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For communities at risk, simply having a preparedness plan and warning system may not meet the needs of all residents.
What if a person has a visual disability?
A TSUNAMI WARNING HAS BEEN
ISSUED FOR
URAKAWA-CHO AT 14:35.
EVACUATE TO
HIGHER GROUND IMMEDIATELY.
What if a person has a hearing impairment?
What if a person has a motor disability?
What if a person has a cognitive disability?
Disaster Preparedness map provided to citizens of Urakawa Japan
What if a person has a print disability or is unable to communicate in the local language?
DANGER

Volcanic fumes are hazardous to your health and may be life-threatening.

DO NOT enter this area if you are among the following persons who are especially at risk:

- People with breathing or heart problems
- Infants and young children
- Pregnant women
地震・津波・避難

Earthquake · Tsunami Comes · Immediately Evacuate Quickly!

ゆっくり1分
高いところへすぐに避難！

TSUNAMI WARNING!
If an earthquake lasts for more than one minute IMMEDIATELY EVACUATE to higher ground!

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What if a person is colorblind?
What does color coding tell you if you have colorblindness?

People with color deficiencies may have difficulty distinguishing certain colors (e.g., a red/green color deficiency means that reds and greens are more difficult to distinguish). Many other colors are just as distinguishable to a person with a color deficiency as to someone with normal color vision.
Kinds of Disabilities

- Visual
- Auditory
- Mobility
- Communication
- Cognitive
- Or situational disability such as
  - Obese
  - Pregnant
  - Recent surgery
  - Chronic Medical Conditions
  - Etc.
Number of Disabled world-wide

- According to estimates of the United Nations/WHO, about 10% or 650 million of the world’s population is disabled.

- In developed countries, the percentage is much higher, closer to 20% of the population is identified with some form of disability.

- Assume that 20% may be the more accurate figure globally... 1.3 billion persons with disabilities.

- Unified standards for data collection are in development with the goal of providing an accurate count of the disabled world wide.
Goals of this work:

- Focus on the specific challenges people with disabilities face in a disaster.
- Enabling people with disabilities to prepare and respond to disaster
  - Develop Awareness of Risk
  - Detect Alarms and Discern the type of emergency
  - Respond quickly
  - Shelter or evacuate as dictated by the emergency
  - Assisting others in need
  - Reaching safety
  - Returning to normalcy
Recent Catastrophes

Pakistan Earthquake
Hurricane Katrina
Indian Ocean Tsunami

are prime examples of catastrophes that have focused our attention on the need for disaster preparedness and mitigation.
The South Asian Tsunami and Aftermath

- Indian Ocean Tsunami was a low probability event
- Majority of the population, throughout the affected area were not prepared and not warned
- Human nature succumbs to nature, with some individuals heading towards the exposed seabed instead of fleeing
Who wouldn’t want to see the exposed sea bottom?

Low tide at Patong Beach, Thailand
Post Tsunami Developments:

- Among the estimated 200,000 people killed on December 26, 2004, were many with disabilities.

- Media reports, and interviews reveal some of the stories that detail the **plight of persons with disabilities**, such as the following:
At a shelter for the mentally and physically disabled in Galle, only 41 of the 102 residents of the home survived. Source: AP.
From the Tangalla School for Blind, 16 blind students on an outing were caught up in the tsunami, 12 died, and 4 of the more senior students escaped and helped the teachers who were sighted to get out of the vehicle.

Source: author’s interviews
Problems Associated with Tourist Destinations

Transient nature of the tourist population

Lack of attention & motivation to seek out preparedness information

Need for information delivery in multiple languages or through symbols to the effectively illiterate
Disabled visitor to Patong Beach, Thailand, May 2005
After the South Asia Tsunami, the scientists involved said…

“We can build a Tsunami warning system, but it will be useless if people do not know how to respond to it. This is an issue of behavioral psychology, not geophysics.”

Comment at the International Symposium on Tsunami Disaster Mitigation for the Future

- Not an issue of geophysics… the issue is human behavior

- Is this news?
Understanding meanings of alerts

- **Hawaii**: As early as the 1960 it has been reported that 60% of the population did not understand the official meaning of the warning siren prior to a tsunami. Lachman et al (1961)

- **Patong**: In a recent evacuation drill the message, given in several languages, was met with some confusion as to the meaning of the alert tones (author interviews, 2005).
Non-Disabled confused

- **Gregg 2005** - Survey results, 12% understood the siren warning system Hawaii

- **Stanton & Edworthy, 1999** Human factors research on design for effective warnings and sirens.

- Lacking research for those with physical, perceptual or cognitive disabilities.
Path of the Hurricane Katrina

- **Path of the Storm**
- **August 29\textsuperscript{th} 2005**
Many of the affected were unable to leave their homes to reach safety.

Assistance often did not arrive until after several days. This interval was an extreme burden on all the citizens waiting for rescue but especially difficult for Special Needs Populations.
Hurricane Katrina

- Nursing Homes had inadequate (or non-implemented) evacuation plans leaving, in one instance, residents to fend for themselves.

- 34 people drowned in the St Rita’s Nursing Home in St. Bernard's Parish (CNN 2005)
Hurricane Katrina Aftermath: Failure at All Levels

- People confined to wheel chairs awaited rescue or evacuation.
At the Super Dome, deaf individuals were confined in an area designated as "Deaf Area" without adequate support for their information needs.
Growing international need for disaster awareness and mitigation

- Vulnerable populations recognized
- Disabilities **should** be considered
- But little in the way of concrete action
Recent Developments in the United States


- But...
“Disaster preparedness and emergency response systems are typically designed for people without disabilities, for whom escape or rescue involves walking, running, driving, seeing, hearing, and quickly responding to instructions, alerts, and evacuation announcements.”

National Council on Disabilities Report, April 2005
“Access to emergency public warnings, as well as preparedness and mitigation information and materials, does not adequately include people who cannot depend on sight and hearing to receive their information.”

National Council on Disabilities, April 2005
Recommendations to include the disabled in emergency planning and delivery of preparedness materials in accessible, alternative formats

The Question: Does this answer the challenges for all disabilities?
Gallaudet University

Accessible Emergency Notification and Communication; State of the Science Conference November 2-3 2005

In reality this was a State of the Technology Conference, with only one reference to science

Covered many fascinating aspects of communication for the deaf as well as persons with multiple disabilities.

The conference highlighted the culture of the deaf.
Psychology of human behavior, not just technology

How do we succeed in getting near perfect compliance?

- **Educate** - all persons to the possible risk in their environment. High and low probability events

- **Raising Awareness** - of environmental changes so persons will have maximum lead time to seek safety

- **Increasing Preparedness** - Participating in Drills Gathering Critical documents such as a passport or driving license for identification, medicines, etc., stored in an easily available spot so that no time is lost in collecting them.

- **Action** - Quickly following pre-arranged steps to reach safety
Information and Communication Challenges

- People with disabilities can face many barriers when accessing information
  - *Complexity* of phones and other mobile devices can be a challenge to cognitively disabled and the elderly
  - *Poorly designed information*, such as web pages and PDF documents *can exclude* those with visual impairments and hinder those with learning disabilities
To be effective, awareness of escape routes and safety zones must be promoted prior to the occurrence of disaster through use of accessible materials.

Accessibly designed materials can incorporate features such as audio and visual information and include simplified language for the learning or cognitively disabled and verbal descriptions of visual information such as maps for the visually disabled.
The presence of visual, tactical, and auditory cues in the physical environment must augment information contained in preparedness materials.
Examples

- Reduced complexity for user interaction
- Utilize familiar Images (other cues?)
- Not all tasks lend themselves to this simplification so a need to bridge complex tasks into simple units.
Firefly Mobile™

- Caller ID
- Firefly Fireworks™ display
- Parent-Programmed Mom and Dad Call Keys
- Parent-Programmed Phone Book stores 20 numbers and includes call screening option
- Interchangeable Translucent Shell
- Hook for Backpack Clip
- 911 Assistance Button
A new device for cell phone users while driving shows an image of the Person calling and allows for easy Answering of desired calls.

Why?

Hands busy-eyes busy. Diminished cognitive Capacity due to workload of driving.
Similar Application

- Gregg Vanderheiden at the Trace Center (U. Wisconsin) is conducting research on cell phone interfaces for people with cognitive disabilities.


Figure 1. Flip phone (a) and Picture phone (b)
My phone with Image
The Sony PSP (play stations portable) typifies a new class of “appliance” that allows multimedia information, whether delivered with wireless or on memory cards, to be used anywhere. In this case, the information displayed is coming from the American Red Cross web site.
Goal is to make information accessible

- A Nokia 6600 mobile phone (which is displaying the US National Weather Service Alaska and West Coast Tsunami warning information), attached to a wireless keyboard. This kind of keyboard is usable and useful for the Deaf in order to carry out text messaging.
More Research Needed

- **Specialized interfaces** for cueing and assistance, including visual and auditory signals
  - Include **symbols** and **simplified language**
- Meeting the challenges faced by the Cognitively impaired and other groups.
- Cultural differences in perception needs to be incorporated into this research
Thank You

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