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# Global Communication with Icons: Hotel Safety as an Environmental Context

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**Abstract.** Icons are small signs with fixed meanings. Icons are usually context specific. For example in the context of a hotel, the client can often find icons in hotel room books and safety guides. Scandic Hotel chain, for example, currently provides the manual for its safety system in 14 languages. There are at least two major shortcomings of this system: (1) in emergency or panic situations, it is very difficult to find your own language from the leaflet, and (2) there are no Asian languages. There is an obvious need for a global icon-based hotel safety language. In our paper, we introduce an icon-based model, language and mobile application for hotel safety.

**Keywords.** Global communication, icons, environmental context, hotel safety.

## Introduction

The focus of our study is on visual communication. Visual communication is one of the oldest disciplines in the humanities. It began with stick drawings on the walls of caves. We are living in cultural spaces: Japanese in Japanese cultural space and Finns in Finnish cultural space. In these spaces people face different kinds of situations and pictorial symbols or icons in their everyday life and environments.

Icons are small and isolated signs with fixed meanings and very simple graphics. The collections of icons are usually context specific. For example in the context of a hotel, you can often find icons in hotel room books. However, there is an obvious need for a global icon-based hotel safety language. Scandic Hotel, for example, currently provides the manual for its safety system in 14 languages. There are at least two major shortcomings of this system: (1) in emergency or panic situations, it is very difficult to find your own language from the leaflet, and (2) there are no Asian languages. In our paper, we introduce an icon-based model, language and mobile application for hotel safety. This study applies the design science research approach.

This paper is organized as follows. In Section 1, we discuss iconic information, and in Section 2 we provide some examples of environmental icons. The main phases of the design science research approach and the modelling icon design process are described in Section 3. An icon-based model, language and mobile application for hotel

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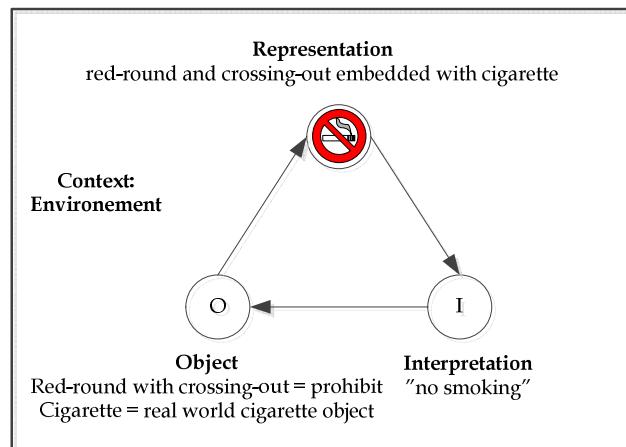
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safety are introduced in Section 4. Section 5 is reserved for conclusions and a discussion of issues requiring further study.

## 1. Iconic Information

Icons are small images that perceptually resemble a particular function or condition, and that are used as main components for nonverbal communication [1, 2]. The appropriate use of icons can mitigate complexity and encourage users to interact with a system in easy and effective ways [3]. Principally, icons are self-explanatory [4, 5], depending upon the representation, the intended meaning, and the referred objects. As an example, Figure 1 illustrates an environmental context with the following components:

- **Representation:** an arbitrary icon (a crossed-out red circle) and a concrete icon (a cigarette).
- **Object:** the cigarette icon generally reflects the real world object, and the crossed-out red circle semantically refers to the “prohibited” meaning.
- **Interpretation:** “no smoking” is the intended meaning.



**Figure 1.** Components relevant to an icons' interpretation.

Icons can typically be classified into three genres depending on their styles and usages [6, 7]: concrete, abstract and arbitrary.

Concrete icons are also known as direct representational icons. Their design explores visual similarity between an icon and its reference. For instance, the camera icon in Figure 2 does not include each component of a real camera, but rather it carries the relevant qualities: the assembly shape and structure of a camera. Using this design style to reference real-world objects has the advantage of being easily perceived, learned and taught.

Abstract icons, also known as indirect representations, attempt to illustrate a concept or an idea that is underlined upon the prosperity of icons to convey the intended meaning. Unlike concrete icons, indirect representational icons explore semantic relationships between an icon and its reference. The clacking glass in Figure 2 is an example of an abstract icon. The intention of this style is to communicate the concept of “fragile”, not to directly represent a glass object. The understanding of abstract icons tends to be more difficult than that of concrete ones.

Neither a concrete nor an abstract icon, arbitrary icons are established by a social convention. The meanings of these icons are the most complex and must be learned (for example traffic signs). The meanings of these icons are somewhat complicated to discover from context alone. The radiation warning icon shown in Figure 2 is a common example of an arbitrary icon. Normally, it is designed using geometric shapes and colours to help ease the learning process and allow rapid recognition.




Concrete	Abstract	Arbitrary
		

Figure 2. Examples of concrete, abstract and arbitrary icons.

## 2. Environmental Icons

In our physical environments, icons are often used in a wide variety of ways to inform people about particular conditions. Examples of common icon uses are healthcare facilities, crisis situations, and public places [5, 8, 9, 10].

In the healthcare context, icons have been introduced with the goal of allowing reliable and accurate interactions between users and the system in cases of emergency [2, 11]. Comprehension of medical instructions can often be particularly challenging for patients who have reading disabilities [12]. Communication through icons may also help physicians or nurses avoid critical errors, especially in multi-cultural environments [2]. A medical icon-based language offers a set of medical icons that can be used to identify signs, diseases, physiological states, life habits, drugs and tests [13]. Examples of the icons that are typically used in healthcare are provided in Figure 3.

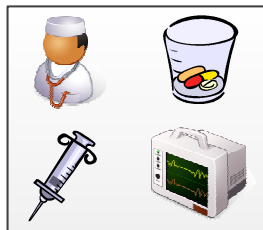
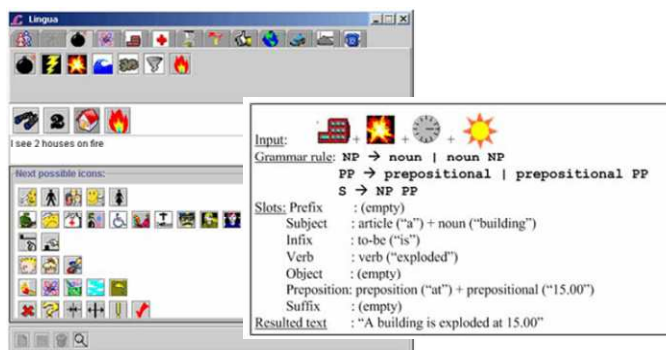


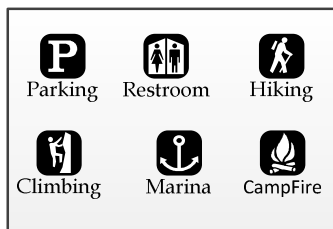
Figure 3. Examples of icons in the medical field.

Icons have also been used successfully in crisis management as a form of auxiliary communication among various users [13, 14, 15, 16]. For instance, in a disaster management system, stress is frequently placed on tackling the shortcomings caused by communication breakdowns. In addition to many other advantages, icons permit people to communicate with each other in a relatively uncomplicated way. In research conducted by Fitrianie et al. [13, 14], the authors devised iconic communication tools to represent concepts and functions in crisis environments. These tools were generally composed of geometric figures, such as arrows, lines, ellipses, rectangles, triangles or icon strings. An example of icons developed for use in crisis management [13, 14] is presented in Figure 4. These icons reflect the situations they represent. The right hand figure shows a way in which iconic sentences are generated and converted into natural language sentences based on the semantic context.



**Figure 4.** Iconic interface and natural language sentence in crisis situations according to Fitrianie et al.










In particular, icons are widely used in public places [5, 9, 17] to express specific meanings. Icons in Figure 5 have been designed to reinforce comprehensibility for users based on their surroundings. For instance, concrete equipment, gestures, and circumstances are used to design icons in recreation areas, whereas abstract icons are used to represent places (e.g., using the letter “P” to represent parking, and using an anchor to represent marine areas). These icons represent a simple language stemming from the need to communicate among people with different backgrounds.



**Figure 5.** Examples of icons in public places.

When seeking an icon to convey a message, it is plausible that the representation is not distinctively unique to one culture. Likewise, when individual reviewers understand icons, they do so personally; each reviewer interprets icons based on his or her own culture, knowledge, and familiarity with the icons. In the context of traffic signs, different countries tend to design their icons based upon their cultural preferences (Table 1).

**Table 1.** Cultural characteristics of icons for traffic signs in Finland, Japan and Thailand [18, 19, 20].

Meaning	Finland	Japan	Thailand
No entry for bicycles			
Stop			
Be aware of animal			

### 3. Modelling the Icon Design Process

We have applied the design science research (DSR) approach [21] to develop and evaluate iconic communication for hotel safety environments. We have first reviewed the state-of-the-art in relevant fields to gain insightful ideas on the utilization of icons in this environmental context. The findings have shown that icons have been adapted for a wide range of areas because they provide an intuitive and effective means of communication, which allows people to interact with each other in a comparatively uncomplicated way. In order to propose a possible solution, we have to define a concrete objective. In this study, the intention is to build an icon design process that can be used as the protocol for the creation of new icons.

At the design and build stage, we infer the requirements for our artefact by following theoretical foundations in iconic communication, human-computer interaction and cognitive science. We further combine knowledge and techniques from the research field of information modelling.

Based on the existing theoretical assessment, our proposal must be tested to confirm whether it can be applied in practice. Usability measurement, including satisfaction and aesthetics, is an outstanding way to justify a new concept. The final activity involves contributing new knowledge obtained by this study to the body of scientific evidence. In our paper we are reporting the three first main phases of the DSR process: environment, design and build artefact. The first iteration of the evaluation phase is under construction for assessing and developing the proposed approach and model.

The design of icons may appear to be the esoteric work of graphic artists or designers; however, there are some guidelines that provide basic structures to the design process [8, 9]. Figure 6 illustrates a model for icon design process, which can be

divided into three distinct steps or phases: defining an object to depict, rendering the design and creating an icon, and testing the icon.

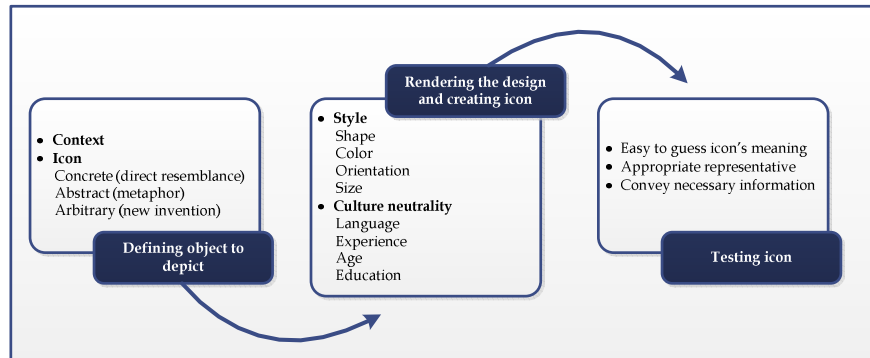


Figure 6. Icon design process.

Beginning with defining an object to be depicted by icons, context definition is essential to ensure that icons will be successfully interpreted. In a broad sense, the context is the message or boundary—what is to be communicated. Ideally, the context must be initially defined in an explicit manner that can later be sufficiently depicted by an icon. Next, the icon type—concrete, abstract or arbitrary—must be determined to depict the defined context.

The last and most difficult phase of this process is the design and rendering of icons. Self-evident icons rely on their style and individual culture. In this regard, there are four chief elements that must be considered and countered during the design process: shape, colour, orientation and size. Colour can be used to highlight information that could further improve discernibility. The dominance of shape plays a particular role in discriminating between different iconic constructions. Orientation is more visually expressive when the icon is either too complex or designed with a high density. The size of the icon is another essential factor in determining whether recognition will be clear enough. To make icons more universal, cultural aspects have to be taken into account during the design process [22, 23]. Cultural preference may include influences from a users' background, including spoken language, experience, age and education.

During the icon design process, a critical concern is the question of how to validate whether the icons, both their design and usage, are reasonable to distribute and use. Three characteristics have been proposed to test new icons. (1) Reviewers should be able to guess the intended meaning of icons on the first encounter. (2) Context or messages should be appropriately affected by the resembling icons. (3) Icons should be designed to contain adequate information to convey the intended message, not too overwhelming or too simple.

#### 4. Icon-Based Language for Hotel Safety

Creating a standard icon-based language for hotel safety and security guidelines may ensure positive outcomes by helping in emergency situations or preventing an

accident/crime before it occurs. Associated stakeholders such as travel agencies or detectives emphasize to offer safety lessons that are likely to protect traveller's property [24, 25, 26, 27]. Nevertheless, many end-users of hotel safety systems encounter usability problems such as learnability and flexibility. For example, the Scandic Hotel safety system [28] provides its safety manual in 14 languages (Figure 7). This may provide an obstacle for users if they are not capable of quickly finding their own language or reading and understanding other languages. Because Scandic Hotel is an international chain, they should also support Asian languages in addition to the 14 existing languages.



Figure 7. Scandic Hotel safety booklet which includes 14 languages.

We introduce a new model in Figure 8 called the *HotelSafetyModel*. The foremost idea behind this model is to develop generality, which can be realized by icons to speed up recognition and to improve understanding of hotel safety topics among all users. The main class, *HotelSafetyMode*, links to the following subclasses: *AlarmCase*, *SettlingCase*, *SmellSmokeCase* and *StruggleCase*. All of these classes are interconnected through datatype properties. Each of these knowledge classes contains the possible situation and instruction relevant to their context.

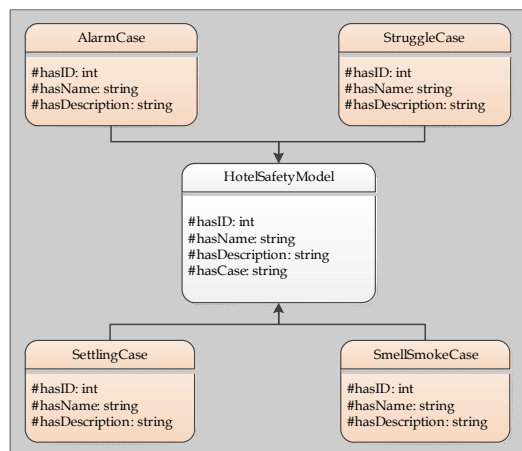


Figure 8. High-level hotel safety model.

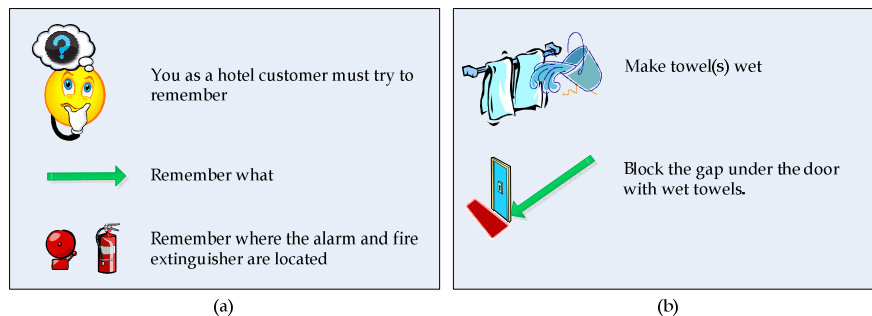


Icons should be self-explanatory and able to convey the concept of hotel safety conditions to people who speak different languages. However, icons must also provide suitable connections between the concept and the representation that enhance a reader’s interpretation. When constructing a sentence, rule-based principles are employed, for example:

- A subject is regularly represented by a noun form (concrete or abstract icons) such as a “smiley face” introduced to represent the actor of the sentence.
- A verb is signified by gesture such as a person looking at a book to signify “study”, which is an action of the sentence.
- An object is designated by a noun form (concrete or abstract icons) such as an extinguisher icon used to represent an extinguisher object in the real world.
- An adjective is portrayed by arbitrary icons (geometric shapes, arrows, and lines).

We have used the MS Visio icon collection for our proof-of-concept study. Interpretation is the process of reconstructing the meaning of icons, as shown in Figure 9. Figure 9(a) demonstrates the iconic sentence that can be perceived from left to right, whereas Figure 9(b) portrays the iconic sentence when reading from right to left.

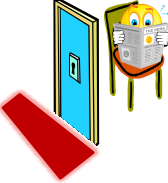


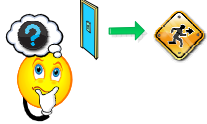
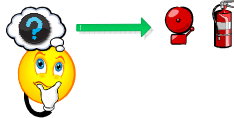



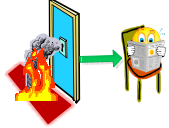


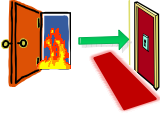
A smiley icon is normally treated as an actor of the sentence. In this context, the smiley icon means “you” as a hotel customer. A line and arrow together, such as a forward arrow, indicate that the next item is the object or the specific condition that must be executed. In contrast, a backward arrow indicates that what happens before the action must be performed.



**Figure 9.** Examples of how to interpret icons using left to right direction (a) and right to left direction (b).

In accordance with the four classes in *HotelSafetyModel* (Figure 8), this study attempts to propose icons that are representative of safety instructions. As portrayed in Table 2, concrete, abstract and arbitrary icons have been amalgamated.

**Table 2.** An example set of icon-based hotel safety instructions.

Class	Safety Instruction	Resemble Icons
<p data-bbox="370 642 553 737"><i>SettleCase</i> (While settling in the room)</p> 	Study the evacuation plan on the door.	
	Make a mental note of where the nearest emergency exit is, such as a staircase that leads outdoors.	
	Make a mental note of the number of doors between your room and the nearest emergency exit. This will help you to find the exit even in the dark.	
	Make a mental note of where the alarm and fire extinguisher are.	
<p data-bbox="370 1283 565 1377"><i>SmellSmokeCase</i> (Discovering a fire or smelling smoke)</p>  	Alert the hotel's reception or telephone the emergency number - 112 - from a safe place.	
	If the corridor is filled with smoke, stay in the room.	
	Take the room key with you if you leave the room. You may need to return if escape is blocked by smoke or another obstacle.	
	If the fire is small and limited - use the fire extinguisher located in the corridor.	
	If it is not possible to extinguish the fire close the door of the room that is on fire.	





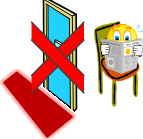
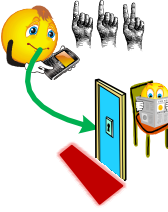

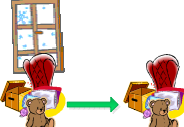

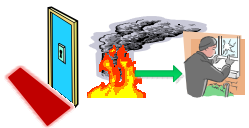
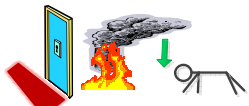
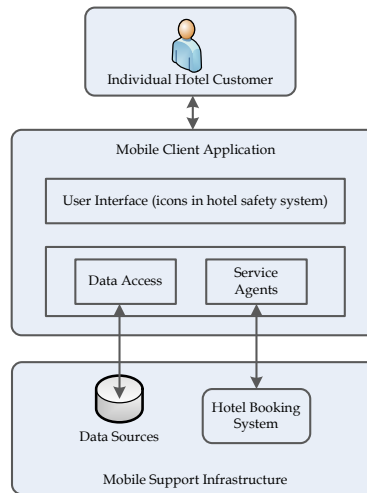
<p><i>AlarmCase</i> (Hearing the alarm)</p> 	<p>Leave the room if the corridor is free of smoke.</p>	
	<p>Take the room key with you and make your way to the nearest emergency exit.</p>	
	<p>Do NOT use the lift.</p>	
<p><i>StruggleCase</i> (Cannot leave the room)</p> 	<p>Telephone the reception or 112 and say that you are still in the room.</p>	
	<p>Block ventilation grills and gaps under doors with wet towels.</p>	
	<p>Move all inflammable materials away from the windows.</p>	
	<p>Stand near a window so that you can be seen from outside and try to attract attention.</p>	
	<p>If the room starts to fill with smoke, open a window.</p>	
	<p>In a smoke-filled room you will be able to see and breathe better if you crouch or lie down on the floor</p>	

Figure 10 illustrates the mobile client application for icon-based hotel safety systems. The application provides the presentation layer by means of iconic interfaces associated with safety information, which allows individual users to understand all safety instructions in the form of icons. The data layer is connected to the databases that store relevant data, and to the hotel's booking system for retrieving booking information such as check-in and check-out period. The application is activated when customers check-in to the hotel and deactivated immediately after customers check-out.



**Figure 10.** Mobile application design for hotel safety system.

## 5. Conclusions

In this paper, we introduced a first iteration of the icon-based model, language and mobile application for hotel safety. From more formal point of view, a new iconic language definition should be based on visual notations and on validated syntactic and semantic construction rules. Our next steps include implementing the prototype and a first iteration evaluation in a hotel. Interpretation of icons is an essential and culture-sensitive issue. The challenge is to minimize misinterpretations. The interpretation and the use of icons are not only task-dependent but also culturally determined beside the context. Icons are therefore not easy to handle whenever different cultures are concerned. They might be self-explanatory in one environment and completely misleading in another one. The evaluation of hotel safety icon language should be carried out side-by-side with the hotel safety booklet. Globally speaking, the evaluation results can give us very valuable information about cultural interpretations of icons.

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