The utility of the World-Wide-Web for fire preparedness of residents

Bernd Rohrmann reports on expert assessment of six websites on their usefulness for informing residents about environmental hazards

By Bernd Rohrmann

The "World-Wide-Web" (WWW) is the newest – yet also least researched – tool for informing residents about environmental hazards such as cyclones, fires, volcanic eruptions or floods and for enhancing their preparedness for emergencies and disasters. In this research, a set of six websites by fire authorities (four Australian and two international) were systematically assessed by a group of fire experts, disaster researchers, cognitive psychologists, website experts and residents (N=16). Evaluation criteria included: comprehensibility, completeness of information, relevance for residents, visual appeal, layout, navigability, and suitability for relevant target groups. The results indicate that the websites are well accepted and mostly rated as useful, yet there is considerable potential for improvement. Pertinent suggestions are outlined and further research needs discussed.

1 The issue: Risk mitigation information for residents

Residents exposed to environmental hazards – such as cyclones, fires, volcanic eruptions, and floods – face difficult tasks and crucial decisions: should they stay in their home or leave, in case of an emergency? If they decide to stay: how to prepare their house and property efficiently, and how to deal with animals? If they decide to leave: when, how, and where to? Furthermore, after a disaster: how to cope with the aftermath, and how to return to normal life? Obviously these issues create a very significant need for information related to risk mitigation before, during and after emergencies.

Therefore residents need to be optimally informed about the hazard characteristics, preventative measures and appropriate behaviors during the onset of an emergency situation and after the event (Blaikie et al. 1994, Chase 1993, Covello 1990, EMA 1997, Handmer 2000, Paton & Long 1996, Salter 1998, Webster 2000). Authorities must communicate the relevant information to residents and communities as a whole. This is also stated in the Australian/NZ Risk Management Standard. Effective risk communication is also a moral obligation, given that the health and well-being of citizens are at stake (Bennett & Kalman 1999, Willis et al. 1997). This applies to each of the three main types of aims, i.e., increasing risk awareness, decreasing risk worries, aiding risk choices.

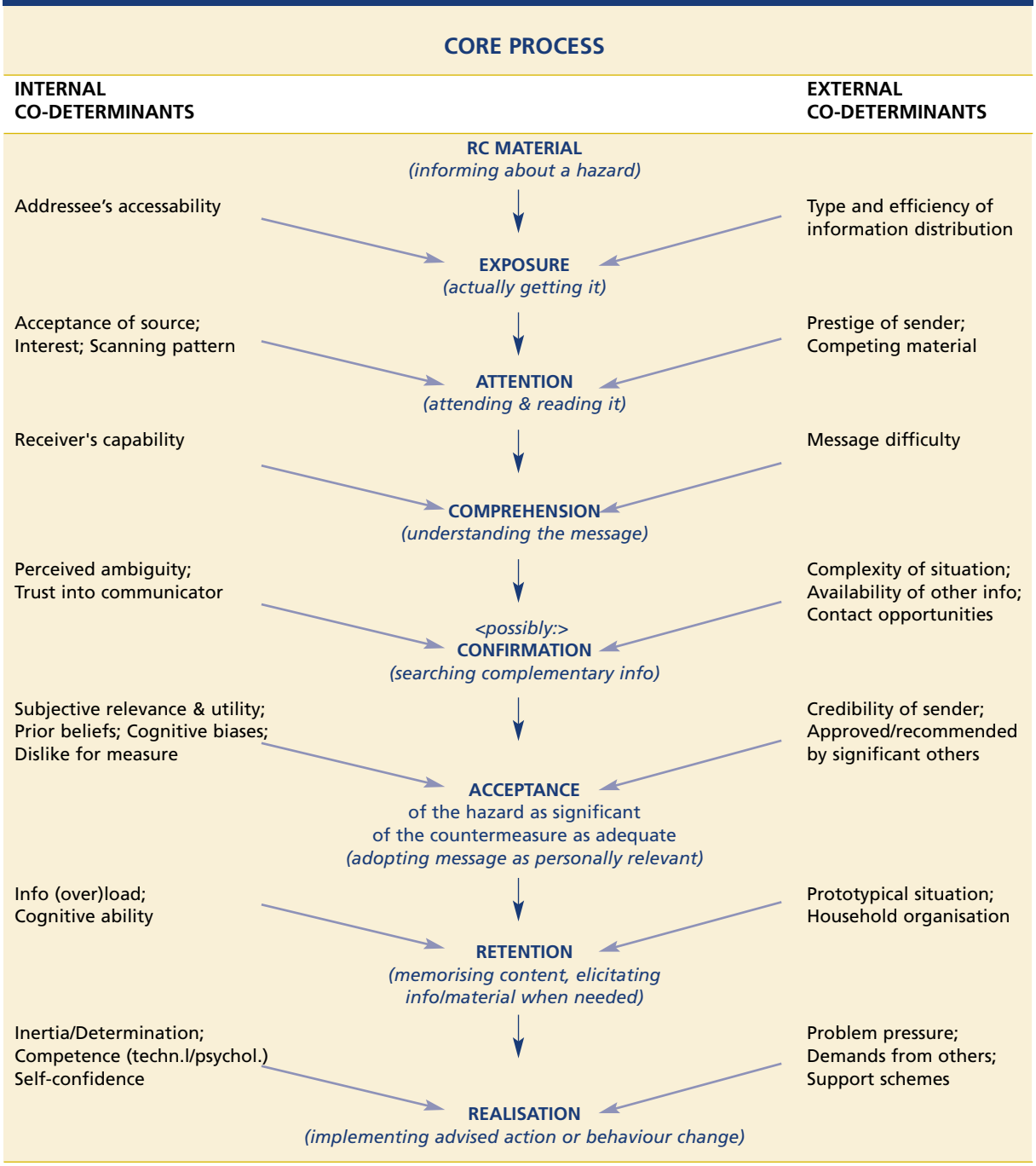
Within information campaigns for enhancing disaster preparedness, media activities (television, radio, internet), meetings with residents, and a variety of visual communication means are used, including printed material such as information leaflets and brochures, picture series (slides, graphs, posters) and video-tapes. Internet-based information provision—such as websites run by authorities (e.g. EMA, Fire Authorities, State Emergency Services) and email-based communication means—have only recently been established and are not yet 'mainstream' procedures, even though they are widely available. It is anticipated, however, that these 'electronic' information channels will eventually become as commonplace in disaster preparedness as in many other fields of public information, communication and education. In fact, WWW-based risk communication has considerable advantages: information can be updated regularly and quickly, users can bookmark and store relevant hazard information, access is fast and blockage unlikely (unlike telephone contacts).

Of course, mere distribution of material is not enough—it is crucial that information efforts are effective (Fischer et al. 1991, Gaull 1997, Rohrmann 1992, 1999). This requires socio-psychological expertise about the impacts of text and visual material on risk perception and preparedness (e.g., Batistich & Chick 2000, D'Arcy 1998, Lange 1998, Lopes 1992, Rohrmann 1995, Sims & Baumann 1988) and critical effectiveness evaluation (Kasperson & Palmlund 1989, Rohrmann 1992, 1998, Weinstein & Sandman 1993). Such research is still mostly lacking (Fischer 1999, Joyce 1999), and inherent problems of the internet approach (Quarantelli 1997) have not yet received much attention.

There is also the issue of user attitudes, habits and needs. Do residents actually wish to use the WWW for

enhancing their disaster preparedness, and if so, what kind of information would they search for on websites, what kind of expectations and requirements do they have, and how likely will the knowledge gained from the WWW be converted into actions? There is hardly any research on these questions (Quarantelli 1997, Rohrmann in press), yet anecdotal evidence seems to indicate that for many people the value of fire websites is not salient, and that conventional information channels and means are still widely preferred. Using websites is certainly a problem for those who are not familiar with computers and the internet, and there may be psychological barriers to internet usage as well. Consequently, it cannot be assumed that WWW-based information is efficient, regardless how proficient a website is—the efficiency of risk communication depends upon the interaction between technological features of the message and psychological characteristics of the receiver (Covello et al. 1989, Lundgren & Makin 1998, Rohrmann 2000).

Figure 1. Informing about Risks: Process Components and Co-Determinants(Preconditions or barriers for enhancing risk mitigation)



2 Requirements for effective information programs

Evaluation research (cf. Chelimsky & Shadish 1997, Cook & Reichardt 1992, Fink 1993, Hinn et al. 2001, Patton 1997) has to find out not only *whether* but also *why* a program works (or not). The crucial question is: which factors determine whether hazard information – provided as text or pictorially or both – is useful in enhancing residents' preparedness? Empirical studies need to be based on a sound conceptual framework (Lloyd & Roen 2002, Mulilis & Duval 1997, Renn 1998, Rohrmann 1995, 2000, Zimmermann 1997). Therefore, a socio-psychological model for the context in which risk communication occurs and a framework for the individual steps of dealing with a material/message must first be developed. Two such models were outlined in Rohrmann (2000); one of them is shown in Figure 1 (see previous page). It identifies the relevant preconditions (or 'barriers' to effective risk communication and preparedness) for each level of an information process—that is, the response 'chain' exposure-attention-comprehension-confirmation-acceptance-retention-realisation.

Appraisal criteria are the centrepiece of an evaluation study. They need to be chosen systematically so that both the substantive objectives and the communication approach of a program are reflected. Usually, 'content', 'process', and 'outcome' criteria are distinguished, and practicality aspects deserve attention as well. In Table 1, a list of pertinent risk communication features is presented.

Authorities choosing between communication means, like brochures, videos, websites, information meetings and so on will have a range of utility considerations, such as: how effective for increasing knowledge and enhancing preparedness is a campaign likely to be? How costly? How easy to distribute? How much information may be wanted by residents? How quickly can materials become outdated?

Obviously only data gathered from the receivers of risk communication efforts can clarify whether a program was effective and successfully achieved its goals.

Table 1. Assessing risk communication effectiveness.

Type of criteria—and examples relevant for websites
Content evaluation e.g., correctness & completeness of information; comprehensibility of the messages; usefulness of graphs/ pictures/drawings; concordance with information needs; feasibility of proposed activities; potential to capture and maintain attention; presentation style;
Process evaluation e.g., possibility of sending and receiving feedback; facilitation of a learning process; addressee's activities re confirmation of information; relevant target audiences reached;
Outcome evaluation e.g., provided information studied a/o discussed in household; websites 'bookmarked'; information search intensified; acceptance of hazard messages a/o suggested actions; increased/ improved understanding of bushfire/preparedness issues; change of beliefs (mental models) regarding bushfire preparedness; reduced information need; commitment to improve bushfire preparedness (behavioral intention); preventive measures conducted/ realised (house; property; evacuation planning changed; increased confidence in information source (i.e. fire authorities);
Practicality aspects e.g., technical or practical preconditions for receiving material; 'printability' and ease of storage of the information/materials; availability of information updates via other communication channels;
Pertinent assessors (depending on the evaluation criterion)
A: RC *agency* (authoring the risk communication material or program)
E: hazard and/or risk communication experts (independent researchers)
R: information receivers or participants of the RC program

Source: adapted from Rohrmann 1992 & 1998

Table 2. Projects re fire risk information and education—1997–2002.

	TOPIC	STUDY TYPE	PUBLICATION
[A]	Community group work	Survey + focus groups	Rohrmann 1999, 2001
[B]	Flyers & brochures	Survey Expert appraisal + focus group Experiment	Lange 1998 Rohrmann 2000 Wilson 2002
[C]	Videotapes	Focus groups	Rohrmann 2000
[D]	Websites	Expert appraisal + focus group Survey	{This study} {Rohrmann in prep.}

3 Empirical appraisal of websites about fire hazards

3.1 Research plan

The research to be reported here is part of a series of studies on "Fire safety information and education means", listed in Table 2.

The investigation of websites consists of two parts, (1) an expert appraisal of fire websites and (2) a survey about residents' expectations and experiences (currently under way).

The plan for sub-study (1) was as follows:

Research aim:

Assessing the usefulness of major websites about fire safety and preparedness, based on criteria which reflect both expert and layperson perspectives. The focus is on information needs of residents.

Method:

Expert ratings based on a detailed catalogue of substantive and procedural assessment criteria (standardised instrument). Additionally, exploratory open-ended questions.

Assessed websites:

Four Australian and two international websites.

Assessment criteria:

Substantive quality: comprehensibility, relevance for residents, completeness of information, visual appeal. Suitability for relevant target groups (professional or private users). Technical website features: layout and navigability.

Assessors:

Fire experts, fire researchers, disaster researchers, cognitive psychologists, website experts, residents who are WWW-literate (N=16, 2 or 3 participants in each group).

3.2 Selected websites

The six chosen websites are listed in Table 3. They include websites dealing with bushfires (forest fires) and urban fires. The two overseas websites – one Canadian and one US-American one – were chosen for comparison reasons.

The websites differ considerably in their style and purpose. None of them are solely or explicitly geared to the 'general public' but all include information for residents or employees. As an example, the frontpage of one of these websites is shown in Figure 2.

Figure 2: Front page of a website—example Metropolitan Fire Brigade (MFB) Melbourne

Source: http://www.mfbb.vic.gov.au/default.asp

3.3 Website appraisals: main results

The data for the main quantitative evaluation aspects are presented in Table 4. In addition to the individual scores, means across all six websites and mean ratings for the three sets of criteria are given.

These results can be summarised as follows:

- Substantive quality: while the understandibility of these websites' content is rated quite positively (overall mean for criterion B2 is 3.7 on a 5-point scale) and their trustworthiness acknowledged (mean for B17 = 4.1), most other aspects are rated as only average, and they are not seen as very motivating

Table 3. Project *AWF* assessment of websites of fire authorities: selected websites.

Country Fire Authority Victoria	Australia	www.cfa.vic.gov.au
Melbourne Metropolitan Fire Brigade	Australia	www.mfbb.vic.gov.au
NSW Rural Fire Service	Australia	www.bushfire.nsw.gov.au
ACT Firebreak	Australia	www.esb.act.gov.au/firebreak/firebreak.html
Canadian Forest Service	Canada	www.nofc.forestry.ca/fire
American Redcross	USA	www.redcross.org/disaster/safety/guide/fire.html

Table 4. Assessment of websites on fire safety preparedness ratings.

Q #	EVALUATION ASPECT	CFA	MFB	NSW	ACT	ARC	CFS	all websites MEAN	SD
B1	Interesting to look at	3.2	3.7	3.1	2.7	2.7	2.7	**3.0**	0.9
B2	Understandability	4.2	3.9	3.9	2.7	4.1	3.1	**3.7**	1.1
B4	Visual appeal	2.9	3.3	2.9	2.5	2.4	3.0	*2.8*	1.0
B5	Helpfulness of pictures/illustrations	2.2	3.4	1.6	1.9	1.5	2.2	**2.8**	1.2
B7	Comprehensiveness	4.0	3.6	3.4	2.4	3.8	2.6	**3.3**	1.9
B9	Length (1=short, 5=long)	3.1	3.1	3.1	2.0	3.1	1.9	**2.7**	1.0
B11	Good examples given	2.9	3.6	2.9	1.8	3.7	2.4	**2.9**	1.4
B12	Clarity of fire safety actions	3.3	3.9	3.6	2.4	4.1	2.9	**3.4**	1.3
B13	Own (residents') info need met	3.3	3.6	3.3	1.6	3.9	2.2	**3.0**	1.2
B15	Extent motivation for preparedness	2.6	3.0	2.3	1.6	3.0	2.0	**2.4**	1.0
B16	Difficulty remembering info *(reversed)*	3.4	3.1	2.7	2.1	3.5	2.9	**3.0**	1.2
B17	Seen as reliable source of information	4.3	4.5	3.9	3.9	4.3	4.1	**4.1**	1.0
	Mean B1-17:	*3.3*	*3.6*	*3.1*	*2.3*	*3.4*	*2.7*	*3.1*	
A3	Organisation of the website	3.6	3.5	3.3	3.4	3.2	3.3	**3.4**	.9
A4	Ease of navigation	3.6	3.7	3.2	3.4	3.9	3.8	**3.6**	1.0
A5	Ease of locating relevant information	4.2	3.4	3.4	2.9	4.3	1.9	**3.3**	1.3
	Mean A3-4-5:	*3.8*	*3.5*	*3.3*	*3.2*	*3.8*	*3.0*	*3.4*	
B21*	a) Suitability of website for residents	3.6	3.9	3.9	1.4	4.1	1.8	**3.1**	1.4
	b) Suitability for employees	2.1	2.7	2.7	1.3	2.3	1.3	**2.1**	1.1
	c) Suitability for high school teachers	3.5	2.5	2.5	1.9	2.5	1.9	**2.6**	1.1
	d) Suitability for high school students	2.9	2.7	2.7	1.7	2.5	1.8	**2.5**	1.0
	e) Suitability for university students	2.9	2.8	2.9	2.6	2.5	2.0	**2.6**	1.1
	f) Suitability for public authorities	2.3	3.1	3.1	2.9	2.7	2.6	**2.8**	1.3
	g) Suitability for journalists	2.7	3.2	3.2	2.3	2.8	1.8	**2.6**	1.1
	h) Suitability for researchers	3.0	2.8	2.8	3.9	2.2	3.4	**3.0**	1.2
	Mean B21:*	*2.9*	*3.0*	*3.0*	*2.2*	*2.7*	*2.1*	*2.7*	
C1	Recommendable to lay people	3.6	3.4	3.4	1.3	3.5	1.7	**2.9**	1.4
C2	Better than brochures	3.4	3.4	3.4	2.3	3.2	2.6	**3.1**	1.2
	Weighed mean across all aspects:	*3.3*	*3.5*	*3.1*	*2.5*	*3.3*	*2.6*	*3.1*	

*Data are mean rating from 16 raters

KEY:

CFA Country Fire Authority Australia
MFB Melb. Metropolitan Fire Brigade
ACT ACT firebreak
NSW NSW Rural Fire Service
ARC American Red Cross
CFS Canadian Forest Service

(mean for B15 = 2.4). The visual quality (criteria B1, B4, B5) is assessed as 'medium'. Only one of the websites is perceived as 'good', in terms of meeting the information needs of people.

- Technical website features: the assessment of layout and navigability are assessed as medium to good for all sources.
- Suitability for relevant target groups: the raters were quite critical in this regard (overall mean for the six websites regarding 8 potential targets is 2.7). Two of the sites are clearly not useful for residents or any other kind of laypeople.
- The overall mean differences between the 6 websites are considerable (ranging from 2.5 to 3.5). The websites of the three major Australian fire authorities covered in this study, Victoria's Country Fire Authority, Melbourne's Metropolitan Fire Brigade and NSW's Rural Fire Service (NSW-RFS) are all rated in the upper range, on par with the fire information website of the American Red Cross (ARC). An advantage of the ARC and the NSW-RFS websites is that information for both forest/bushfires and urban fires is offered.

Finally, did the assessors "think that the website is better for getting informed about fire safety than brochures"? Four were seen as slightly better, but the two others were not (cf. criterion C2, mean = 3.1). Nevertheless, this appraisal substantiates the potential of WWW-based fire preparedness programs.

3.4 Results from exploratory interviews

Within the open-ended part of the data collection, the considerations underlying the participants' assessments were explored. In one task they were asked to rank-order the six websites for overall quality and then identify the reasons for their rating. The results are summarised in Table 5.

As these responses show, there is no single dominating reason—as users have high expectations for the combination of content and presentation style. It seems, though, that substantive quality is especially important for experienced web users, while newcomers often struggle to find their way through elaborate websites and therefore particularly value good navigation features.

In sum, most websites are rated as useful, yet for all, quite a number of shortcomings were noticed by the assessors. One principal problem is the mixture of material for different addressees—for example, residents are unlikely to be interested in annual reports, while professional users generally do not need to read about community matters. The frontpages of the six websites are not optimal in reflecting such heterogenous interests and directing different target groups accordingly.

Table 5. Assessors' reasoning.

REASONS FOR ASSESSORS' WEBSITE RATINGS—QUALITATIVE DATA

Respondents' favourite website: main reasons for liking it

- Comprehensive and meets needs of different people;
- Good visual appeal; helpful pictures;
- Clear; concise; understandable;
- Addresses necessary action for fire preparedness;
- Easy to navigate and locate relevant information;
- Internal and external links well organised;
- Up-to-date.

Main reasons for disliking the least favourite website

- Information not relevant to residents; limited to specific groups;
- Lacks information on important issues;
- Too much information; too technical;
- Language difficult to understand;
- Visually not appealing;
- Unsatisfactory layout makes navigating difficult;
- Outdated sections.

Table 6. Resident requirements.

MAJOR REQUIREMENTS FROM A RESIDENT'S POINT OF VIEW

Re *CONTENT* features:

- information on how to prepare for fire events
- on decision-making re evacuation (criteria for staying or leaving the residence)
- on fire safety in public places such as schools and the workplace
- contact details (phone/letter/fax/email) for the institution should be complete

Re *PRESENTATION* features:

- appealing graphics
- large easy-to-read text
- pictures to add visual appeal and to enhance the salience of fire hazards

Re *WEBSITE* design:

- clear frontpage structure
- fast downloading
- efficient navigating within the website
- links to related institutions.

4 Conclusions for designing websites for the public

Websites provided by fire authorities have to suit a multitude of users, ranging from professionals to laypeople, with very different levels of substantive knowledge. The current inquiry was focused on the perspective of residents in fire-prone areas who want to inform themselves about fire hazards and improve their preparedness. With such a clientele in mind, some suggestions have been outlined, summarised in Table 6. Furthermore it would be useful to systematically separate 'corporate' purposes from parts which aim at fire information and education—these need to be consistently tailored towards residents as users.

The use of fire websites by the general public is still at an early stage, but this will very likely soon change. Thus it seems advisable for authorities to optimize this relevant instrument for risk communication and disaster preparedness. Evaluation studies are vital for achieving this (cf. Burgess & Houghton 2002, Smith 2001), as is the advice of professional web designers (e.g., Nielsen 2000).

5 Needs and plans for further research

The focus of the current investigation was message and media features, as reflected in content evaluation criteria. In order to widen the scope of this research, process and outcome criteria need to be studied using a longitudinal approach, and samples of users with different backgrounds need to be investigated. Relevant research questions include:

- **Regarding user features:**
Which type of people are likely to utilize WWW-based risk communication? Do they mainly 'surf' before, during or after disasters? Is information for non-English speakers warranted?

- **Regarding information content:**
What are residents' core information needs regarding websites, compared to other information means? How do we address the needs of children and the elderly?

- **Regarding website design:**
Which website styles do WWW 'newcomers' prefer? What is the role of pictures and graphs?

Several of these topics will be addressed in the continuation of this project; a survey with residents is already underway.

A further issue is the interrelationship between different risk information means/procedures. For example, videos could be linked with websites, and brochures designed to compliment electronic information means. Obviously the WWW cannot be a 'stand-alone' approach to enhancing fire preparedness; therefore it is important to optimise the linkage between all elements of a program.

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