



**USYS***TdLab*  
Department of Environmental Systems Science  
Transdisciplinarity Lab | Science-Society Interface



Schweizerischer Erdbebendienst  
Service Sismologique Suisse  
Servizio Sismico Svizzero  
Swiss Seismological Service

**ETH**

Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich

# Understanding public's preferences for information provided on multi-hazard platforms

EGU General Assembly 2020, Vienna, Austria  
4–8 May 2020

Irina Dallo, SED ETH Zurich, [irina.dallo@usys.ethz.ch](mailto:irina.dallo@usys.ethz.ch)

(© Dallo et al. All rights reserved)



# Content

- What's already there?
- Our focus
- Method and Material
- Main results
  - (i) Design of the start page
  - (ii) Hazard announcements
- Discussion
- Conclusion
- Limitations and future research

# Multi-hazard platforms – Apps

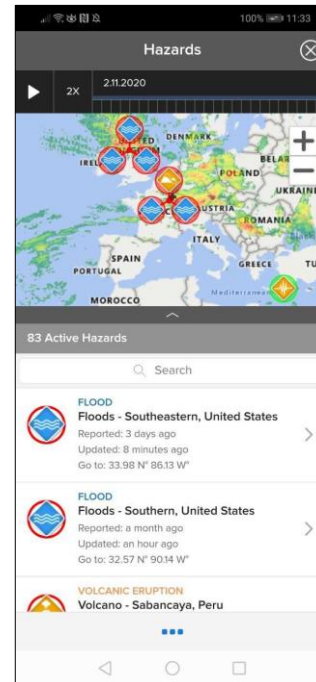
Triggered by technical progress that allows combining information about natural, anthropogenic and socionatural hazards, numerous multi-hazard platforms have been established over the last few years.



MeteoSwiss [1]  
(Switzerland)



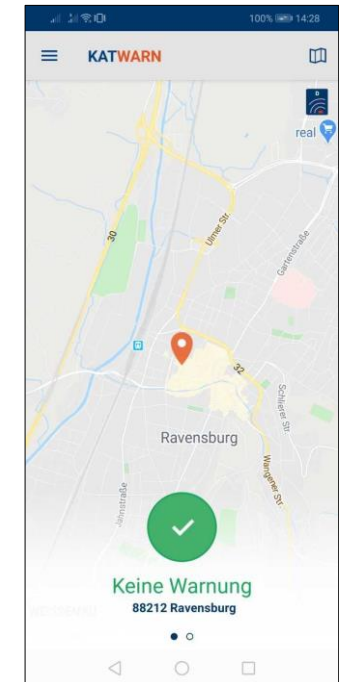
AlertSwiss [2]  
(Switzerland)



DisasterAlert [3]  
(globally)



WarnWetter [4]  
(Germany)



KATWARN [5]  
(Germany)

# Multi-hazard platforms – Websites

Current research has mainly focused on technical challenges [9-11].

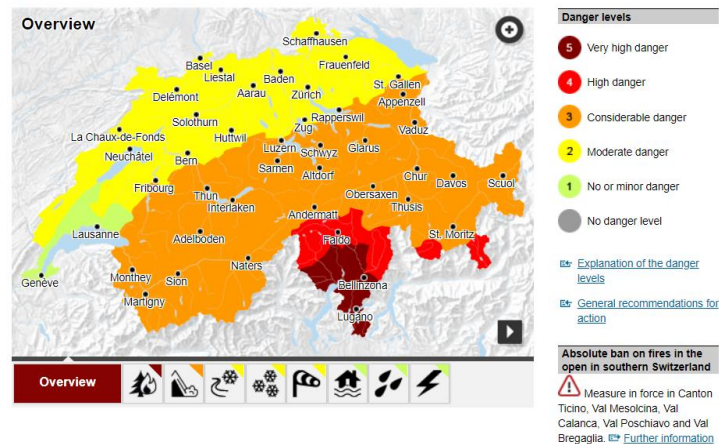
## Current natural hazards situation in Switzerland

[Natural hazard bulletin](#)

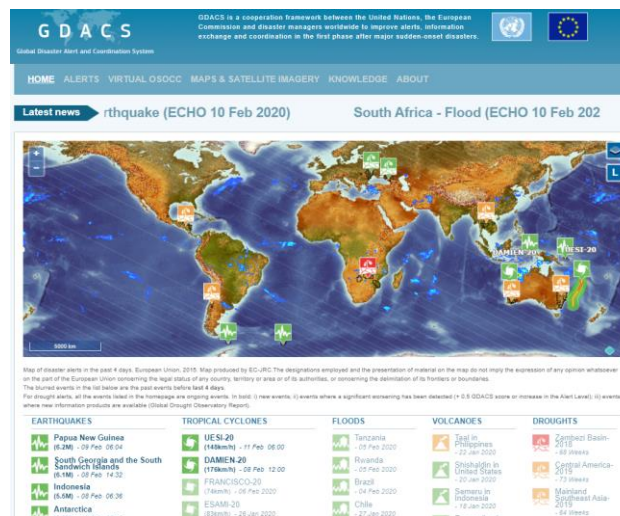
Updated on: 11.02.2020, 11:39

location / ZIP

Search location



Natural Hazards Portal [6] (Switzerland)



Global Disaster Alert and Coordination System [7] (globally)



Hazard map on the website HungerMap [8] (globally)



## Research is missing [12,13], answering the questions ...

Are consistent and compatible hazard announcements and maps correctly **understood** by the receivers?

Which information **content** do the users **prefer**?

Even if information about earthquake and other hazards is embedded in frequently used weather apps, do the users **look at this information at all**?

Do the information provided on multi-hazard platforms actually increase societal resilience in **comparison to earthquake-specific platforms**?

Do the app functionalities aiming to increase society's preparedness levels **actually have an impact**?

Which **individual, societal and contextual factors** influence people's preferences for, and **ability to handle information** provided on multi-hazard platforms?

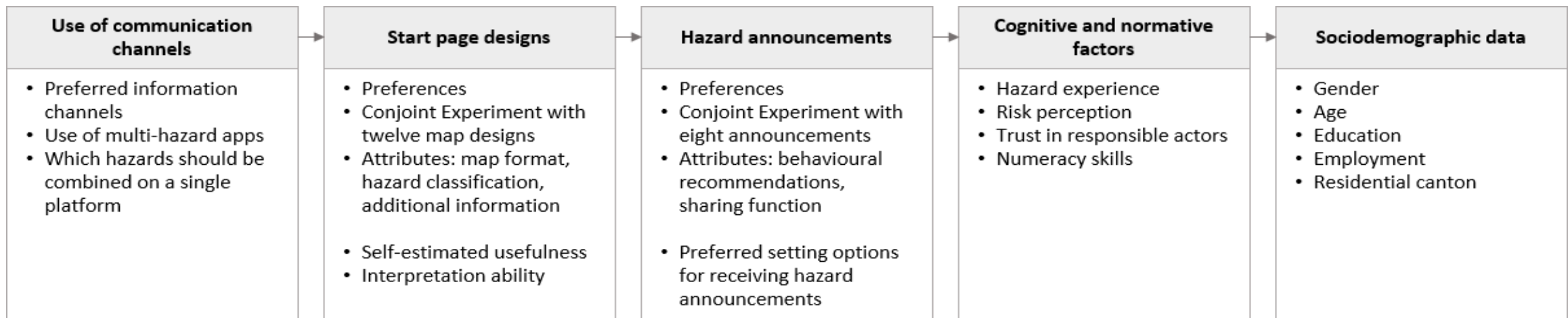
What are **end-users preferences** and **needs**?

## Filling the research gap...

- As most multi-hazard platforms use maps on the start page, we especially focused on the different approaches to presenting multiple hazards and to compiling contents of hazard announcements attached to the maps.
- With an online conjoint experiment (N=768, full randomized design) in Switzerland, we empirically tested participants' preferences for start page designs and hazard announcements.
- Research questions:
  - (i) Does the public prefer and actually use multi-hazard platforms to get information about the current hazard situation?
  - (ii) Which elements of start page design does the public prefer, correctly interpret and perceive as useful?
  - (iii) What contents of hazard announcements does the public prefer?

# Method – Conjoint Choice Experiment

The survey consisted of five question blocks (Fig. 1). As part of the second and third question blocks (start page designs & hazard announcements) we applied conjoint choice experiments [14,15]. Regarding the start page designs, to each participant three consecutive pairs of different start page designs were randomly displayed. First, they had to rate them separately before having to choose one of them. Regarding the hazard announcements, each participant received a pair of earthquake announcements and a pair of thunderstorm warnings. As before, they first rated them separately before indicating which of the two they prefer.



**Fig. 1. : Structure of the survey.**



# Material I

In Table 1, the attributes we varied for the start page designs and for the hazard announcements respectively are listed (first column). In the second column, the levels of each attribute is described in detail. And in the third column, some examples of platforms with the corresponding attribute levels are mentioned.

When selecting and varying the attributes we followed both current practice in different fields as well as best practice from research.

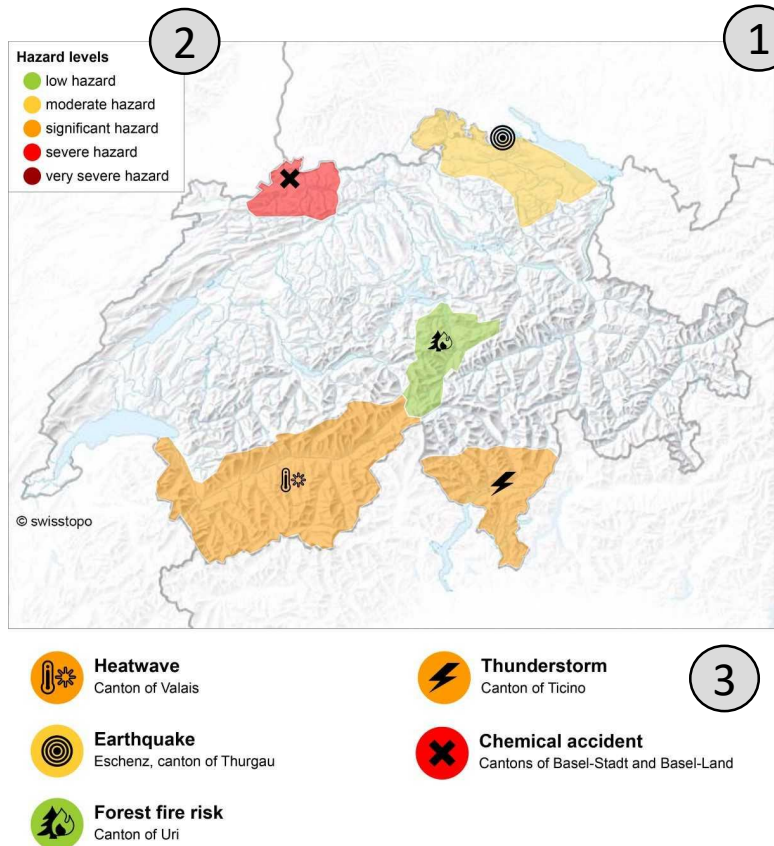
**Table 1: Attributes selected and varied**

Start page designs		
Attribute	Levels	Examples of platforms
Map format	<ol style="list-style-type: none"> <li>1. Single map displaying all current hazards</li> <li>2. Separate maps for each current hazard</li> </ol>	<ol style="list-style-type: none"> <li>1. HungerMap, Disaster Alert</li> <li>2. Vigilance météorologique, ThinkHazard</li> </ol>
Hazard classification	<ol style="list-style-type: none"> <li>1. Three categories: considerable hazard / severe hazard / very severe hazard (orange / red / dark red)</li> <li>2. Four categories: information / warning / alert / all-clear (blue, orange, red, green)</li> <li>3. Five categories: low hazard / moderate hazard / significant hazard / severe hazard / very severe hazard (green, yellow, orange, red, dark red)</li> </ol>	<ol style="list-style-type: none"> <li>1. Global Disaster Alert and Coordination System</li> <li>2. AlertSwiss, KATWARN</li> <li>3. Natural Hazards Portal, MeteoSwiss, WIND</li> </ol>
Additional information around the map	<ol style="list-style-type: none"> <li>1. List with textual information (hazard type, hazard category and location) below the map</li> <li>2. Pictograms of the current hazards below the map (single maps) or in the upper left corner (separate maps)</li> </ol>	<ol style="list-style-type: none"> <li>1. Disaster Alert, AlertSwiss</li> <li>2. WarnWetter, MeteoSwiss</li> </ol>
Hazard announcements		
Attribute	Levels	
Behavioural recommendations	<ol style="list-style-type: none"> <li>1. Textual</li> <li>2. Pictured</li> </ol>	<ol style="list-style-type: none"> <li>1. NINA, AlertSwiss</li> <li>2. LastQuake, First aid app</li> </ol>
Sharing function	<ol style="list-style-type: none"> <li>1. Available</li> <li>2. Not available</li> </ol>	<ol style="list-style-type: none"> <li>1. FEMA, LastQuake</li> <li>2. On most</li> </ol>




# Material II – two examples

- ① Map format
- ② Hazard classification
- ③ Additional information around the map



- ① Behavioural recommendations
- ② Sharing function



## Thunderstorm

Zurich, Tue, 06. Aug. 14pm – Wed, 07. Aug. 18pm




- **Type of the thunderstorm:** pulling storm
- **Side effects:** hail, gale-force winds, heavy rain

**Behavioural recommendations**

- Keep an eye on local weather developments, and act appropriately, according to the information you receive on the conditions
- Avoid mountain ridges, exposed trees, groups of trees, masts and towers, all of which are at risk of lightning strikes
- Seek shelter – in a building or car (acts as a Faraday cage)
- Do not go hiking in the mountains or walking in forests
- Stay away from metal objects and water
- If a thunderstorm takes you by surprise when swimming, get out of the water immediately
- Drive slowly on flooded stretches of road, or avoid these altogether
- Avoid stream beds and steeply inclined slopes
- Always follow the official recommendations

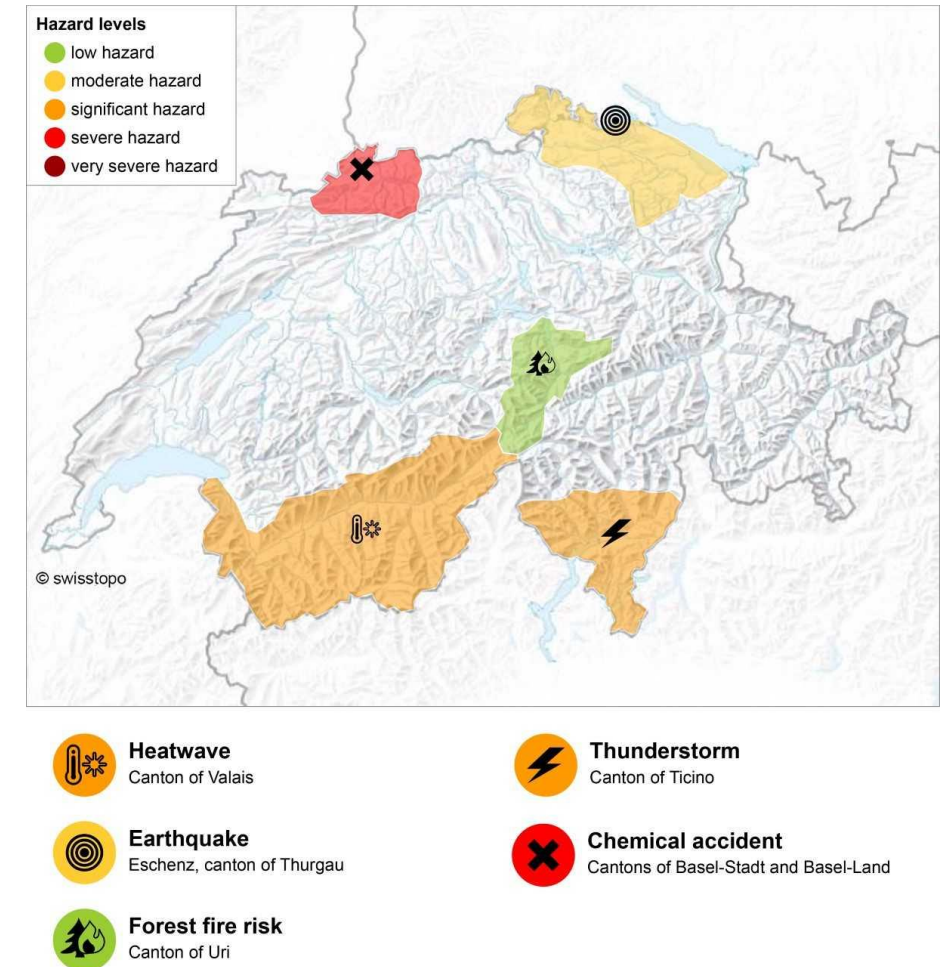
**Contact**

Responsible federal authority: [Federal Office of Meteorology and Climatology MeteoSwiss](#)

Inform your family and friends:   

# Design of the start page


- Participants prefer a start page with (Fig. 2)...
  - ... a single map displaying all current hazards,
  - ... textual information about the current hazards below the map,
  - ... and the use of a hazard classification with four or five categories.
- Participants with high levels of *trust in actors involved in the communication process* and high *risk perception* rated the start page designs in general higher.
- Participants indicated that they were more motivated to seek further information and to take (precautionary) actions when the hazards were combined on a single map.
- Participants are not aware that even if a earthquake-risky area is not colored at the moment they still have to be prepared for an earthquake.
- High numeracy skills lead to a better understanding of the information presented.



**Fig. 2. : Start page preferred by the participants.**

# Hazard announcements

- Hazard announcements with a sharing function are preferred.
- For thunderstorm warnings, textual behavioural recommendations are favored.
- For earthquake announcements, no significant tendency.  
→ In the comments a combination of textual and pictured announcements is wished (Fig. 3).
- Participants with a high risk perception and high levels of trust in the responsible actors rated the hazard announcements overall better.






## Earthquake

Eschenz, region of Lake Constance

4:15pm Earthquake with a magnitude of about 4.5 at Eschenz (TG). Widely felt. Minor damages possible.




### Behavioural recommendations

Inside the building




- Take cover (e.g. under a sturdy table) and keep calm
- Beware of falling objects (e.g. shelves, heavy furniture, televisions, stereos and light fittings) and keep away from windows and glass walls, which may shatter.
- Only leave the building when the surrounding area is safe (when there are no more falling objects such as roof tiles, etc.)

Outside

- Stay outside, do not seek shelter in a building
- Keep away from buildings, bridges, electricity pylons, large trees, and other things that could collapse or fall
- Keep away from the shores of bodies of water




In a vehicle

- Stop the vehicle and do not leave it during the quake
- Do not stop on a bridge, at an underpass, or in a tunnel, and keep away from buildings at the side of the road (danger of collapse)

### Contact

Responsible federal authority: [Swiss Seismological Service at ETH Zürich](#)

Inform your family and friends:   

**Fig. 3. : Preferred earthquake announcements.**



# Discussion

## **Design of the start page:**

- A combination of maps and textual information is recommended in order to minimize erroneous interpretation [16,17].
- Various individual factors such as risk perception and trust in the authorities significantly influence people's preferences, interpretation abilities and motivation to take actions [18-21].

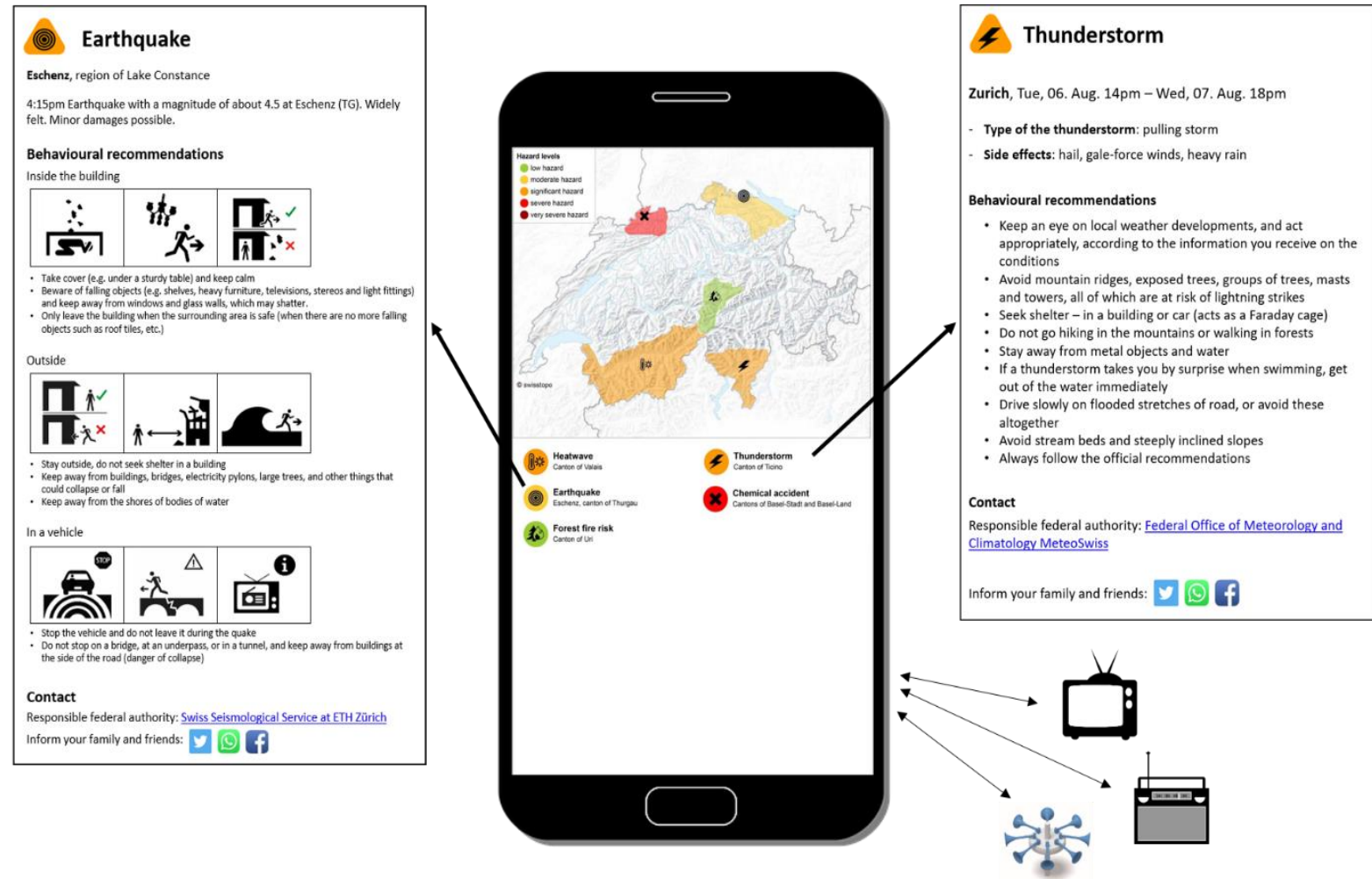
## **Hazard announcements:**

- A combination of pictured and textual behavioural instructions is recommended. The main reasons are that not all pictograms are understood at first glance, and people not speaking the language in which the message is issued could still look at the pictograms [22,23].
- People appreciate to share a hazard announcement received with their family members and friends. The increasing use of social media might also be a future potential for emergency managers to get further insights about an event from the public [22,24-25].

# Conclusion

To conclude, results indicate that the design of multi-hazard platforms and individual characteristics affects the public's preferences for information and hazard announcements presented (Fig. 4).

Therefore, in parallel of the continuous improvement of scientific-technical products, scientists should systematically examine the communication and perception of these products in order to increase society's resilience.



**Fig. 4. : Participants' preferred start page and favored hazard announcements.** The symbols on the bottom right represent the need of a multi-channel communication strategy in order to inform as many people as possible, and to compensate the failure of other channels.



## Limitations and future research

- Our findings are restricted to the five attributes we varied for the different alternatives.
- We only displayed five hazards on the maps. The upper complexity threshold of information presented on one map should thus be analyzed in future research.
- With respect to the hazard announcements, further issues like the length of the message, the inclusion of information about impacts etc. should as well be analyzed [26-28].
- Besides the four cognitive factors we tested, many other factors such as social interactions, milling, self-efficacy influence people's preferences for certain information and abilities to react before, during and after an event [28-32].
- Future research is needed assessing the usefulness of and preferences for other app functionalities and contents such as test-warnings [33-34].

# References

- (1) Federal Office of Meteorology and Climatology MeteoSwiss. (2016). MeteoSwiss App.
- (2) Federal Office for Civil Protection. (2020). AlertSwiss App.
- (3) PDC. (2020). DisasterAlert App.
- (4) Deutscher Wetterdienst. (2015). WarnWetter App.
- (5) Frauenhofer-Gesellschaft. (2020). KATWARN App.
- (6) Federal Administration. (2019, July 4). Current natural hazards situation in Switzerland [Artikel]. Natural Hazards Portal. <https://www.naturgefahren.ch/home/aktuelle-naturgefahren.html>
- (7) European Union. (2020). Global Disaster Alert and Coordination System. <https://www.gdacs.org/>
- (8) PDC/ Active Hazards Map Service. (2020). Hazard Map. <https://hungermat.wfp.org/>
- (9) A. Carpignano, E. Golia, C. Di Mauro, S. Bouchon, J. Nordvik, A methodological approach for the definition of multi-risk maps at regional level: first application, J. Risk Res. 12 (2009) 513–534. <https://doi.org/10.1080/13669870903050269>.
- (10) S. Greiving, Integrated risk assessment of multi-hazards: a new methodology, Spec. Pap.-Geol. Surv. Finl. 42 (2006) 75–82.
- (11) N. Komendantova, R. Mrzyglocki, A. Mignan, B. Khazai, F. Wenzel, A. Patt, K. Fleming, Multi-hazard and multi-risk decision-support tools as a part of participatory risk governance: Feedback from civil protection stakeholders, Int. J. Disaster Risk Reduct. 8 (2014) 50–67. <https://doi.org/10.1016/j.ijdr.2013.12.006>.
- (12) J.M. Johnson, J.M. Coll, P.J. Ruess, J.T. Hastings, Challenges and opportunities for creating intelligent hazard alerts: The “FloodHippo” prototype, JAWRA J. Am. Water Resour. Assoc. 54 (2018) 872–881. <https://doi.org/10.1111/1752-1688.12645>.
- (13) R.E. Mays, M. Haselkorn, Y. Zhuang, Strategies for designing RCRC preparedness messaging in digital applications, University of Washington & Global Disaster Preparedness Center, 2018. <https://www.preparecenter.org/resources/strategies-designing-rcrc-preparedness-messaging-digital-applications-0> (accessed August 23, 2019).
- (14) A. Rinscheid, R. Wüstenhagen, Germany’s decision to phase out coal by 2038 lags behind citizens’ timing preferences, Nat. Energy. (2019). <https://doi.org/10.1038/s41560-019-0460-9>.
- (15) J. Hainmueller, D. Hangartner, T. Yamamoto, Validating vignette and conjoint survey experiments against real-world behavior, Proc. Natl. Acad. Sci. 112 (2015) 2395–2400. <https://doi.org/10.1073/pnas.1416587112>.
- (16) S. Savelli, S. Joslyn, The Advantages of Predictive Interval Forecasts for Non-Expert Users and the Impact of Visualizations: Advantages of predictive interval forecasts, Appl. Cogn. Psychol. 27 (2013) 527–541. <https://doi.org/10.1002/acp.2932>.
- (17) K. Broad, A. Leiserowitz, J. Weinkle, M. Steketee, Misinterpretations of the “Cone of Uncertainty” in Florida during the 2004 Hurricane Season, Bull. Am. Meteorol. Soc. 88 (2007) 651–668. <https://doi.org/10.1175/BAMS-88-5-651>.
- (18) L. Maduz, F. Roth, T. Prior, M. Käser, Individual Disaster Preparedness: Explaining disaster-related information seeking and preparedness behavior in Switzerland, Center for Security Studies (CSS), ETH Zürich, 2019. <https://css.ethz.ch/en/services/digital-library/publications/publication.html/bae52ca7-2dcb-481f-935b-f8a4c8fb2f61> (accessed February 4, 2020).
- (19) H. Joffe, G. Perez-Fuentes, H.W.W. Potts, T. Rossetto, How to increase earthquake and home fire preparedness: the fix-it intervention, Nat. Hazards. 84 (2016) 1943–1965. <https://doi.org/10.1007/s11069-016-2528-1>.
- (20) C. Solberg, T. Rossetto, H. Joffe, The social psychology of seismic hazard adjustment: re-evaluating the international literature, Nat. Hazards Earth Syst. Sci. 10 (2010) 1663–1677. <https://doi.org/10.5194/nhess-10-1663-2010>.



# References

- (21) M. Marti, M. Stauffacher, S. Wiemer, Difficulties in explaining complex issues with maps. Evaluating seismic hazard communication – the Swiss case, *Nat. Hazards Earth Syst. Sci.* 19 (2019) 2677–2700.
- (22) R. Bossu, F. Roussel, L. Fallou, M. Landès, R. Steed, G. Mazet-Roux, A. Dupont, L. Frobert, L. Petersen, LastQuake: from rapid information to global seismic risk reduction, *Int. J. Disaster Risk Reduct.* 28 (2018) 32–42. <https://doi.org/10.1016/j.ijdrr.2018.02.024>.
- (23) R. Parrott, K. Silk, K. Dorgan, C. Condit, T. Harris, Risk Comprehension and Judgments of Statistical Evidentiary Appeals.: When a Picture is Not Worth a Thousand Words, *Hum. Commun. Res.* 31 (2005) 423–452. <https://doi.org/10.1111/j.1468-2958.2005.tb00878.x>.
- (24) R. Lacassin, M. Devès, S.P. Hicks, J.-P. Ampuero, R. Bossu, L. Bruhat, Daryono, D.F. Wibisono, L. Fallou, E.J. Fielding, A.-A. Gabriel, J. Gurney, J. Krippner, A. Lomax, Muh.M. Sudibyo, A. Pamumpuni, J.R. Patton, H. Robinson, M. Tingay, S. Valkaniotis, Rapid collaborative knowledge building via Twitter after significant geohazard events, *Geoscience engagement/Co-creation and co-production*, 2019. <https://doi.org/10.5194/gc-2019-23>.
- (25) G. Lotan, All shook up: mapping earthquake news on Twitter from Virginia to Maine, *Bills Blog*. (2011). <https://billhubbell.wordpress.com/2011/10/02/all-shook-up-mapping-earthquake-news-on-twitter-from-virginia-to-maine/> (accessed July 25, 2019).
- (26) M.M. Wood, D.S. Mileti, H. Bean, B.F. Liu, J. Sutton, S. Madden, Milling and Public Warnings, *Environ. Behav.* 50 (2018) 535–566. <https://doi.org/10.1177/0013916517709561>.
- (27) J.T. Ripberger, C.L. Silva, H.C. Jenkins-Smith, M. James, The Influence of Consequence-Based Messages on Public Responses to Tornado Warnings, *Bull. Am. Meteorol. Soc.* 96 (2015) 577–590. <https://doi.org/10.1175/BAMS-D-13-00213.1>.
- (28) M.M. Wood, D.S. Mileti, M. Kano, M.M. Kelley, R. Regan, L.B. Bourque, Communicating actionable risk for terrorism and other hazards\*: communicating actionable risk, *Risk Anal.* 32 (2012) 601–615. <https://doi.org/10.1111/j.1539-6924.2011.01645.x>.
- (29) E.E.H. Doyle, J. McClure, S.H. Potter, J.S. Becker, D.M. Johnston, M.K. Lindell, S. Johal, S.A. Fraser, M.A. Coomer, Motivations to prepare after the 2013 Cook Strait Earthquake, *N.Z.*, *Int. J. Disaster Risk Reduct.* 31 (2018) 637–649. <https://doi.org/10.1016/j.ijdrr.2018.07.008>.
- (30) Y.-C. Kim, J. Kang, Communication, neighbourhood belonging and household hurricane preparedness, *Disasters.* 34 (2010) 470–488. <https://doi.org/10.1111/j.1467-7717.2009.01138.x>.
- (31) K. Rowley, Tornado warnings: delivery, economics, & public perception, *National Oceanic and Atmospheric Administration*, 2018. <https://repository.library.noaa.gov/view/noaa/20215> (accessed August 16, 2019).
- (32) E. Verrucci, G. Perez-Fuentes, T. Rossetto, L. Bisby, M. Haklay, D. Rush, P. Rickles, G. Fagg, H. Joffe, Digital engagement methods for earthquake and fire preparedness: a review, *Nat. Hazards.* (2016). <https://doi.org/10.1007/s11069-016-2378-x>.
- (33) S. Colombelli, F. Carotenuto, L. Elia, A. Zollo, Design and implementation of a mobile device APP for network-based EEW systems: application to PRESto EEWs in Southern Italy, *Nat. Hazards Earth Syst. Sci. Discuss.* (2019) 1–19. <https://doi.org/10.5194/nhess-2019-266>.
- (34) C. Reuter, M. Kaufhold, I. Leopold, H. Knipp, Katwarn, Nina, or Fema? Multi-method study on distribution, use, and public views on crisis apps, (2017) 16.



## Contact

RISE Project Office: ETH Swiss Seismological Service | Sonneggstr. 5 NO-H Floor  
CH-8092 Zurich

[rise-office@sed.ethz.ch](mailto:rise-office@sed.ethz.ch) | Phone number: +41-44-632 4381

## Liability Claim

The European Commission is not responsible for any that may be made of the information contained in this document. Also, responsibility for the information and views expressed in this document lies entirely with the author(s).