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Directional Zoological Signage Image PReferences An Inclusive Design Perspective

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Abstract:

When the design of directional signage takes into account both the needs of different types of end users and the nuances of a specific environment, this can greatly enhance a localised wayfinding system. This need for contextualised wayfinding design is particularly apparent within zoological gardens, as the presence of captive animals represents a distinctive challenge in terms of sign design. Equally, zoological gardens are visited by a wide range of people, including foreign tourists, hence the increased need for signage to be universally comprehensible.

Observations from four United Kingdom zoological gardens revealed that on-site directional signs display either text alone, or pictograms and text. This finding highlighted a missed opportunity in terms of depicting species-specific detail, as photographic imagery can offer an enhanced level of detail, when compared to equivalent pictograms. Importantly, from an inclusive design perspective, photographs can increase access to information.

Visitors at the Welsh Mountain Zoo were asked which of two directional sign designs they preferred, using self-report measures. One sign displayed a photograph and one displayed a pictogram. Results were recorded at three separate viewing distances. The experiment hypothesis was that people would prefer the photographic sign, due to its vibrancy and clarity. Quantitative and qualitative results from 219 participants show that overall the sign that displayed a photograph was preferred. This has indicated that in a zoological context photographs should be considered as a communication medium on directional signage.

Keywords:

Directional Signage, Inclusive Design, Photograph, Pictogram, Zoological Gardens

1. Introduction

Observations from four United Kingdom zoological gardens revealed that when imagery is displayed to convey a message on directional signage it is limited to the use of pictograms. Furthermore, there is currently no universal pictogram system specific to zoological directional signage, as each of the four sites visited either displayed their own unique pictograms, or text alone. Pictograms are not pictures; rather they are a type of symbol (Kjorup, 2004). They transcend language barriers allowing for global and universal communication (Herwig, 2008) and convey information through convention and consistency (Yule, 2014). Effective pictograms are simple to understand as they create associations of meaning, however, many do not share a visual similarity with the image they represent (Kjorup, 2004). A pictogram of a bus, for instance, is typically used to indicate a bus stop, rather than an actual bus. Similarly, a knife and fork pictogram is conventionally used to signify a restaurant, rather than cutlery (see figure 1). In a zoological context, animal pictograms represent animals within their enclosures. While some pictograms may be used to represent the enclosure of a specific species, others may be used to represent numerous enclosures for a specific genus or for multi-occupancy enclosures, which house more than one species.

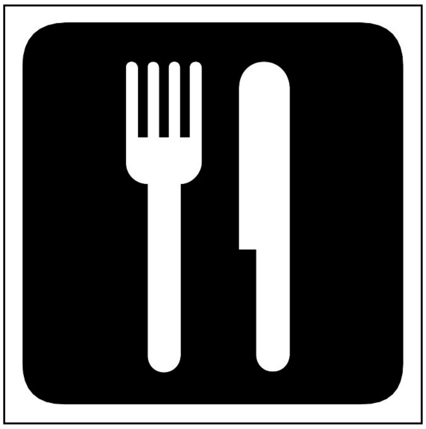

Figure 1. Royalty free pictogram

A consideration of contextualised pictogram use for directional signs relates to the broader topic of wayfinding. There are typically four stages in any wayfinding process: orientation, route decision, route monitoring, and destination recognition (Lidwell *et al*, 2010). Orientation relates to establishing where a person is in relation to where they want to go. Route decision is the selection of path to reach a desired location. Route monitoring is an ongoing process of reaffirming that a person is heading in the correct direction. Finally, destination recognition allows for confirmation that a desired destination has been reached. Landmarks and signage both function as wayfinding cues (Lidwell *et al*, 2010). In a typical zoological garden, many varying cues exist, such as litter bins and statues. The most obvious, in terms of its explicit function, is directional signage. Thus, the experiment focuses upon this type of perceptual cue as a suitable starting point for this novel research area.

The rationale for this experiment is based upon the argument that photographs can offer an enhanced level of species-specific detail when compared to pictograms, with reference to directional zoological signage. This is particularly relevant when species share a similar symbolic outline with others within their genus. For instance, a pictogram of a cheetah (*Acinonyx jubatus*) and a cougar (*Puma concolor*) look very similar, however photographs of these two animals look quite different. It is therefore clear that for people who cannot read supporting text, photographs can offer enhanced access to information.

Figures 2 and 3 illustrate the potential advantages photographic imagery presents. When viewing figure 2, most illiterate people would only know that the image represents a species of bear. Figure 3 would provide this group of end users with the knowledge that a brown bear (*Ursus arctosis*) is being represented, so both an illiterate person and an individual who can read the text on display would be privy to the same information, albeit in different formats. The point being made here is also relevant to tourists who visit zoological gardens from outside of the United Kingdom and may not be able to read English text. Frost (2011) notes the popularity of zoological gardens with foreign tourists.

Figure 2. Design by Michael David William Richards using a royalty free pictogram

Figure 3. Design by Michael David William Richards using photography by Mike Levin

Nobody could determine what type of bear the pictogram alone represents in figure 2, without resorting to guesswork. The fact that the pictogram is of a general bear and not a particular species, further illustrates this point. Therefore, there is little value in testing a person's ability to read this information from the pictogram, compared with their ability to read it from the photograph. For those people who cannot read English text it would not be possible to determine what kind of bear is being described from a text alone sign, unless they understood another language and the two words in both languages were similar. Equally there is little value in testing a person's ability to read a language which is not their own. 'белый медведь' means 'polar bear' (*Ursus maritimusor*) in Russian. The claim that it meant brown bear (*Ursus arctosis*) would sound equally plausible to most non-Russian speakers. Due to the redundancy of some similar tests described here, it was appropriate to test preference for this experiment.

The importance of providing imagery that increases access to information for people who cannot read supportive text links to inclusive design philosophy. Designing products and environments that are accessible to the wider population, irrespective of age or ability, is the basis of this philosophical position (Vaes, 2014). However, inclusive design is not just about accessibility in terms of needs, it also refers to aspirations (Clarkson and Coleman, 2015). This offers an additional reason why preference was utilised for this experiment as a vehicle to explore the topics under discussion.

Directional signage in zoological gardens is an under researched area; however, some existing literature and research is of relevance. Rees (2011) states that zoological imagery conveys directional information more effectively compared to text alone, especially for children and foreign visitors. His informed opinion further support the notion of exploring which imagery type is preferred. Shettel-Neuber and O'Reilly (1981) found that zoological garden visitors prefer following a suggested route, rather than one of their own choosing. Although dated, this again supports the need for further related research. Most other zoological signage research relates to enclosure signage. For example, Martin (2012) recorded average reading times, while Fraser *et al* (2009) documented preferences for enclosure signage content, finding that facts about diet were most interesting to site visitors.

No current literature specifically promotes the use of photographs on zoological directional signage, nor does it discuss why photographs have not previously been employed in this role. Tinkler (2013) does however note that photographs can offer high levels of detail when compared to other visual mediums, without making specific reference to signage. In addition, the Dementia Engagement and Empowerment Project (2013) states that when presenting images to people with dementia it is preferable to use photographs, rather than illustrations, as the latter can be difficult to interpret for some people. Figure 4 illustrates this concept. It shows a photographic toilet sign from the Woodlands Hospital in Salford, which provides services for people with dementia.

Figure 4. Photography by Professor Marcus Ormerod

Binder and Schöll (2010) have documented how farmers prefer photographs rather than pictograms as they relate to their concept of reality. Beyond this reference, related research is limited to contextualised pictogram comprehension, rather than preferences comparing both pictograms and photographs. Rother (2008) has recorded confused interpretations of pesticide pictograms in South Africa, while Dowse and Ehlers (2004) have documented inconsistent levels of medical pictogram interpretation, also in South Africa. Records of pictogram interpretation issues, such as this, further support the notion that alternative communication mediums should be evaluated and considered for use. In contrast, Banda and Sichilongo (2006) have observed that animal pictograms are easier for people to understand compared to abstract alternatives (such as the St. Andrews Cross) as their meaning can be logically deciphered.

To explore the issues mentioned within this introduction, an experiment was undertaken on-site at the Welsh Mountain Zoo. This paper details the results of the experiment. Visitors were shown two sign designs at three separate viewing distances; one sign displayed a pictogram and one displayed a photograph. They were then asked which of the two signs they preferred. The experiment hypothesis was that zoological garden visitors would prefer a directional sign that displayed a photograph rather than one that displayed a pictogram, as it would require less interpretation, offer an increased level of reality, and be more engaging. The hypothesis was based upon literature references to photographic detail (Tinkler, 2013) and reality (Binder and Schöll, 2010), and the aforementioned theory regarding an increase in species-specific detail.

Results show that most visitors preferred the sign that displayed the photograph. This suggests that directional photographic signs should be considered for use in zoological gardens, due to visitor preference.

2. Method: Design

The experiment took place at the Welsh Mountain Zoo, where two new signs were temporarily installed. Ethical approval was granted by both the University of Salford and the Welsh Mountain Zoo. Figure 5 shows the design that incorporated a pictogram, while figure 6 shows the design that incorporated a photograph. Both signs were designed as possible alternatives to an existing sign that was highlighted as being poorly conceived, from an access to information perspective. The main issues associated with the existing sign (as shown in figure 7) were that it relied solely upon text and did not display the international symbol of accessibility, which is typically used to denote an accessible route (Barlow *et al*, 2010). The new signs designed for the experiment were printed rather than displayed on a computer screen, using a material that did not cause glare. Glare can cause legibility problems, especially for many older people (Hillier and Barrow, 2014). Although printing increased costs it allowed visitors to analyse the signs in a real world context. It was hoped that this would make the experiment feel more tangible and stimulating for participants.

Figure 5. Design by Michael David William Richards using royalty free pictograms

Figure 6. Design by Michael David William Richards using royalty free pictograms and photography by Mike Levin

Figure 7. Photography by Michael David William Richards

The first independent variable in the experiment was the communication medium (pictogram or photograph), as this was under the researcher's control. The second was the distance at which the signs were assessed (three, six and nine metres), a factor also under the researcher's control. The dependent variable was the participant's preference for one of the signs, at each distance.

The experiment represents a single case, focusing upon one species. Clearly, given the context, many others could have been selected. The brown bear was chosen because a generic bear silhouette clearly illustrates the argument that photographs offer enhanced species-specific detail, when compared to pictograms. This argument is especially convincing when the brown bear is compared to the polar bear, black bear (*Ursus americanus*), or giant panda (*Ailuropoda melanoleuca*), due to clear physical differences, which are difficult to convey using pictograms. In terms of practicalities, the fact that the Welsh Mountain Zoo houses brown bears allowed the experiment to relate directly to a real enclosure. The popularity of brown bears with visitors was also of relevance. Some visitors may not have known what a spectacled bear (*Tremarctos ornatus*) was, irrespective of image choice.

Although the focus of the experiment related to the pictogram versus photograph argument, sign height needed to be considered during the design stage. The two temporary signs were positioned just above average eye height. The existing sign that the alternatives were designed to replace was not ideally positioned in terms of height. It was, and still is at the time of writing, positioned below average eye height. Mollerup (2005) suggests that directional signs should be positioned at average eye height unless there is a chance that numerous people will want to view a sign at one time, in which case it is sensible to position signs just above average eye height. Heiss *et al* (2010) add that signs are typically positioned at above average eye height when they are to be viewed from an extended distance. From an inclusive design perspective, positioning signs at just above average eye height means that the needs of the majority of end users are taken into account. However, it is acknowledged that some people will benefit from a reduced sign height. For example, Goldsmith (2011) notes that average eye height for a male wheelchair user is 1220mm, while it is 1650mm for a male non-wheelchair user.

Detailed guidance on reading distances for text based signs, which evaluates the relationship between text sizes and reading distances, is available. For example, Baines and Haslam (2005: 199) recommend *'a ratio of cap height to (minimum) reading distance of 1:250, so cap type that is 1cm high can be read 2.5 metres away'*. Literature does not however provide similar guidance for signage without text. It was not possible to adapt the rules for text-based signs to suit the needs of the experiment. A new calculation would be required to determine accepted reading distances and in turn analyse how distance influences the legibility of both pictograms and photographs. To begin to explore this topic in terms of preference, commonsensical distances were selected for the purposes of the experiment.

3. Method: Participants

Representative sampling was utilised, as all people taking part in the experiment were visitors at the Welsh Mountain Zoo. Therefore, their views were used to represent other zoological garden visitors. Those taking part had to be over 18 years of age. People who looked under 21 were not asked to take part, in an attempt to ensure that this rule was adhered to during the experiment. This stipulation eased the process as part of the ethical approval concerning both the University of Salford's and the Welsh Mountain Zoo's requirements. All people who took part in the experiment did so voluntarily and did not receive any form of remuneration for taking part. A total of 263 people were asked to take part in the experiment, with 44 declining to do so, leaving 219 results. It is recognised that the experiment presented a barrier for anybody who could not communicate, or could not understand a request to take part. It was also an exclusively visual experiment, meaning that some visually impaired people were not able to participate.

According to data provided by the Welsh Mountain Zoo’s zoological director, Nick Jackson, the organisation received approximately 126,000 visitors during 2010 (Jackson, 2011). This figure provided an approximate daily population of 345. Through the use of this statistic as a population figure, it was possible to determine an appropriate sample size of 219 using an online tool provided by Creative Research Systems (2012). A chosen confidence level of 95% and a confidence interval of four were utilised to run the calculation.

4. Method: Apparatus and Materials

The primary apparatus required were the two signs on signposts, which were cable tied to fencing, while chalk and a tape measure were used to make floor markings relating to the three viewing distances. Visitors were provided with a pen and a clipboard to assist them in completing the response forms, which were stored in a folder following completion. Experiment materials included 219 Participant Consent Forms and 219 Experiment Response Forms. Figure 8 shows the experiment being undertaken during September 2012.

Figure 8. Photography by Richard James Evans

5. Method: Procedure

Visitor responses were gathered over four days during August and September 2012. Responses were taken from approximately 9.30am to 5.00pm each day. All responses were taken on-site at the Welsh Mountain Zoo. 58 responses were recorded on the first and second day. The third date provided 53 responses, and 50 responses were recorded on the final day to reach the desired target of 219.

Potential participants were approached and asked to participate when passing by the signs. People were not asked to participate again if they walked past the signs more than once, to avoid multiple sets of results from one person. All individuals taking part were asked if they preferred the temporary sign that displayed a pictogram or the temporary sign that displayed a photograph. Participants were first asked to state their preference at three metres, then six metres and finally at nine metres. They were also able to make additional comments on the topic. This allowed for the collection of qualitative feedback from prospective end users.

6. Quantitative Results

Table 1:

	3 Metres	6 Metres	9 Metres	Total Participant Responses
Pictogram	57	92	134	283
Photograph	159	123	81	363
Neither	2	2	2	6
Declined to State	1	2	2	5
Total Number of Participants	219	219	219	657

Table 1 shows all of the quantitative results. Table 2 shows Chi-Square tests for the three separate distances and for the total responses for the pictogram and the photograph. In all cases, the p value is less than 0.05. This means that the total responses and the differences in preference at each of the three viewing distances are all statistically significant. For statistical testing purposes, those that responded ‘neither’ and ‘declined to state’ have been removed, and this then necessitated the removal of one of the responses for ‘photograph’ at three metres.

Table 2:

		3 Metres	6 Metres	9 Metres	Total Participant Responses
Observed	**Pictogram**	57	92	134	283
Observed	**Photograph**	158	123	81	362
Expected	**Pictogram**	107.5	107.5	107.5	322.5
Expected	**Photograph**	107.5	107.5	107.5	322.5
	P =	5.65254E-12	0.034499692	0.000300847	0.001866938

7. Qualitative Results

This section presents what were deemed to be relevant qualitative results, following a process of directed content analysis. The process was ‘directed’ as it linked to the experiment's underlying inclusive design philosophy. Thus, additional comments, which were revealing in terms of signage preference, are included, while unrelated, unrevealing, and idiosyncratic comments have been omitted. Not all people who took part provided optional additional comments. In total 17 people chose not to do so. The qualitative results are as follows:

- 54 additional comments referenced the clarity of the photographic sign. For example, 'it's clear what you are going to see'.
- 54 people stated that the pictogram sign was clearer when the viewing distance was increased. For example, 'at a distance the pictogram stands out more'.
- 49 people praised the general clarity of the pictogram sign. For example, 'it stands out a lot more'.
- 32 comments referenced the appealing nature of the photographic sign. For example, 'it's attractive and nicer looking'.
- 24 people claimed that when viewing distance was increased the photographic sign began to blend in to the background. For example, 'the photo blends in with the scenery at a further distance'.
- 20 people criticised the clarity of the pictogram sign. For example, 'the pictogram could be some other animal'.
- 15 participants criticised the photographic sign, claiming that it was more difficult to make out from a distance. For example, 'the photo is not as clear at a distance'.
- 15 people stated that the photographic sign was positive for children. For example, 'kids wouldn't understand a pictogram'.
- Eight people referred to problems that the sun caused when viewing the photographic sign. For example, 'the photo is difficult to make out in the sun'.
- Eight people stated that the pictogram was clearer for people with a visual impairment. For example, 'people with visual impairments would find the pictogram easier to understand'.
- Six people said that the photograph was preferred, but only 'close up'.
- Two comments referred to the pictogram sign as 'boring'.
- One participant stated explicitly that had the photograph been displayed against a white background, it would have been selected at all three viewing distances.

8. Discussion

Although the pictogram sign was favoured at nine metres, the experiment's quantitative results show that the photographic sign was preferred at three metres, six metres, and overall. Furthermore, this overall preference for the photographic sign was significant, rather than slight. Discounting the responses for 'neither' and 'declined to state', approximately 57% of participants preferred the photographic sign, while around 43% preferred the pictogram sign.

The quantitative results also show that viewing distance significantly influenced preference. As distance increased, the likelihood of the pictogram sign being selected as a participant's preference also increased. Nevertheless, concerning the overall results, the experiment's original hypothesis has been confirmed. Moreover, numerous additional comments concerning clarity and appeal justify the rationale for the hypothesis. If generality is implied, zoological gardens should consider utilising photographic directional signs, depending upon intended viewing distances, should they wish to take visitor preference into account.

Qualitative results show that all positive feedback regarding the pictogram sign was of a practical nature. Specifically, these comments referenced clarity. Conversely, positive feedback about the photographic sign was both practical and referred to the sign's appealing nature. 54

people praised its clarity, while 32 people mentioned its general appeal. This suggests that had some of the practical problems concerning the photographic sign been addressed then it may have been chosen as a preference selection more often. For example, 24 people stated that the background the photographic sign was set against visually blended into the surrounding foliage. Had this not been an issue, preference selection for these 24 participants might have been completely different. Note that one participant stated explicitly that had the photographic sign been displayed against a white background, it would have been selected at all three viewing distances. While the photographic sign was certainly criticised, this only occurred due to practicalities, whereas two participants referred to the pictogram sign as boring, for no tangible reason. Although there are no direct references, existing knowledge partially supports what is being suggested. Research conducted by Day *et al* (2002) has shown that in regards to tourism marketing, people preferred animal photographs compared to images of natural landscapes, city scenes, and people. In fact, only photographs of beaches were more popular.

If a similar experiment were to be undertaken, it would be advisable to have the signs produced in a thicker material. Eight visitors complained that sunlight made the photographic sign difficult to distinguish. Observations at the time clarified that this was due to sunlight passing through the temporary signs and that the sunlight had less of an effect on the pictogram sign. Following such complaints, it was explained to participants that the signs were produced inexpensively to reduce costs and would never be used as permanent on-site installations. This finding suggests that had the signs been originally produced in a thicker material then the photographic sign may have been chosen more often as a preference selection.

Although additional comments from participants highlighted a number of practical issues regarding the photographic sign, both concerns about sunlight and the background the photograph was set against are possible to address. Conversely, there is an inherent problem with the pictogram sign, which cannot be addressed without fundamentally changing the sign to the point that it would no longer be a pictogram. 20 people stated that the pictogram sign could be confused for another animal. Comments included ‘it could be a pig’, ‘it could be anything’, and ‘it could be a polar bear or black bear’. One participant commented that a number of animals would be impossible to represent as a pictogram. Put simply, for these individuals it was not unequivocally clear that the pictogram represented a bear. This finding shows that for some visitors, bear pictograms do not specify genus, as effectively as bear photographs. The importance of this finding is clear, as the sole purpose of directional signs in zoological gardens is to specify which species or genus people are being directed towards. Further research could explore this topic in greater detail, by testing comprehension of various animal pictograms and photographs.

The influence distance had upon preference selection was further emphasised by the qualitative results. 54 people claimed that the pictogram sign was clearer when the viewing distance was increased. Equally, 15 participants stated that as the viewing distance increased the clarity of the photographic sign decreased. In addition, six people specified that their preference for the photographic sign only existed at a reduced viewing distance. Although the photographic sign was preferred overall, the influence of distance cannot be discounted. Had the experiment only been conducted at 9 metres, the results would show that the pictogram sign had been preferred. Thus, if the results of this experiment are considered to be generalisable, then zoological gardens should consider the influence of typical viewing distances when selecting appropriate imagery for directional signage.

The experiment's qualitative results are revealing, as although the photographic sign was preferred overall, and this preference was statistically significant, there were still a notable number of people who made positive comments regarding the pictogram sign. For instance, 49 people praised its clarity. While eight people claimed the pictogram sign was better for visually impaired people, without explaining why. If placed in a broader context, these additional comments suggest that zoological gardens will not be able to please all visitors when selecting either a pictogram or a photograph for directional signage. Existing research on pictogram comprehension for people with visual impairments has shown that pictograms are useful, but only if they are designed to draw attention to key information and remove fine detail (Katz *et al*, 2006). This concept supports the additional comments made by participants, regarding visual impairment. As around one million people in the United Kingdom are registered as having a visual impairment (Waterman and Bell, 2011), this is an important consideration for zoological gardens, and one that could be explored through future research.

With reference to another typically marginalised group, 15 adults commented that children would find the photographic sign easier to understand, presenting a specific subtopic, which warrants further exploration. This notion is also important from an inclusive design perspective, as it adds further rigour to the argument that photographs increase access to information for end users, irrespective of their age or ability. However, these comments were not made by children. Moreover, the participant's comments on this topic conflict with existing research. Hameen-Anttila *et al* (2003) found that when context is understood, children are normally able to understand common medical pictograms. As existing research relates to medical labels and no children took part in this experiment, further research involving children would be required to explore their interpretation of zoological pictograms. Undertaking such study would certainly be worthwhile, due to the high number of children who visit zoological gardens (BIAZA, 2015).

After data collection for the experiment had been completed, a potential imperfection in terms of conditioning was revealed. Each person who took part in the experiment provided an answer at three, six, and nine metres. If a similar experiment were to be conducted in the future, it would be prudent to ask each participant for their preference at just one of the three distances; for instance, 50 people could provide a preference selection at three metres, while 50 different people could answer at six and nine metres. The reason for this is that participants may have been influenced to repeat the answer they provided at three metres at the other distances in an attempt to appear consistent or they may have felt the need to change their answer at nine metres to provide what they thought might be the 'correct' answer. This may account for the number of people who did have a preference for the pictogram sign at nine metres only. This is a potential conditioning issue and may not actually exist. Running a similar experiment with a singular response approach could confirm if this issue had influenced the results. Undertaking a similar experiment at a different time of year could also prove to be useful, as it is possible that the time of year influenced data collection in terms of the visitor demographic.

In relation to statistical testing, interval ratings could be used on the participant response forms if a similar experiment were to be undertaken in the future. For example, a Visual Analog scale or a Likert scale. Doing so would produce interval or ratio data, so that data could be analysed more comprehensively using a parametric test. This would also reveal how much each participant preferred a particular sign, rather than that it simply was preferred. Utilising this approach would present the opportunity to show participants either a photographic sign or a pictogram sign in isolation, rather than by way of a side-by-side comparison.

To allow for greater generality claims, it would be useful to conduct similar experiments using images of different species other than the brown bear. The familiarity visitors have with a species may influence results; however, it has not been possible to explore this issue by looking at one species only. Future testing may imply that zoological gardens should consider utilising photographic directional signs for certain species, while pictogram signs are preferable for others.

9. Conclusion

In summary, the experiment's results show that visitors preferred the photographic sign overall. Significantly, the results also show that at nine metres the pictogram sign was preferred. The experiment was successful in exploring preferences for these two sign types at varying distances, yet it was restricted to only an analysis of brown bear signage. The experiment hypothesis was confirmed, as more participants preferred the photographic sign.

When placed in a broader context the results have real world implications. Depending on intended viewing distances, zoological gardens should now consider using photographic imagery and text on directional signs, rather than pictograms and text or text alone. Not only are they theoretically superior in terms of information provision, but in this instance they were also preferred by site visitors.

Qualitative feedback suggested that had the photographic sign design been modified it would have been chosen as a preference selection more often. These additional comments, coupled with the experiment's quantitative results, have been used to develop an end result or design solution to conclude the report. Figure 9 is a design that could be installed by the Welsh Mountain Zoo to replace the existing sign. Equally, it could be used by other zoological gardens. The new design takes into account the participant's overall preference for the photographic sign, while also addressing comments regarding the use of a white background, which contrasts its potential surrounding environment and the photograph itself.

Figure 9. Design by Michael David William Richards using royalty free pictograms and photography

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