depending whether the pitch was above or below a user-specified threshold respectively.

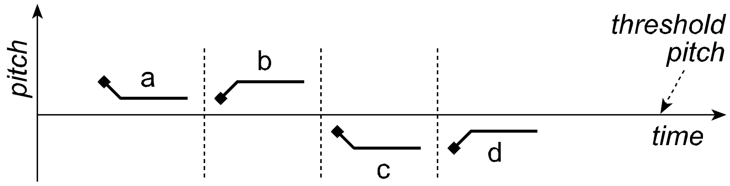

Fig. 3: Non-speech gestures for the BlueCar control: a … forward left; b … forward right; c … backward left; d … backward right.

Procedure. Since the performance of using the acoustic input increases with the user's experience, we decided to train the users further before commencing any measurement. According to the results of our previous experiment described in [8] we decided to ask the participants to train using the interface for 5 days, which was therein reported length of the training period. The structure of individual participant's involvement was as follows:

- Day 1: Initial training in the laboratory. The experimenters have demonstrated the function of the user interface and gave instructions on how to download and install the training software.
- Days 2—4: Individual unsupervised training at home. The participants were only asked to report how long they trained each day.
- Day 5: The main measurement in the laboratory, filling out a questionnaire. On the fifth day, the participants were invited to the laboratory again to perform the steering tasks using both methods and fill out a simple post-test evaluation questionnaire. The actual steering tasks were to drive the car through tracks built out of small wooden slabs. Their layout is shown in Fig. 4.
    - Task 1 … Go 2m forward, then back off to the starting point.
    - Task 2 … Go 2m forward, take a turn, then return to the starting point.
    - Task 3 … Drive a curved route.

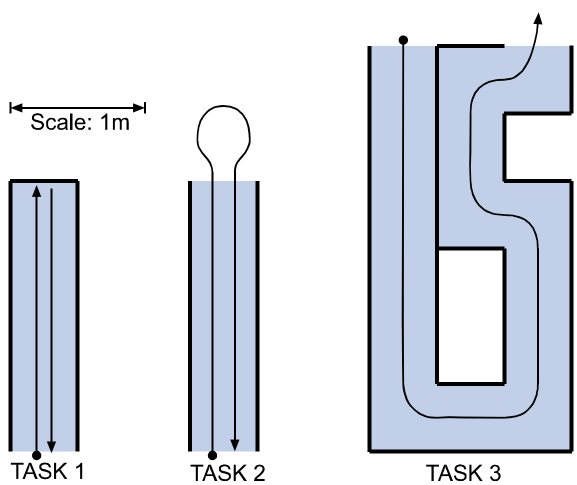

Fig. 4: Steering Tasks

Two values were measured on each performed task: Time needed to complete the task, and the number of penalty points. One penalty point would be awarded for each wooden slab that the car would have pushed over during the course of the task. Due to the failure of the BlueCar's battery, we were not able to record the performance of U7 using the speech recognition.

Discussion and Conclusion

Table 1 shows the performance of individual users U1 through U7 in each task with both methods. Due to the time constraints, the tasks were not repeated. Table 2 shows the aggregate values and their standard deviations.

Table 1: Performance Data.

	Task 1				Task 2				Task 3			
	Speech		NS		Speech		NS		Speech		NS	
User	PP	Time	PP	Time	PP	Time	PP	Time	PP	Time	PP	Time
U1	21	50	0	20	5	80	0	25	29	132	0	17
U2	0	22	15	49	18	70	0	23	26	95	2	18
U3	8	25	0	20	15	60	4	72	22	78	5	40
U4	7	50	0	18	23	72	8	90	16	45	1	20
U5	0	20	0	22	17	63	0	52	22	44	0	37
U6	11	88	0	14	15	89	0	102	29	130	1	57
U7	n/a	n/a	0	21	n/a	n/a	2	53	n/a	n/a	0	68

Legend: PP … penalty points. Time is in seconds.

Table 2: Aggregate values for each user and all users.

Total Time [s]

	U1	U2	U3	U4	U5	U6	Average	SD
Speech	262	187	163	167	127	307	202.2	68.1
NS	62	90	132	128	111	173	116	38.12

Total Penalty points [-]

	U1	U2	U3	U4	U5	U6	Average	SD
Speech	55	44	45	46	39	55	47.3	6.4
NS	0	17	9	9	0	1	6	6.9

Figure 5 shows the average users' responses reported in the questionnaire. The questionnaires used the 1…5 scale where 1 corresponded to „absolutely false“ and 5 to „absolutely true“ on each particular aspect of the system.

The two-tailed *t*-test ($p = .05$) proved significant differences within the following pair of values: „Difficult to use“ (the speech control was considered more difficult), „Fast response“ (the non-speech sound input was considered providing faster responses than the speech control) and „Frustration“ (the level of frustration when using the non-speech sound input was lower).

The overall grade assigned by the participants on the 1…10 scale (1 worst, 10 best) and their overall comments are reported in Table 3. The ratings of non-speech sound input were significantly better than those of the speech control.

Overall, the non-speech sound input proved a better solution than the control by speech recognition for the real-time control of a model car.

Table 3: Overall Evaluation (1—10 scale) and user comments

User	SR	NS	Comment
U1	2	8	"I like the NS method better than speech."
U2	5	8	"The NS method is easier to use."
U3	6	9	"The speech recognition does not work well."
U4	6	9	"The reaction time of NS is much better."
U5	2	8	"No need for the stop command."
U6	1	9	"NS: fastest reaction -- SR: poor recognition."
U7	7	9	"Worked better, was more convenient, and more interesting."

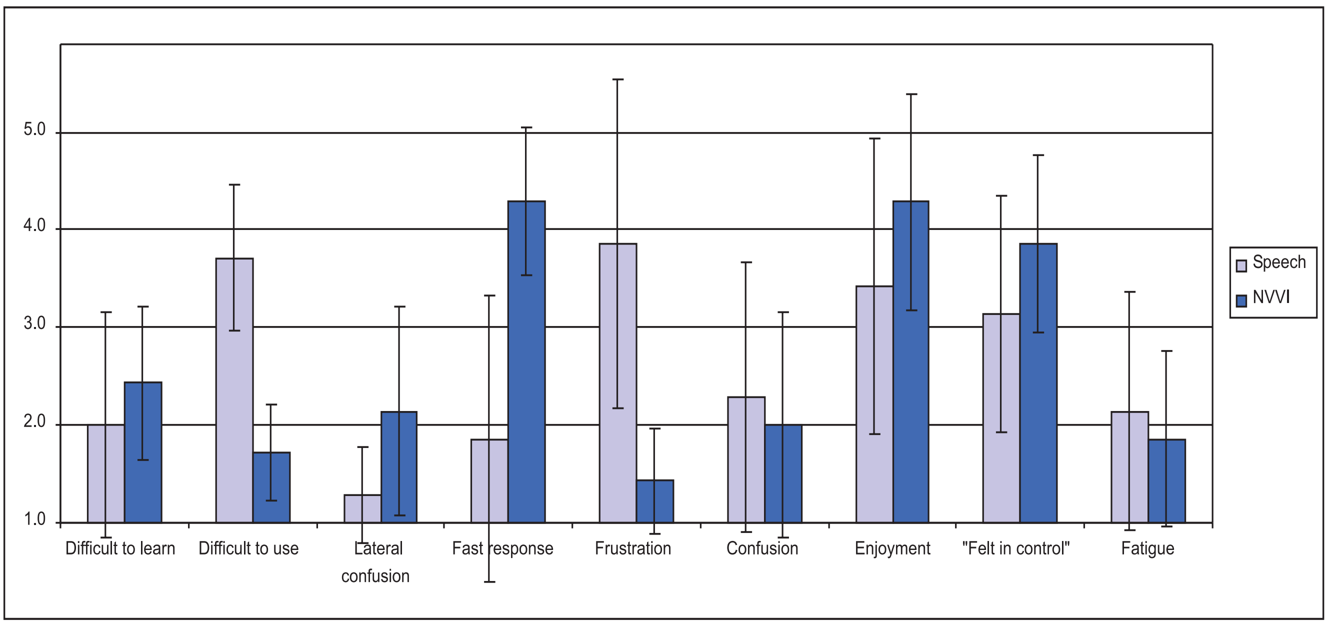

Fig. 5: Subjective evaluation results. The error bars show the standard deviation.

Acknowledgment

Adam Sporka's research is currently being supported by European Comission Marie Currie Excellence Grant for the ADAMACH project (contract. No. 022593). However, the study presented in this paper has been been partly supported by the Ministry of Education, Youth and Sports of the Czech Republic under the research program LC-06008 (Center for Computer Graphics).

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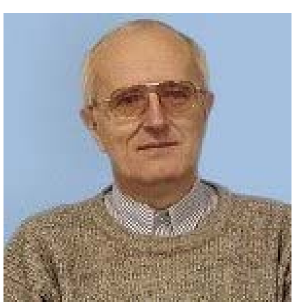

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Structuring and Designing Web Information System for Stroke Care: A Malaysian Perspective

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The rapid development of information technology is a powerful instrument for organizational problem-solving to help with establishing general information systems behavior. The choice of medium is important to insure the success of message delivery. The Internet plays an important role in providing information in a timely manner and in a way that can reach a large geographical area. Internet/web systems mean that business, government, or consumers can access the information (Walter and Scott, 2006). Nowadays, an important use of the Internet is to spread information with an emphasis on health. For more than thirty years, clinicians, health service researchers and others have been investigating the use of advanced telecommunications and information technologies to improve healthcare as mentioned by Hawkey et al. (2007). Health information includes stroke and cancer awareness to inform the public about how to detect and cope with situations related to these two diseases.

This research focuses on stroke because it is a leading cause of morbidity, the third leading cause of death in Malaysia and a major reason for adult disability. According to World Health Organization (2000), stroke is also a major cause of death in developed countries. Many people are not aware that stroke is actually preventable and that stroke survivors can live a normal life again. Raising awareness is therefore one of the main agendas of this research.

Throughout the world, government agencies have provided online information to remind the public how important it is to understand stroke, which can affect anyone at any age. Unfortunately, research shows that this information is too vague to allow people to prioritize the information that they really need and to discard what they need less (Younbo et al., 2006), most likely because most information was provided as paper pamphlet with badly organized sections. Two general issues that this study aims to tackle are: 1) the appropriate medium for delivering the information and 2) the organization of the information and its appropriate content. Currently, most of the information about stroke is available online in English, which disadvantages those who are not familiar with English, such as lowly educated Malays.

In addition, published information about stroke rehabilitation and coordinated rehabilitative programs is scarce, especially for use by patients and caregivers. Community-based services such as home visits or classes have been successful in improving the patient's and caregiver's knowledge about stroke and may assist stroke survivors and caregivers in making effective decisions about treatment. In Malaysia, however, owing to the limited human resources, only selected hospitals provide home care nursing services. Passive formats (such as pamphlets) have been used to provide information for stroke survivors and caregivers but they are not as effective as educational interventions.

This paper is divided into five sections. The first section introduces user requirements for the four target user groups. The second section reviews existing stroke information systems. The third section describes the study we performed. The fourth section discusses the outcomes of the study. The fifth section gives the hierarchy of website navigation and concludes with a summary of what users can get from this information system and possible future enhancements.

Characteristics of the Information System's Stakeholders

In Malaysia, for years caregivers and rehabilitation centers struggle to get the right information to help them address the needs of stroke survivors. Upon initial interview, it became apparent that they need an information system with a flexible and extensible medium for content delivery. Through the initial interview, four groups of users of such information system are identified: stroke survivors, stroke caregivers, stroke rehabilitation centers and therapists.

Stroke survivors' characteristics

Even though stroke survivors will not become one of the stakeholders in this research, their opinion is important because they are the main reason why we need to develop the system. The aim of the research is to help stroke survivors cope with their situation. As Hawkey et al. suggested, successful technology begins with identifying human needs and then tailor the technology to the target audience based on relevant human factors or needs. Through the initial interview, we gathered some requirements if stroke survivors are to be able to use the designed information system. Specifically, a third of stroke survivors suffer from aphasia, a cognitive disorder that impairs speech and language. This means that in many cases stroke survivors will have to rely on other people to understand any information.

Stroke caregivers' characteristics

Caregivers in Malaysia vary in terms of background, age and race as they range from the spouses, children, grandchildren of the stroke survivors, to hired helpers. It should be noted that the stroke survivors (and caregivers) that participated in our study were from low to middle income families, and therefore, some of them had never used computers before. This means that, whatever information we provide, it should be simple enough for novice computer users to learn quickly.

Rehabilitation centers' characteristics

Rehabilitation centers provide physical and language rehabilitation programs for stroke survivors and how to care for stroke survivors for stroke caregivers. Most of these centers have their own websites. Therefore, the information system that we design should seamlessly integrate with their websites.

Therapists' characteristics

Most rehabilitation centers are manned by three types of therapists: occupational therapist, speech therapist and physiotherapist. These therapists are usually very familiar with Internet technology, speak English well (and therefore can use stroke information in English) and most work in several rehabilitation centers, thereby are not always available in one particular rehabilitation center.

Existing stroke information systems

Websites that aim to aid stroke survivors and caregivers are widely available, albeit mostly in English. Table 1 shows some of those websites. As Table 1 shows, only one website provides the information in Malay.

Table 1: Stroke web resources

URL	*Users*	*Countr y*	*Organization*	*Vide o*	*Downloadabl e document*	*Languag e*
www.strokeassociati on.org/	Therapists, stroke caregivers rehabilitation centers	US	American Heart Association	No	Yes	English
www.nasam.org/	Stroke caregivers rehabilitation centers	Malays ia	National Stroke Association of Malaysia	No	No	English, Malay
www.stroke.org	Stroke caregivers rehabilitation centers	Africa, US	National Stroke Association	No	No	Spanish, English
www.stroke.org.uk	Stroke caregivers rehabilitation centers	UK	Stroke Association	No	Yes	English
www.strokecenter.o rg	Stroke caregivers rehabilitation centers	US	Barnes Jewish Hospital and Washington University School of Medicine	Yes	Yes	English

User Requirement Gathering Methods

Three methods were employed in the development of our systems: interview, focus group and card-sorting. The study was conducted at a rehabilitation center and stroke survivors' homes.

Interview

Interview is one technique we chose to discover user requirements. In such a context the use of interviews is common and recognized as the major technique for ascertaining the requirements of the actors in the organization (Kantola et al., 2007). Three therapists, three stroke caregivers and two stroke survivors were interviewed.

Focus Group

In this research, the focus group combines the ideas that we gathered from the interviews conducted earlier. What focus groups do best is offer 'an opportunity to collect data from groups discussing topics of interest to the researcher' (Ragupathi, 1997). Two groups participated in the focus group sessions: a Chinese group and an English group.

The English group is a group of people who can speak English and involves four stroke survivors. The Chinese group is a group of people who can only speak Chinese and involves eight stroke survivors. The translation process was done by one of the stroke caregivers who works at the rehabilitation center. Two questions that form the basis of the focus group discussions were:

- What problems are they facing at the rehabilitation center?
- What information do they need in addition to the information given by the rehabilitation center?

Card-Sorting

Card-sorting activity is a knowledge-elicitation technique often used by information architects, interaction designers and usability professionals to establish or assess the navigation hierarchy of a website as mentioned by Hudson (2005). Card-sorting requires a few people to select the card which they really think is necessary for them. The content of these cards comes from interview and the focus group treated earlier. The total number of cards that we created is 120 from the information people said they required in the previous focus group sessions. Three caregivers and one stroke survivor did the card-sorting activity.

Results

From the interviews, the following requirements were gathered:

Therapists' requirements

The therapists we interviewed suggested that an online pamphlet consisting of guidelines on how to take care of stroke survivors, which they can distribute to stroke caregivers, would be useful. They also stated that an online communication medium through which they can interact with the stroke survivors (to follow up on treatments) and other stroke therapists (to share ideas) would be helpful. One of the therapists suggested that a VCD with movies of step-by-step exercises be provided for stroke survivors to help them to do rehabilitation at home.

Caregivers' requirements

The stroke caregivers' issues that need to be addressed through the designed information system are:

- Caregivers do not have access to the information on how to take care of stroke survivors, especially during the early days of recovery.
- Caregivers have tremendous emotional burden as they had to cope with their own emotion as well as that of the stroke survivor.
- They need to communicate with other caregivers to share their experience.
- They need to know whom they should see, where they should go and what they should do when they are in an emergency situation.
- A directory of doctors, rehabilitation centers and therapists is needed.

Stroke survivors' requirements

The stroke survivors' requirements were gathered from both interviews and focus group sessions. In the interviews, surprisingly some stroke survivors requested online communication medium to communicate with the therapists. They also suggests a website in which they can choose and shop for rehabilitation equipment that do not cost a fortune (one example that was given was, during early recovery, a stroke survivor's house needs to be fitted with handle bar. Using common handle bars that can be purchased from any home improvement shops costs a quarter of specialized handle bars, and the common bars do the job as well as the specialized ones). They also emphasized that they need to communicate with other stroke survivors to share stories, tips, advice, etc.

From the focus group discussions, it became clear that caregivers are stroke survivors' lifeline. Another finding that kept getting mentioned was, they would like the public to know early signs of stroke and risk factors that can lead to stroke (fatty food, certain ethnicity, stroke in the family, etc).

Card Sorting Activity

Consolidating the requirements and the requested information from all the stakeholders, 120 topical items were gathered. Four respondents (two caregivers and two stroke survivors) did the card sorting. We then merged the results of the card sorting activities. The following is the hierarchy of the sorted cards.

1. General information about stroke
2. Emergency and education for patient

    i. Emergency
    - Helpline for emergency and questions regarding stroke
    - What MUST be done daily
    - Therapy that the patient needs

    ii. Education
    - Getting support for post-stroke
    - Information on communication and swallowing
    - Market-place for modification tools (budgets, where to get)
    - Finding supplies (bed)
    - Financial resources
    - Social welfare support
    - Stroke survivor personal stories

    iii. Videos
    - Video on how to carry stroke survivor
    - Video on how to help patient swallow food
    - Video on how to move patients from bed
    - Video on how to take care of patient's shoulder
    - Video on how to turn patient around
    - Video on how to walk in a correct way
3. Life after stroke
4. Rehabilitation and regaining independence

    i. Therapies
    - New and alternative therapies
    - What to expect in rehabilitation
    - When to begin rehabilitation
    - Chart from initial step to final step in rehabilitation
    - Occupational therapy
    - What programs of rehabilitation are available
    - Highlighted activities (dos and don'ts for stroke survivor)
    - Speech therapy
    - Steps in speech therapy
    - Therapy that the patient needs (different types)

    ii. Effect
    - Warning signs of stroke
    - Information to the effect that family history is a predictor of stroke
    - Media statistics
    - Media stroke news

- Stroke connection magazine

iii. Preparation of home for patient
   - What to prepare in the house
   - Mobility aid application (e.g. people living on fourth floor of an apartment)
   - Sample picture of bathroom modification
   - Step-by-step guidelines for bathroom modification
   - Step-by-step guidelines for stairs modification
   - Example picture of stairs modification
   - Step-by-step guidelines for kitchen modification
   - Sample picture of kitchen modification

iv. How to avoid another stroke
   - Exercise and fitness
   - Diet plan
   - Improving patient care

5. Information from professionals
   - Information on advice center by professionals
   - Psychiatry/psychology information to handle stroke
   - Motivational talk by professionals
   - Motivational talk by doctors
   - Motivational talk(by volunteers)
6. Connecting others
   - Common thread Pen-Pals
   - Patient feedback to therapists
   - Pediatric stroke resources (links for family who experienced strokes)
   - Discussion board for speech therapy
7. Caregivers
   - Information on national organization for empowering caregivers
   - Educational information or caregivers
   - Discussion forum for caregivers
   - Caregivers' personal stories
   - Handling emotion for caregivers
   - Support group for caregivers
   - Information on the caregiver's marketplace
   - Caregiver's health management
   - Information on national organization for empowering caregivers
8. Research findings
9. Program provided
   - Program organized for stroke survivor and caregivers
10. Downloadable
   - Downloadable information on rehabilitation center (e.g.: NASAM,MIND)
   - Downloadable information on daily activities at home
   - Downloadable information that they need at home
   - Downloadable information on schedule of diet plan
11. Contact
   - Links to government hospitals and rehabilitation centers
   - List of donors
   - Directory of nursing homes

- Directory of volunteers
- Directory of doctors
- Directory of care centers

Conclusion

This research proposed a combined technique to get at user requirements from Malaysian perspectives in developing an information system for stroke care.

The approach using card-sorting activities is a first step to obtaining an idea of the hierarchy of the web structure. We are currently planning on testing the stakeholders to navigate around the created information system to detect navigation problems.

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Defining an Agenda for Human-Centered Computing[1]

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Two workshops sponsored by the National Science Foundation (NSF) were held in September 2006 at NSF headquarters in Arlington, Virginia, with the goal of identifying important and emerging research areas and trends in Human-Centered Computing (HCC). In this article we report on these workshops, each of which was attended by about 30 prominent researchers in the area.

About the NSF HCC Cluster

According to the National Science Foundation Act of 1950 (Public Law 81-507), NSF's mission is to initiate and support basic scientific research and research fundamental to the engineering process, programs to strengthen scientific and engineering research potential, science and engineering education programs at all levels and in all the various fields of science and engineering, programs that provide a source of information for policy formulation, and other activities to promote these ends. As part of this mission, NSF recently established a new cluster, referred to as Human-Centered Computing, within the Division of Information and Intelligent Systems. The core of this new cluster was formed by combining what had been three separate programs: Human-Computer Interaction, Universal Access, and Digital Society and Technologies. As a result, this cluster addresses a diverse set of research themes "which are united by the common thread that human beings, whether as individuals, teams, organizations or societies, assume participatory and integral roles throughout all stages of IT development and use" (National Science Foundation, 2007).

The workshops were designed to accomplish the following:

- educate active researchers in the areas of human-computer interaction, universal access, and digital society and technology about the new HCC cluster and the related solicitation (NSF 06-572);
- provide guidance to young researchers regarding areas for future research and issues to consider when developing research proposals for submission to NSF; and
- provide feedback to NSF from the affected research communities regarding topics that are considered particularly important.

The majority of the workshop attendees were principal investigators on grants funded by one of the three merged programs. Other individuals were invited to ensure a broad perspective. The following sections summarize the structure of the workshops and some of the significant outcomes.

[1] Reprinted with permission from HFES Bulletin, Volume 51, Number 2, February 2008, http://www.hfes.org/web/BulletinPdf/0208bulletin.pdf.

Workshop Structure

Both workshops were two-day events. Two breakout sessions in each one allowed smaller groups to explore specific issues in depth. Combined, the two workshops included six breakout groups that discussed continuing and emerging research opportunities, three groups that focused on interdisciplinary research opportunities, and two groups that explored issues related to HCC education. At the conclusion of each session, all groups came together to share their insights.

Outcomes: Continuing and Emerging Research Opportunities

Below are some of the many areas discussed by workshop participants.

1. *Privacy, security, e-government, and HCC*. These questions were seen as fundamental for the HCC community to address in the areas of privacy, security, and e-government: How can we provide usable tools and interfaces to enable individuals to remain in control of their personal information? What tools and policies can help organizations and institutions more effectively manage and secure their data?

   Participants discussed the role of regulations and directives, the integration of usability-related concerns into security and privacy issues, and the need to address these issues in e-government-related projects. Electronic voting was noted as an area for additional research.

2. *Intelligent user interfaces*. Workshop groups highlighted the need for additional research on multimodal interactions, adaptive user interfaces, artificial intelligence-supported interactions, and other related methods of interacting with information technologies, including interactions that leverage speech, eye-tracking, and electrophysiological data.

3. *Universal access*. Children and older adults were identified as being appropriate targets for additional research in universal access. Foci include cognitive impairments in general, autism and illiteracy, and visual, physical, and hearing impairments. Brain-computer interfaces, which can provide interaction opportunities for individuals with severe impairments, may offer interesting possibilities for a broader range of users than has been studied in the past, including individuals without disabilities.

4. *Research with child participants*. Several efforts are ongoing to integrate technology into children's lives in a positive way, including educational technology and other aspects of design. Related HCC research can also involve design ideas specific to younger users.

5. *Needs of an aging population*. Older adults are becoming more familiar with information and communication technologies that enable them to stay connected with family and friends, pursue education, and shop online. Ongoing HCC research for this population involves the provision of an engaging and safe environment for the elderly through technology, especially for adults in assisted-living facilities.

6. *Ubiquitous computing*. This category includes mobile, embedded, and location-aware technologies. There is an increased emphasis on smaller multifunctional devices, such as those that combine the functionality of mobile phones, cameras, digital music players, and personal digital assistants. The workshops focused on embedding these devices in the environment (e.g., integration with home-monitoring systems). This convergence in computing was noted as a research area of great interest.

7. *Mobile computing*. Information and communication technologies are becoming smaller, more mobile, and more connected. There was significant interest in research that would address a broader range of computing environments.
8. *Nomadic computing* (computing on the move) is an area of interest because it leads to more dynamic environments and additional challenges for information technology users. Location-aware technologies are on the rise and enable mobile computing tools to support social connections, e-commerce, and a number of other socially engaging activities.
9. *Social computing*. Of great interest were online communities that support daily tasks and work-related activities (e.g., jobster.com and monster.com), as were the factors that influence the success of such communities. One specific question concerned the usefulness of online communities in engaging children and women in science and math.
10. *Health care applications*. Telemedicine has a potentially far-reaching impact to improve delivery of health care to remote areas. User-centered design of sensor technologies to support home health care could allow for greater independence and better treatment. Information technology can greatly improve disease management and patient safety.
11. *Healthy computing and long-term effects of technology*. Prolonged computer use is associated with such repetitive strain injuries as eye strain and carpal tunnel syndrome. Two areas highlighted for additional research were the relationship between repetitive-stress injuries and mobile devices and other, less-traditional information technology interfaces. Also of interest are potential social and psychological problems stemming from excessive computer use.
12. *Theory and evaluation methodologies*. The groups suggested that greater emphasis must be placed on developing underlying, foundational theories as the HCC area moves forward.

Outcomes: Interdisciplinary Research Opportunities

Research can address issues related to electronic medical records, emergency care, security, privacy, and mobile interactions. Other possible domains include space industry, neuroscience, the humanities, philosophy, and urban computing. With these opportunities come numerous challenges, which include:

1. *Understanding the disciplines*. Effective interdisciplinary research requires an understanding of and appreciation for the various disciplines involved in HCC research. Interdisciplinary experts may not be fully accepted by the various discipline-specific experts.
2. *Promotion and tenure*. The issue of acceptance is particularly important for new faculty members who are seeking tenure and interdisciplinary Ph.D. students who will be pursuing faculty positions. A "tenure home" must be defined for the interdisciplinary faculty if they are involved in a discipline-specific promotion and tenure process. Additionally, finding funding sources may be more difficult for individuals with an interdisciplinary research focus.
3. *Administrative overhead and where to publish*. There were concerns with regard to the most appropriate venues in which to publish interdisciplinary research results as well as the additional administrative overhead that is often involved in such activities.

4. *Different approaches to science*. It can be difficult to identify methodologies that are considered acceptable by all individuals involved in a specific project. Learning and applying new methodologies can also be a challenge for a new faculty member who has limited time.
5. *Interdisciplinary Ph.D. students*. Relatively few doctoral students plan to pursue a faculty career and conduct interdisciplinary research. Some challenges include a lack of mentors engaged in interdisciplinary research, concerns regarding future employment opportunities, and additional work involved to obtain appropriate breadth and depth of knowledge in more than one discipline.

Outcomes: HCC Education

In each workshop, one breakout group discussed HCC education. Their discussions produced a list of curriculum recommendations and a number of ways to enhance the education of future HCC practitioners and researchers. Workshop participants suggested that HCC education would be improved by additional coverage of issues related to the tools used, iterative development techniques, methodologies, theoretical frameworks, and various application domains.

With the establishment of the new Human-Centered Computing Cluster, new opportunities will emerge with regard to the nature of the research that is funded and the types of educational activities that are supported. In these workshops, a diverse set of established researchers, as well as individuals who are still developing their research programs, outlined a variety of important topics for human-centered computing. Researchers and educators interested in the future of this field are encouraged to explore these issues and to watch for future developments within the HCC Cluster at NSF.

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This material is based on work supported by the National Science Foundation under Grant Nos. IIS-0642332 and IIS-0642302. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NSF. A more comprehensive review of the topics discussed in these workshops may be found in Sears, A., Lazar, J. Ozok, A., & Meiselwitz, G. (2008). Human-centered computing: Defining a research agenda. International Journal of Human-Computer Interaction 24(1), 2–16.

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CFP: Tenth International ACM SIGACCESS Conference on Computers and Accessibility

October 13-15, 2008, Halifax, NS, Canada

http://www.sigaccess.org/assets08

The ASSETS series of conferences explores the potential for Computer and Information Technologies to enhance the lives of individuals with disabilities and those around them. ASSETS is the premier forum for presenting innovative research on the design and use of both mainstream and specialized assistive technologies to support people with disabilities.

Since 1994, the Association for Computing Machinery (ACM) and its SIGACCESS Special Interest Group on Accessible Computing has sponsored the ASSETS series of conferences.

This year's conference includes formal paper sessions, demonstrations, posters, a doctoral consortium, and a student research competition.

The single track and friendly atmosphere make ASSETS the ideal venue to meet researchers, practitioners, developers and policymakers to exchange ideas, share information, and make new contacts.

Topics

High quality, original submissions will cover topics relevant to computers and accessibility. This includes the use of technology by and in support of:

- Individuals with hearing, sight and other sensory impairments
- Individuals with motor impairments
- Individuals with memory, learning and cognitive impairments
- Individuals with multiple impairments
- Older adults

Researchers and practitioners will present novel ideas, designs, techniques, systems, tools, evaluations, scientific investigations, methodologies, social issues or policy issues relating to:

- assistive technologies that improve day-to-day life
- assistive technologies that improve access to mainstream Computer and Information Technologies
- innovative use of mainstream technologies to overcome access barriers
- accessibility and usability of mainstream technologies
- identification of barriers to technology access that are not addressed by existing research

Registration Information

The registration costs for ASSETS 2008 are as follows:

Early Registration (before 8/4/2008)

- ACM/SIGACCESS members $450
- Non-ACM/SIGACCESS members $550

- Student $300

Late and on-site Registration (after 8/4/2008)

- ACM/SIGACCESS members $550
- Non-ACM/SIGACCESS members $650
- Student $350

Please visit our website for online registration: http://www.acm.org/sigaccess/assets08