

# Survival Language: A Pattern Language for Surviving Earthquakes

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In this paper, we propose the Survival Language, a pattern language to support survival when a catastrophic earthquake occurs. Although numerous catastrophic earthquakes have struck Japan throughout its history, tragedy continues to repeat, because the significance of preparation for earthquakes or actions for when they hit have not been conveyed sufficiently. In such terms, we propose four patterns to support survival when a catastrophic earthquake occurs: “Daily Use of Reserves,” “Life over Furniture,” “Evacuation Initiator,” and “Kick Signal.” In order to survive when a catastrophic earthquake occurs, these patterns are categorized into three categories: “designing preparation,” “designing emergency actions” and “designing Life after Quake.” The objective of these patterns is to support immediate decisions when an earthquake hits, and to help recall earthquake safety measures even in ordinary moments of everyday life.

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## 1. INTRODUCTION

The objective of this paper is to propose the Survival Language, a pattern language[1][2] to support survival when a catastrophic earthquake occurs.

The basis of this proposal comes from the problem that although countries like Japan have experienced numerous catastrophic earthquakes, tragedies continue to repeat. This is because knowledge about prevention and survival have not been passed down effectively.

In Japan, infrastructure maintenance has been enforced especially after experiencing the Great Hanshin earthquake in 1995. In terms of residential buildings, for example, national earthquake resistance standards have been revised, and people are becoming more aware of safety measures. In addition, after the experience of the Great East Japan earthquake in 2011, Japan has been also enforcing measures on information and communication technology, such as the creation and deployment of the “Basic Policy and Action Plan for Building IT Disaster-Management Lifeline”[3] by the Japanese government in June 2012.

While such maintenances of infrastructure in the macro level is being pursued, guidance concerning specific actions by people is still insufficient. Many suffered from the lack of emergency preparation in the Great Hanshin earthquake of Japan in 1995 [4]. Yet, many similar instances occurred in the Great East Japan earthquake in

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2011. These instances reveal that the significance of safety measures concerning have not been passed on sufficiently.

Therefore, this paper proposes the Survival Language as a methodology that supports people in integrating earthquake preparation in their daily lives, and to make immediate decisions possible when an earthquake hits. The Survival Language intends to design one's immediate actions when an earthquake occurs, because it is critical to accumulate one's knowledge and combine them in such circumstances. Another intention is to constantly remind one about the significance of earthquake preparation, because one's awareness of catastrophic earthquakes that seldom occur tends to gradually fade.

Although the pattern language proposed in this paper is written based on catastrophic earthquakes in Japan (Great Hanshin earthquake in 1995, Tohoku earthquake in 2011), such earthquakes have occurred around the world such as the Northridge earthquake of USA in 1994, Virginia earthquake of USA in 2011, Valdiva earthquake of Chile in 1960, L'Aquila earthquake of Italy in 2009, Sichuan earthquake of China in 2008, Indian Ocean earthquake of 2004 and Christchurch earthquake of New Zealand in 2011, Haiti earthquake in 2010, Kū Tahya earthquake of Turkey in 2011, and tragedies continue to repeat. By finding a pattern language from the many lessons Japan has learned from numerous earthquakes, the Survival Language seeks to support survival through catastrophic earthquakes around the world which may yet happen.

The Survival Language is written as a Pattern Language, which is a language used to write out the design knowledge that lies in an area of profession. The areas of profession that the pattern languages were used for has changed over time. In the first "Pattern Language 1.0", its primary object of design was architecture. In contrast to Pattern Language 1.0 dealing with material objects, "Pattern Language 2.0" focuses on program codes of software. This shift to a nonmaterial subject is a considerable difference that distinguishes the two stages. The evolution then goes on to dealing with human actions, such as innovation, education, learning, presentation, and collaboration, in the new "Pattern Language 3.0".

The most important feature of the Pattern Language 3.0 stage must be the fact that the one who designs is also simultaneously the one being designed. In other words, the users of the 3.0 patterns would be using them to design the actions for themselves. This self-referential structure is a characteristic not found in the previous stages of pattern languages. The metacognition resulting from users constantly reflecting on themselves plays a major role in the use of this new kind of patterns.

Pattern language for safety in disasters is a completely new field of pattern language. It can be classified as a Pattern Language 3.0, a pattern language for human actions. Note that the pattern language proposed in this paper has been mentioned in the Invited Talk [5] in PLoP 2012 as a future subject, and is a proclamation of its first prototype.

## 2. OVERVIEW OF THE SURVIVAL LANGUAGE

The Survival Language focuses specifically on the individual level. It is true that there are many levels of support when a catastrophic earthquake occurs, such as that of communities or governments. However, these supports of communities and governments presuppose each individual's survival when a catastrophic earthquake occurs. The most vital point is this: individual's survival by the individual's own strength, when an earthquake occurs.

The Survival Language is organized into one whole structure in order to achieve each individual's survival when an earthquake occurs. Figure 1 shows the overview of the whole structure of this language. This structure is formed by three categories: "Designing Preparation," "Designing Emergency Action," and "Designing Life after Quake." "Designing Preparation" consists of patterns to use during one's daily life before an earthquake occurs. "Designing Emergency Action" consists of patterns to use immediately when an earthquake actually happens. "Designing Life after Quake" consists of patterns to use within 72 hours after the earthquake (the mortality rate significantly rises after this time period.)

Although this language is planned to be consisted of a few dozen patterns, this paper will show the four patterns out of the set. we propose: "Daily Use of Reserves" from the "Designing Preparation" group, "Life over Furniture"

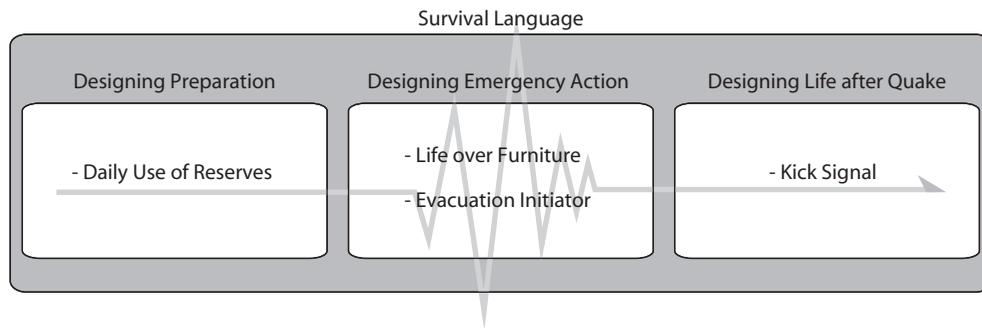


Fig. 1. Overview of the Survival Language

and “Evacuation Initiator” from the “Designing Emergency Actions” group, and “Kick Signal” from the “Designing Life after Quake.”

In addition to these four patterns, a few dozen patterns are currently being written: “1981 Line” from the “Designing Preparation” group, “Armadillo Pose” and “Evacuation before Fire Fighting” from the “Designing Emergency Action” group, and “Shrine Shelter” from the “Designing Life after Quake.” The Survival Language seeks to support survival in a catastrophic earthquake by combining these patterns from each of the three categories.

### 3. PATTERN FORM

The Survival Language seeks to support immediate decisions when an earthquake strikes, and to recall earthquake safety measures even in ordinary moments of daily life. Therefore the format of the patterns in the Survival Language must be written in a manner which is clear and easy to recall. Thus the Context of the Survival Language is written in a style which would allow the person to recall contents of the pattern instantly when an earthquake occurs and quick action is necessary. In addition, the writing style of the Context is designed so that one can quickly search through one's mind. For instance, instead of "When you are with multiple people, an earthquake occurred", the context reads: "An earthquake occurred, and there are people around you". Furthermore, the Problem and Solution is also written in a simple manner which can be completely memorized, and be easily recalled. The Forces and Actions describe the Problem and Solution more specifically.

Each pattern is written in the same form: Pattern Name, Introductory Sentence, Picture, Context, Problem, Force, Solution, Action, and Consequence. The Pattern Name is the attractive and memorable names that could be used as building blocks for the thinking process and as a vocabulary for communicating for survival in an earthquakes; the Introductory Sentence and Picture are introductory parts of the patterns to present the pattern livelier; the Context describes the conditions for when survivors should apply the pattern. The Problem describes difficulties that often occur in the context, and the Forces are unavoidable laws that make the problem difficult to solve; the Solution describes how to solve the problem, with Actions offering concrete methods to put the solution into practice; and Consequence describes the result of applying the pattern.

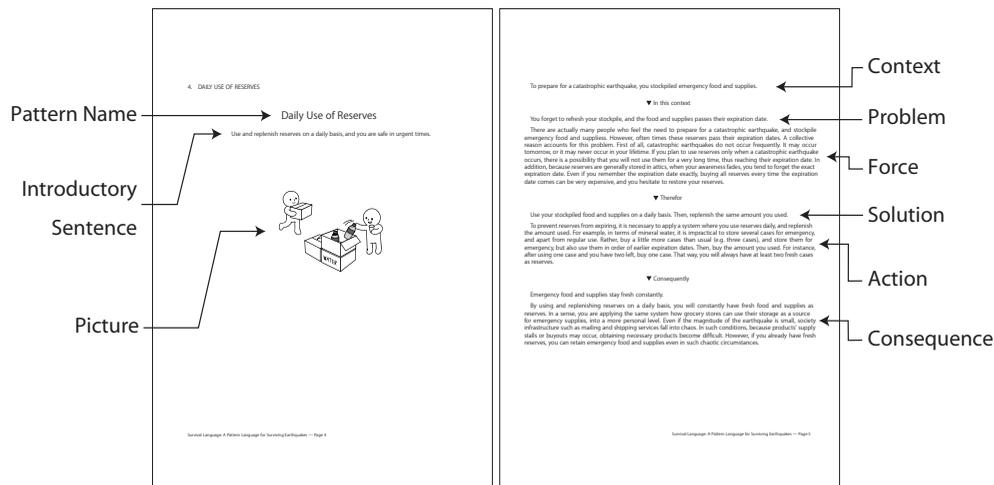


Fig. 2. Pattern Form of the Survival Language

### 4. PATTERNS

Here is four patterns from the Survival Language, A Pattern Language for Surviving Earthquakes: "Daily Use of Reserves," "Life over Furniture," "Evacuation Initiator," and "Kick Signal."

## Daily Use of Reserves

Use and replenish reserves on a daily basis, and you are safe in urgent times.



**To prepare for a catastrophic earthquake, you stockpiled emergency food and supplies.**

▼ In this context

**You forget to refresh your reserves, and the food and supplies will have passed their expiration date when about to use.**

Many people actually have the feeling that they need to prepare for a catastrophic earthquake, and stockpile emergency food and supplies. However, often times these reserves pass their expiration dates. A collective reason accounts for this problem. First of all, catastrophic earthquakes do not occur frequently. It may occur tomorrow, or it may never occur in your lifetime. If you plan to use reserves only when a catastrophic earthquake occurs, there is a possibility that you will not use them for a very long time, thus reaching their expiration date. In addition, because reserves are generally stored in places away from the usual living space in the house, your awareness for them fade, and you tend to forget the exact expiration date. Even if you remember the expiration date exactly, buying all reserves every time they expire can be very expensive, and you hesitate to restore your reserves.

▼ Therefor

**Use your stockpiled food and supplies on a daily basis. Then, replenish the same amount you used.**

To prevent reserves from expiring, it is necessary to apply a system where you use the reserves daily, and replenish the amount used. For example, when storing drinking water, it is impractical to store several boxes of water only for emergency purposes, apart from regular use. Rather, buy some extra cases than usual (e.g. three cases), and store them for emergency, but also use them on a daily basis in order of earlier expiration dates. Then, buy the amount you used. For instance, after using up one case and you have two left, buy one new case. That way, you will always have at least two fresh cases as reserves.

▼ Consequently

**Emergency food and supplies constantly stay fresh.**

By using and replenishing reserves on a daily basis, you will constantly have fresh food and supplies as reserves. In a sense, you are applying the same system of how grocery stores can use their storage as a source for emergency supplies when an earthquake happens into a more personal level. Even if the magnitude of the earthquake is small, social infrastructure such as mailing and shipping services may fall into chaos. In such situations, because product supply stalls or buyouts may occur, obtaining necessary products will become difficult. However, if you already have fresh reserves, you can retain emergency food and supplies even in such chaotic circumstances.

## Life over Furniture

Don't try to support your furniture - run.



**During an earthquake, furniture around you are shaking, making them likely to collapse or its contents to fall out.**

▼ In this context

**You try to support the shaking furniture, but they will consequently collapse on you.**

When an earthquake hits and furniture start to shake, although you may feel danger, you also feel the urge to support the furniture from collapsing, or keep the objects inside from falling. However, when the earthquake intensifies, even light furniture that may look like it could be held down easily will have potential dangers in which objects inside may burst out and hit your body (such as your head.) Furthermore, when the earthquake becomes severe, not only can objects inside burst out of furniture, but also the furniture themselves can fall or slide. If the furniture falls on you, your body will be trapped, and in the worst case, you may lose your life from the pressure.

▼ Therefor

**Don't hold shaking furniture.**

If you feel an shake, immediately get away from any furniture nearby. Especially look out for tall furniture, or those with breakable objects inside. For example, when the shaking intensifies, dishes can burst out violently from inside dish shelves. Prevent injuring yourself with broken pieces of glass or dishes by getting away from it as much as possible. In addition, books on bookshelves, or heavy objects placed on higher shelves are also similarly hazardous. Your life may be in danger especially if the furniture itself falls on you, so it is critical to go away as fast and as much as you can.

▼ Consequently

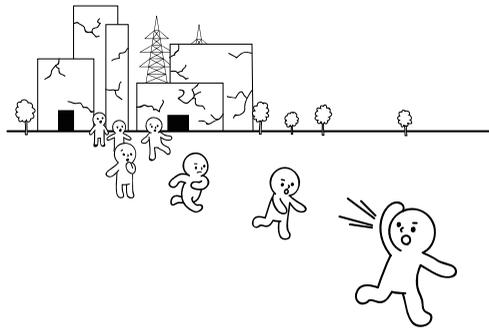
**You can prevent furniture from collapsing and its contents from falling on yourself.**

By immediately getting away from any furniture nearby, you can protect yourself from collapsing furniture or falling objects. Objects inside furniture or furniture themselves may break, but at least your body will be safe. For instance, with dish shelves, dishes shatter, and the shelf itself may break. However, if you attempt to hold the shelf from falling, glass or dishes may hit you, and you may suffer severe injuries. With bookshelves, valuable

books may fall off, and may be destroyed. However, if you attempt to hold the bookshelf, countless books may fall on you, and in worst case scenario, put your life in danger. By restraining from supporting shaking furniture, and immediately going away, you can save your life from danger.

## Evacuation Initiator

Initiating the run will also save others.



**An earthquake occurred, and there are people around you.**

▼ In this context

**You are influenced by people around who do not seem to move, and you cannot evacuate in time.**

When an earthquake happens, the fear from the shake brings the idea of evacuating. However, since neither the magnitude of the earthquake nor its source is known, we tend to hesitate taking the run. When looking around, the people around are also uncertain on what to do, but no one seems to be evacuating. Some people even are saying that there is no need to evacuate in effort to calm the people around down. These conditions are giving you the idea that it is still safe and an evacuation is unneeded, but as aftershocks and additional earthquakes happen, the crowd is faced with even worse danger.

▼ Therefor

**Shout out loud to let people around you aware, and take the initiative in the evacuation.**

When an earthquake hits, become an Evacuation Initiator and take the first move to evacuate. When doing so, shout out loudly to tell the people around to move also. Although specifics about the earthquake that just happened is unknown, nor may all people not evacuate with you, taking the first action to trigger others to move to a safe place is top priority. When at school or office, use the stairs and not an elevator to get outside. If outdoors when an earthquake hits, watch out for any falling trees and buildings, and head for a big field far from anything around. A school field, or a large park are good candidates for places to evacuate to.

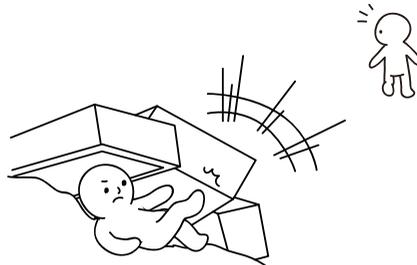
▼ Consequently

**You can evacuate with the people around you.**

By shouting out loud while running, it will take away the qualm from running away alone. It would make the people around aware of the danger, and they could move to save their lives too. Even though it may turn out that an evacuation was not needed afterwards, it will not hurt to move to a safe place just in case when consequences of not evacuating may have brought is imagined.

## Kick Signal

If you are trapped, kick your surroundings and signal out an SOS.



**You are surrounded by fallen debris, and are trapped inside.**

▼ In this context

**No matter how loudly you shout for help, your voice is muffled by objects around you, and people outside do not notice you.** When a catastrophic earthquake occurs, parts of a building or furniture may collapse on you, and you may get trapped inside. It is very difficult to escape from fallen debris by yourself, and you call out for help. However, no matter how loudly you call, your voice will be muffled by fallen debris, and people outside may not notice you. Rather, you lose stamina from the continuous loud shouts you make. In addition, because no one notices your existence even when you shout, you feel hopeless, thinking that you cannot be saved.

▼ Therefor

**Kick your surroundings, and signal out a banging noise.**

If parts of a building or furniture fall, and you are trapped under them, kick your surroundings and signal a banging noise outside. For instance, if there is a desk that fell near your leg, kick it as hard as you can, and make a banging noise. Because the vibrations from this noise pass on to other debris, it is more likely to be noticed. If you sense someone is near, make as loud of a banging noise as you can. In some cases, you may not be able to move your leg. In such conditions, bang objects with your hand, or even your head. You can also use a stick if one is available near your hand. In one way or another, it is important to send out a banging noise from under the debris.

▼ Consequently

**You can notify people outside about your existence, and your chances of being rescued increases.** By kicking your surroundings and making a banging noise, you can signal your existence to people outside. When parts of a building or furniture fall on you, they may restrict bodily movements, or produce large amounts of dust which may choke your eyes, mouth, or nose. Trying to make noises as loud as you can from under debris with your leg or arms, and sometimes even head can be very tough. However, even if you shout for help, the chances of notifying people outside are low. But if you make a banging noise with all of your strength, and the noise passes

on outside, and you can signal your existence outside. And when your signal goes outside, your chances of being rescued rises.

## 5. DISCUSSION

In Christopher Alexander's view[12][13], when pattern languages are successfully applied in architecture, some of the fifteen geometric properties appear in space. In other words, pattern languages must be employed in a way that allows buildings to have the fifteen geometric properties. In color, the eleven color properties which are very similar to the fifteen geometric properties, emerge. (Table.1)

This can also be applied to the Survival Language. When the Survival Language is used successfully, and when many people survive in an earthquake, some similar properties will emerge. Presumably, the number of these properties would not be five or a hundred, but approximately fifteen. In addition, the Survival Language needs to be developed and applied so that these properties are expressed.

According to Alexander's concepts, "these properties arise because they are the principal ways in which centers can be strengthened by other centers." [12] In the case of space (in architecture), center is "an organized zone of space." [13] A pattern is a generic center which creates these centers. Combining these centers creates the "field-like structure" [14] as a whole.

Table 1. The Fifteen Geometric Properties and The Eleven Color Properties

SPACE	COLOR
<p>The Fifteen Geometric Properties</p> <ul style="list-style-type: none"> <li>● LEVELS OF SCALE</li> <li>● STRONG CENTERS</li> <li>● BOUNDARIES</li> <li>● ALTERNATING REPETITION</li> <li>● POSITIVE SPACE</li> <li>● GOOD SHAPE</li> <li>● LOCAL SYMMETRIES</li> <li>● DEEP INTERLOCK AND AMBIGUITY</li> <li>● CONTRAST</li> <li>● GRADIENTS</li> <li>● ROUGHNESS</li> <li>● ECHOES</li> <li>● THE VOID</li> <li>● SIMPLICITY AND INNER CALM</li> <li>● NOT SEPARATENESS</li> </ul>	<p>The Eleven Color Properties</p> <ul style="list-style-type: none"> <li>● HIERARCHY OF COLOR</li> <li>● COLORS CREATE LIGHT TOGETHER</li> <li>● CONTRAST OF DARK AND LIGHT</li> <li>● MUTUAL EMBEDDING</li> <li>● BOUDARIES AND HAIRLINES</li> <li>● SEQUENCE OF LINKED COLOR PAIRS</li> <li>● FAMILIES OF COLOR</li> <li>● COLOR VARIATION</li> <li>● INTENSITY AND CLARITY OF INDIVISUAL COLOR</li> <li>● SUBDUED BRILLIANCE</li> <li>● COLOR DEPENDS ON GEOMETRY</li> </ul>
<p><u>CENTER</u></p> <ul style="list-style-type: none"> <li>● An Organized Zone of Space</li> </ul>	<p><u>CENTER</u></p> <ul style="list-style-type: none"> <li>● Each Color</li> </ul>

What is the center for the Survival Language? A center for the Survival Language is a human action which saves the people's lives whether under one's own power or not. A pattern of the Survival Language is a generic center which causes these centers.

The Survival Language causes human actions at many levels, from actions that impact what will happen right after them, to actions that cause large effects in terms of time or scale. This is similar to the relationship of "LEVELS OF SCALE" in the fifteen geometric properties. LEVELS OF SCALE is "the way that a strong center is made stronger partly by smaller centers contained in it, and partly by its larger strong centers which contain it." [12] A pattern of the Survival Language has influence on human actions at many levels of the number of people and the length of time.

For example, "Life over Furniture" or "Kick Signal" has impacts on the actions of a few people such as a person or his/her family which uses this pattern. On the other hand, "Evacuation Initiator" has a strong effect on the

actions of many people in some cases. Survivors by “Life over Furniture” can save many lives by conducting “Evacuation Initiator.” With respect to the length of time, “Daily Use of Reserves” produces an effect on long-term actions from pre-quake to post-quake. In contrast, “Life over Furniture” causes momentary actions during earthquake. In order to survive an earthquake, both patterns are needed.

As is the case with “LEVELS OF SCALE”, which is one of the fifteen geometric properties, it is possible that the functions of the patterns of the Survival Language are associated with the other properties. At the same time, we need to consider the relevance with the fifteen geometric properties in space and some properties in the Survival Language.

## 6. CONCLUSION

This paper proposed the Survival Language which aims to support people with their survival when a catastrophic earthquake occurs, and presented four patterns out of the set. These four patterns are just a part of the Survival Language, and we will present more patterns in the future. The pattern language introduced in this paper can be classified as patterns to support human actions in a broad sense[6] [7]. We are planning to convene a workshop concerning disaster safety with the Survival Language, to support people’s actual safety measures. In the future, to make survival possible when catastrophic earthquakes occur, we would like to develop and improve this pattern language even further.

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