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Warning signs at beaches: Do they work?

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ABSTRACT

Aquatic safety signs are widely used to alert potential users to hazards such as strong currents (rips), submerged rocks or dangerous marine life. To assist in providing guidance on the way such signage should be deployed the present study asks to what extent warning signs on the approach to some popular beaches add to the existing knowledge of beachgoers exposed to such signage. Interviews were conducted with 472 users at four beaches in the Australian state of Victoria. Three different signage conditions were used; no signage, a single standard composite signboard, and signage spatially separated into four types of signs; location name and emergency information, safety hazard symbols, lifeguard service information, and prohibitions. The interview investigated hazard identification, signage recalled, comprehension of that signage and, to elucidate a question about the shape of warning signs, whether users noticed whether warnings were in a triangle or diamond shape. Currents/rips was the hazard foremost in respondents minds regardless of whether signage was present warning of this danger. Less than half of the respondents (45.0%) reported observing any signage. Of those that did report observing signage the majority noticed the hazard related symbol signs above any other information provided. Neither composition of the sign (i.e. separated or composite/standard sign) nor symbol shape affected recognition. Strategies to direct beachgoers to read and heed the information on aquatic safety signage are discussed.

1. Introduction

Beaches can be dangerous places. In Australia the crude coastal drowning rate is 0.43 per 100,000 population (Surf Life Saving Australia, 2012). It is estimated that from 2002 to 2007 an average of 53 people drowned each year at Australian beaches (Franklin et al., 2010). In addition, for every reported death there were over 260 rescues on Australian beaches in 2009/2010 (Surf Life Saving Australia, 2010a).

The many authorities having responsibilities associated with beaches have implemented a wide range of actions directed towards reducing the potential effects of dangers on beachgoers. Actions range from the standard supervision of beaches by professional lifeguards and volunteer lifesavers to beach safety campaigns (Hatfield et al., 2012). One almost universal approach is to display safety-related signage at the approaches to beaches. Such signage is designed to alert potential users to aquatic-related hazards such as strong currents (rips), submerged rocks or dangerous marine life. Signage present on beaches also typically includes regulatory information and information on what to do in case of emergency.

It is often held that warnings should be designed to alert the potential audience, to provide information about the hazard, about its potential consequences and about appropriate behavior to avoid those consequences. These components are outlined, for example, in the US Standard ANSI Z535.4 (2011b). The alerting function is often conveyed through relevant signal words such as danger or caution and ANSI Z535.4 (2011b) provides details of a range of words to be used. The alerting function can also be conveyed through the use of symbol signs involving various colors and shapes. For example, a black symbol on a yellow triangle or diamond shape with a black border defines a color and shape combination that is well-known as providing a warning. The international standard ISO 3864-1 (2011) provides design rules for the shapes and colors of this and other safety-related symbol signs as does ANSI Z535.3 (2011a).

Information about the hazard (such as rips on beaches), the possible consequences and the appropriate behavior to engage in or avoid can be transmitted with appropriate text. However, in order to avoid the necessity for text which may be required in several languages, a pictorial symbol using an appropriately-shaped and colored symbol format is often used. Another reason for using pictorial symbol signs is that they can increase the likelihood that the warning will be noticed. A symbol sign can usually be recognized at a greater distance than the equivalent sign in words (Jacobs

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et al., 1975), and has better visibility for viewers of all ages, particularly in the reduced light of dusk (Kline et al., 1990).

In order for a symbol sign to be effective it must be comprehended appropriately. The international standard ISO 9186-1 (2007) and the US ANSI Z535.3 (2011a) both provide details of testing methods that can be used for determining the extent to which a safety sign that uses only a pictorial symbol is comprehended as intended.

Laughery and Wogalter (2013) have pointed out that warnings can be seen as fulfilling a variety of roles. They may be there to provide information, to influence behavior, or simply to be a reminder. In each of these roles differing emphasis may be needed on each component of the warning. In particular, where a warning relates to a danger that is not well understood it may be necessary to provide more information, but where everyone who encounters the warning has had, for example, a work-related induction involving learning about the relevant dangers then all that may be required is a reminder. In a public situation such as a beach the question arises as to what people already know prior to attendance and what they can infer from warnings that might be presented. For example, if there is a warning symbol sign showing sharks it may be assumed that those seeing it would know that the appropriate behavior is to remain alert for shark warnings and not to enter the water. On the other hand, one of the warnings commonly shown on the approach to Australian beaches relates to dumping waves, which are waves that break right at the water's edge and are thus likely to drop an unsuspecting body surfer precipitously, and with some force, onto the sand possibly resulting in serious injury. These waves are commonly poorly understood but the relevant standard requires only the symbol sign with no further explanation.

There are two conventions for the way a warning pictogram or symbol is displayed. One is in a yellow triangle with black border, as used in Europe and as shown in ISO 20712-1 (2008). The other is within a yellow diamond with black border as traditionally used in Australian and US public and roadway warnings. When Australia and New Zealand adopted ISO 20712-1 (2008) the triangle-shaped warning signs shown in that standard remained. Research suggests that when the color of a well-known symbol sign is changed it is very readily noticed (Adams and Hsu, 1981). Shape changes are also noticed but less reliably so. The question remains in the present context as to whether a change from diamond to triangle will be noticed and, more particularly, whether it will cause confusion.

There has been much research into safety and risk communication generally (e.g. Lundgren and McMakin, 2009) but very little has focused on the specifics of effective aquatic safety signage. A major reason for this lack of evidence is that warning signs are rarely evaluated in the context of actual use. The current study was therefore conducted within the environment in which aquatic safety signage is used, namely at local beaches near the major Australian city of Melbourne. The research was designed to extend the evidence on aquatic signage by answering the following questions:

- To what extent do beachgoers have a prior conception of the hazards at beaches?
- Do beachgoers who pass warning signs on their approach to a beach become more aware of the dangers depicted on those signs than beachgoers who do not encounter such signs?

There were two subsidiary questions to be answered:

- There was an opinion within the Australian safety community that warning signage would be more effective if its components were spread out spatially instead of being grouped on a single large signboard. The present study aimed to investigate this.
- The present study also aimed to determine whether beach users notice the shape of the black-symbol on yellow background warning signs—whether that shape is the European triangle shape or the US/Australian yellow diamond shape.

2. Method

The design involved administering a questionnaire to randomly selected respondents at four beaches. The main factor was presence or absence of signage. When signage was present it was in either a single standard composite signboard as shown in Fig. 1 or separated into its four components as described below (2.2 Signage). There were two types of beaches: bay and ocean. For one of each type of beach, when either type of signage was present, the warning symbols were shown within yellow triangles, for the other they were shown within yellow diamonds as shown in Fig. 1. Interviews were conducted in person by trained interviewers using a questionnaire designed for the purpose.

2.1. Locations and materials

Hazard symbols appropriate for beaches are listed in international standard ISO 20712-1 (2008) which has been adopted as Australian and New Zealand standard AS/NZS 2416 (2010). In order to provide for conditions both with and without signage it was necessary to select sites with no pre-existing safety signage. It was also necessary to select sites at which a range of standard hazard warnings taken from ISO 20712-1 (2008) would be plausible. Beaches which met this criterion, and for which appropriate permission could be obtained, included two bay beaches and two ocean beaches. All the beaches had a hazard rating of 3 or 4 on the 10-level beach classification scale developed by Short (1996) in which the least hazardous beaches are rated 1 (safest) through to the most hazardous 10 (least safe). The beaches used in this study are thus classified as presenting low to moderate hazards. The bay sites were Brighton and Seaford and the two ocean beaches were Point Leo and Balnarring, all being within 100 km of the city of Melbourne.

2.2. Signage

In the no-signs condition the beaches remained as they were. There were no hazard signs but there were some local authority regulatory signs, for example regarding dogs not being allowed on the beach or not removing shellfish. These remained in place. As the main questioning of respondents was in relation to hazard signage these regulatory signs, unrelated to the present study, were not considered to pose a concern for the design.

For the composite signage condition temporary signs were designed according to ISO 20712-3 (2008), a separate one for each beach, as shown in Fig. 1, with content relevant to the foreshore environment and beach conditions at each selected site. In the separated signage condition the composite sign was broken down into its four separate panels as described in ISO 20712-3 (2008) namely the location name and emergency information on the first panel, the safety hazard symbols on the second, the lifeguard service information on the third and prohibitions on the fourth. At each beach the path from the car park to the beach was through foreshore vegetation so it was possible at each beach to separate the four components with at least 5 m between each.

The signs were located so as not to obstruct access or interfere with beach activities but so as to appear to be standard beach signs. The number of signs placed at each site was variable and based on the length of the immediate beach face and number of