

# Symbols in Alerting

By Nuwan Waidyanatha  
([nuwan@sahanafoundation.org](mailto:nuwan@sahanafoundation.org))

prepared for the Sahana Software Foundation  
([www.sahanafoundation.org](http://www.sahanafoundation.org))

2013 May 10

*I had a dream once – I was walking along a river in China and then an audible alarm in my mobile phone got my attention. When I looked at the screen, surprisingly, a symbol with a red border showing rising water and a human figure running uphill towards shelter, was displaying. Later I realized, being illiterate in Mandarin, a text message would have done me no good. However, the symbol made perfect sense. It was an immediate threat of a sudden-onset flash flood (possibly caused by a damn burst). The response action from the image was self-intuitive; especially, the red border insinuating it is an urgent priority message and that I should immediately seek higher ground to evade the strong waters. That is what got me thinking about symbols in alerting; especially, for mobile phones.*



Figure 1: Flash flood alert

## BACKGROUND

We say “a picture paints a 1000 words.” Can we draw a rendition from that to say “a warning symbol can save lives or livelihoods?” Emergency managers often use symbols in their informatics.

UNOCHA has defined [500 symbols for humanitarian response](#). They use these symbols to mark reliable data on a map of locations and needs of affected people and who is best placed to assist them. UNOCHA has chosen a blue background with symbols in white.



Figure 2:  
Landslide

The [Common Alerting Protocol](#) (CAP) Emergency Data Exchange Language (EDXL) content standard enabled [MASAS](#) software tool, in Canada, adopts symbols with [ESRI](#) layered maps in exchanging location-based situational awareness reports with all of their agencies and their neighbor across the boarder: USA. Natural Resources Canada designed “[emergency mapping symbols](#)” are used in MASAS. These symbols are in color with a white background.



Figure 3:  
Fire

[USA Home Land Security](#) adopts their emergency symbols from the Pennsylvania State University designed Department of Geography designed “[symbol store](#)”. They emphasize that the symbols be in black-and-white and are diamond shaped.



Figure 4:  
Tornado

I can continue to list more examples of software tools and symbols initiatives as I have done above but they are all for emergency managers who are in-tuned with the meaning and purpose of those symbols. The question is, “can the public understand

them; i.e. are they self-intuitive to the public?" There is none or very little use of symbols in public warning or alerting, to my knowledge.

## THE REAL NEED

Often people are misconstrued by alert messages and act inappropriately because they have not fully understood the message; especially, when they are short-text messages with partial information. [The paper on the use of CAP and SMS-based messaging](#) highlights the evidence - when a cyclone warning was issued during an “[early warning pilot exercise](#)”, in Sri Lanka, they responded to a tsunami, seeking higher grounds, when they should have sought shelter in low lying areas (Sri Lanka homes don't have basements).

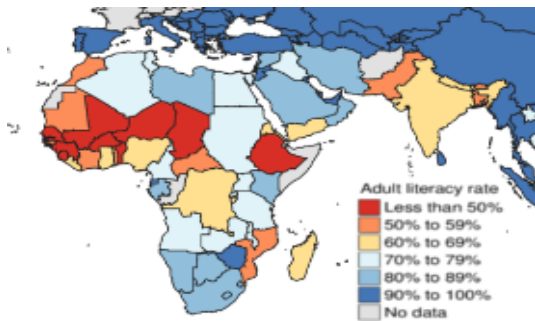


Figure 5: South/West Asia and Africa illiteracy rates infographic

UNESCO estimates, on average, [30% of South/West Asians and Sub-Saharan Africans to be illiterate](#). Those countries combined account for ~40% of the world's population. Over the past 20 years, there has only been a ~10% improvement in this aspect. Not all countries are perfect in their literacy indicators, accounting many lives that could possibly misinterpret an alert or warning message.

[World Bank tourism statistics](#) have estimated over 955 million departures over the past 4 years (2008-2012) and the numbers to rise to 1.6 billion per annum by 2020. Could a Chinese tourist in USA, or any other person alien to English for that matter, understand a rapid-onset Tornado warning text-message? Moreover, would that particular tourist know how to respond to such a rapid-onset alien event? There are other physical and mental handicaps that challenge people from comprehending an electronic text message. Can an alert symbol, depicting the hazard and the required response, be catalyst to removing the ambiguity and effectively warn those challenged persons who are at risk.

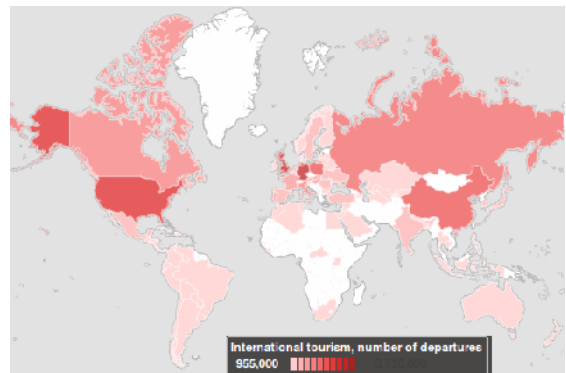


Figure 6: World Bank infographic on Tourism departures (2008-2012)

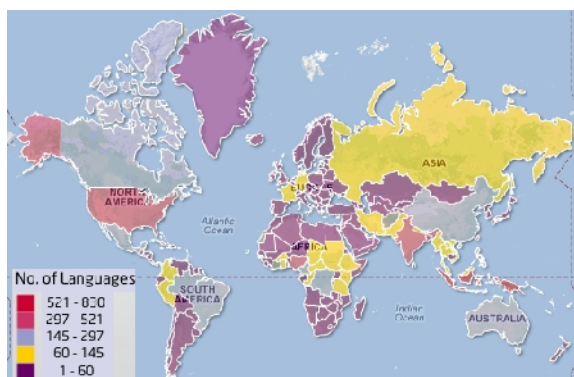


Figure 7: Country-wise language diversity infographic

Studies show that every country in the world is home to more than one language; on average 6 languages, according to [recent studies by Ethnologist](#). In most cases it is above 50 (Figure 7), if we consider regions such as Europe, Asia, and Central Africa. Addressing alerts in each language is cumbersome. Although CAP allows for carrying a message in multiple languages, delivering each language overwhelms the communications networks. Typically, a Country CAP-profile would fix on a minimum set of languages. However, we cannot expect that every citizen is literate in that

minimum set of languages. Where as symbols are language independent and can be pivotal to overcoming the need to alert in multiple languages and further minimize on the set of languages needed in a Country CAP-profile.

Although we are specifically proposing symbols in alerting for mobiles, other stakeholders engaging in public alerting such as TV broadcasters or web alert Aggregator could adopt them as well.

[Google Public Alerts](#) show alerts on a map, as in Figure 8, but use a common circle symbol with letters A, B, C, ..., etc to identify the effective location. The side scroll requires that the user read each message to determine the hazard. If those messages were pegged with a symbol associated with the hazard it would be much faster for the human eye to filter through the list of messages.

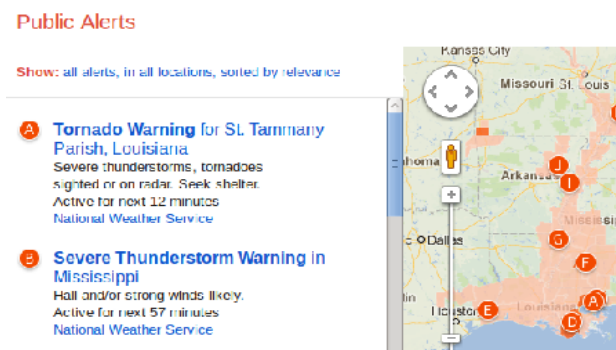


Figure 8: Google Public Alerts

Then the challenge is mapping that description with the symbol to the location on the map because the map could be filled with multiple Tornado icons, for example. It could possibly be overcome by superimposing a number or character, like A, B, C, ..., which they are already doing. However, Google uses symbolism with their hazard specific alerting information pages such as with [Weather Hazards](#), where the color coding represents the potential impact.

Elizabeth Klute<sup>1</sup> (2012), in her Caribbean Islands early warning through symbols study, provides evidence for the need for pictograph (or symbol) based public alerting. Her independent thesis mentions the many challenges with cognition, or understanding, of public warning messages. She emphasizes the need for symbol based alerting for tourists, people challenged by language and literacy, and for physically/mentally challenged persons. The research survey participants preferred symbol-based alerts to be triggered by Cell-broadcast Messages, which implies there is a public need for symbols in alerting for mobile phones.

## SYNOPSIS OF THE PRESENTATION

“Symbols in Alerting” was the basis of my talk at the [6<sup>th</sup> Common Alerting Protocol Implementation Workshop](#) that took place in Geneva, Switzerland (23-25 April 2013). There were seventy participants (70) from thirty seven (37) countries representing and several International organizations, Sahana Software Foundation was one of them.

### Research and development objectives and proposed methods

- 1) **What are the hazard categories for which symbols would be necessary and be effective?** For example, a slow-onset hazard like a cyclone that may take several days to impact, would not require an instantaneous response and there is ample time to warn the public. However, a rapid-onset or sudden-onset hazard like flash-flood,

1 Elizabeth F. Klute. (2012). “Towards Regional Warning: a critical assessment of warning across language barriers, using pictograms, in the Caribbean”, Dissertation submitted in partial fulfillment for

tornado, or tsunami severely constrains the response time. Hence, symbol based alerting would be effective in these two cases.

- 2) ***Do we simply show the symbol of a hazard in an alert, assuming the recipient knows how to respond?*** Or do we use both the hazard and the recommended response? Or do we flip-flop between the hazard symbol and the response symbol, which may be strenuous and may add to the uncertainties of failure. Going back to the example of the Chinese tourist in USA, the second or third, with displaying the nature of the hazard and the response, combined, would, intuitively, be most effective (shown in Figure 9).



Figure 9: Tornado warning symbol with arrow pointing direction to seek shelter

- 3) ***What about color and/or numerically coded severity levels?*** For example, mentioning the [Fujita Scale of Tornado Intensity](#): F-0, F-1, ..., F-5 along with the color code. Thereby, a person challenged by deciphering the color could default to the 'F' number to be informed of the intensity. The symbol background would be set based on the color representing the severity (or intensity) level. Here we assume the alert recipient is aware of the Fujita Scale. Is it self-intuitive?
- 4) ***Can people be confused by similar symbols?*** For example, the symbol for a tidal wave can be confused for tsunami. In the case of a tidal waves the action would be to stay away from the shorelines but not necessarily evacuate from your homes safely locate away from the danger zone. However, a tsunami would mean that people in those home would need to seek hire grounds because the water could inundate several kilometers inland. The risk of evacuation is that homes are vulnerable to burglary. A person misunderstanding the tidal wave warning for a tsunami, then evacuating would expose their homes to potential burglary.
- 5) ***What is the most efficient and effective way to use symbols with mobile phones?*** Given that mobile phones are, globally, the most widely used communications technology with nearly each house hold having access to one, it is best to focus on "symbols in alerting for mobiles". The challenges are in addressing all makes and brands. They typically vary between iOS, Android, Windows, Symbian, so on and so forth. The most effective way may be to host a small applet along with the pictograms in the mobile phone memory. Thereafter, trigger the appropriate pictogram using CAP message for display. A customizable generic applet can be developed. Cellular Operators can adopt the applet, then customize it for the country-context, based on the country CAP-profile. The customized applet can be deliver, over the air, to the subscribers. Thereafter, the subscriber could further customize as to which alerts they would like to see and at what threat levels. The symbol-based alerts on the mobile can be triggered using Cell-broadcast, SMS, or HTTPS (REST-ful) strings.
- 6) ***Finally, what would be the minimum set of CAP elements used to implement such a system that can trigger symbols on a mobile phone as well display the respective content (a mix of symbols and short-text)?*** The selection of CAP elements would need to address the four questions (1 – 4) addressed above. The current intuition is to utilize the <category>, <headline>, <urgency>, <severity>, <certainty>, <areaDesc>, <parameter>, <web> CAP elements. A short-text, possibly

comprising the <headline> and <areaDesc> can be superimposed with the Symbol. The <web> URL can be embedded in the symbol as an icon, when clicked would automatically navigate to the full HTTP CAP message or RSS/Atom feed. Then again some would argue against it because providing a <web> URL would instigate a high volume of Internet traffic that may bring the networks to their knees.

## OUTCOMES FROM THE DISCUSSIONS

These are some of the lessons learned and summary of the discussions around this topic:

- Symbols are indeed effective provided they carry both the hazard and the required response action. The example, in Figure 10, of the tsunami hazard and response action hectogram is sensible. However, what about a local threat such an Elephant attack, which may require a combination of responses such as securing family members (seeking shelter) and lighting fire crackers as a response. When there is more than one response, the implementors should be cautious in, possibly, associating only the response with utmost priority and educating the public of the other actions. Then again, that removes the self-intuitiveness that we are expecting.



Figure 10: tsunami evacuation

- Colors and Numbers are a good way to present the priority (or the severity, certainty, and urgency) of the message. For example, the Hong Kong (HK) Observatory responsible for Meteorological warnings use the numbers 1,3,8,9, 10 and a combination of triangles to communicate the severity, shown in Figure 11. Hong Kong people are historically accustomed to these numbers with symbols and changing them would cause ambiguity. The World Meteorological Organization's World Weather Service uses colors to highlight the severity of a severe weather incident, and studies have proven this to be effective with communities with a diverse array of unique languages in Africa.



Figure 11: HK tropical cyclone categorical alert symbols

## CONCLUSION

The common consensus of the workshop participants was that “symbols in alerting” is important and some initiatives must be exercised to research and develop a framework that is in-line with the CAP standard. It may take time to understand the functional requirements, design parameters, and the process variables. However, the outcomes of the study conducted by Elizabeth Klute would serve as a basis to formulate a potential pilot study. The pilot study would be two parts: 1) technology developments with CAP and for mobiles and 2) developing the set of symbols associating with linguistics and semantics. Thereafter, field testing would be a first step towards gathering evidence to determine the effectiveness of such a program. Sahana would certainly be a good platform to drive this initiative.