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Passenger Knowledge of Airline Safety Icons: A Cultural Study

Bridget L. Mattingly

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PASSENGER KNOWLEDGE
OF AIRLINE SAFETY ICONS:
A CULTURAL STUDY

by

Bridget L. Mattingly

A Thesis Submitted to the
Department of Aeronautical Science
in Partial Fulfillment of the Requirements for the Degree of
Master of Aeronautical Science

Embry-Riddle Aeronautical University
Daytona Beach, FL
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This thesis was prepared under the direction of the candidate's thesis committee chair, Dr. John Wise, Department of Aeronautical Science, and has been approved by the members of his thesis committee. It was submitted to the Department of Aeronautical Science and was accepted in partial fulfillment of the requirements for the degree of Master of Aeronautical Science.
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The author would like to express much gratitude to the Thesis Chair, Dr. John Wise, as well as committee members, Dr. Deaton and Dr. Cunningham. Without their input, support, and enthusiasm, this thesis would not have been possible. Also, Ryoko Kosterman and Ray Klinke of United Airlines and Ron Wilson of the San Francisco International Airport have my undying gratitude for allowing this project to happen. The translators, Yumi Morisaki, Son Hee Lee, Rachel Preston, and Min Kim, deserve their own round of applause, and lastly, the author would like to extend sincere appreciation to family and friends who have always supported every chosen path.
The purpose of this study was to examine the relationship between Japanese, Korean, and American cultures in their ability to comprehend icons used in airline passenger safety information. The 116 subjects were outbound international airline passengers traveling from San Francisco International Airport to either Japan or Korea. The instrument used contained thirteen icons similar to those on current passenger safety briefing cards. Subjects were asked to identify the icons as accurately as possible. Answers were graded on a three point ordinal scale, and frequency data were obtained. To test for significant differences between cultures, the data were analyzed through use of the chi-square test in a two-way design. Five of the 13 icons showed significant differences in interpretation among the three cultures. Appropriate recommendations were made.
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INTRODUCTION

According to the International Air Transport Association (IATA), the number of international scheduled passenger enplanements increased by 7.6% annually between 1985 and 1990 and will reach 736 million passengers by 2010. This increase can be seen most prominently in the Asia-Pacific area, where international scheduled passenger traffic increased annually by an average of 12.1% between 1985 and 1990. Asia-Pacific will account for over 50% of all international scheduled passenger traffic by the year 2010. By 2010, Transpacific traffic between the Americas and Asia will account for 86 million passengers, dominated by travel to and from Japan (24.2 million) followed by travel to and from Korea (7.1 million) and Hong Kong (3.4 million). This growth in international travel in Asia has come about because of the strong economic growth throughout the area, the abatement of travel restrictions, and the political stability found in most countries in the area (IATA, 1992).

With this increase in flights comes an increase in the risk of a major accident occurring, and with the size of airplanes increasing along with the overall traffic levels, any accident could prove to be even more dramatic. In the event of a survivable accident, passengers must be able to perform various acts in order to evacuate the aircraft safely. Therefore, passengers from all cultural backgrounds must be able to comprehend all safety information presented to
them. This information may take on many forms, including words, symbols, photographs, colors, videos, etc.

Statement of the Problem

Since no two cultures are identical, people from various cultures may interpret coding differently. This could cause problems during emergency situations, especially on international flights that may contain passengers from many diverse backgrounds. Cross-culturalization could lead to confusion in emergency situations if safety information is not correctly understood by all passengers. Therefore, it is important that all passengers understand what to do in case of an emergency to avoid any unnecessary loss of life.

The purpose of this study was to investigate the ability of people from American, Japanese, and Korean cultures to comprehend the icons used on airline passenger safety cards. These icons are found on passenger safety briefing cards and provide passengers with information vital to their survival in the event of an emergency. It is therefore of the utmost importance that the icons on the cards are interpreted correctly.

Review of Related Literature

In order to justify a study on this subject, literature was reviewed. The topics under review were passenger safety briefing card studies and cultural studies on visual information.

Passenger safety briefing card studies. Passenger safety briefing cards are required under the Federal Aviation Regulations Parts 121 and 135. Although many guidelines are provided through Air Carrier Operations Bulletins
and Advisory Circulars as to the content of these cards, the only requirements are the inclusion of diagrams and methods for operation of the emergency exits and instructions for the use of other emergency equipment. Cards must also be pertinent for the type and model of airplane on which they are being used. No other stipulations are given, and there is no standard format provided.

In an effort to determine the effectiveness of various methods used to convey safety card information, many studies have been conducted. A study conducted by Johnson and Altman (1973) examined the effects of different briefing information on the ratio of passengers who jumped or sat when using the emergency evacuation slide. Subjects were either supplied with a card that gave the instruction “jump” or “jump - do not sit” or given no card. Those subjects not given a card were least likely to jump onto the evacuation slide, while those given a card that read “jump - do not sit” were most likely to jump onto the evacuation slide. The researchers subsequently recommended that briefing cards instruct passengers both to jump and not to sit through the use of simple drawings or pictures with a minimum number of words.

Another study conducted by Schmidt and Kysor (1987) explored the design characteristics of safety card instructions. Both human factors professionals and airline passengers were used as subjects. Cards were placed into one of five categories: mostly words, words plus pictures, words integrated with pictures, mostly pictures, or words plus photographs. When subjects ranked the cards in order of perceived effectiveness, the highest ranking cards were integrated words with pictures and were generally larger, less wordy, and more
colorful and graphic. The cards that were ranked lower were generally smaller, less colorful, and more wordy. It was also found that, when coupled with a pre-flight briefing, the safety cards tended to increase retention and comprehension of the instructions given on those cards. Therefore, the researchers concluded that the design used for safety cards can impact user preference and performance.

In 1985, the National Transportation Safety Board (NTSB) reviewed methods used to present safety information to passengers, including passenger safety briefing cards. Upon examination of 80 safety cards from 13 airlines, many deficiencies and discrepancies appeared.

The clarity, size, and number of illustrations varied considerably. Some cards used sequentially numbered illustrations for more complex instructions such as donning life preservers, opening ventral exits, and activating oxygen systems, whereas other cards did not number the illustrations; these cards subsequently were judged as being less informative and more difficult to follow. The Safety Board believes that topics contained on all safety cards can properly lend themselves to standardized presentations to ensure that passengers will receive the same detailed information from all safety cards on similar airplanes regardless of which airline the passenger may choose. (p. 43)

In addition to differences in clarity, size, and number of illustrations, there were also variations in understandability, content, and methods of presenting the pictorial and printed information.

In 1992, the Federal Aviation Administration (FAA) conducted an extensive study on airline passenger safety education. Industry safety specialists, passengers, and crewmembers were surveyed for their opinions and habits. When asked what the most serious problem is in passenger cabin safety
today, one answer given by many safety specialists was inferior passenger education. Specialists were also asked to rate the effectiveness of current safety cards. The majority of responses were either “somewhat effective” or “somewhat ineffective”, with explanations including such items as the need for more colors, accuracy, and standardization. The majority of the passengers surveyed stated they did not attend to the safety cards at all, and if the cards were attended to, they were not studied. Flight attendants also stated overwhelmingly that safety cards are generally not heeded by passengers. When asked what would make them pay more attention to the safety cards, the top three responses of passengers were “passengers were rewarded for reviewing them,” “flight attendants explained their importance,” and “they were placed in the open rather than in seat pockets.” With regard to safety cards, the FAA concluded that reform is needed and gave the following recommendations:

Safety cards should be standardized across the industry with requirements including colorful, consecutive-action illustrations that are easy to interpret and can be understood despite the national language of the passenger. These cards should be removed from their current in-pocket site, and permanently affixed to a cabin structure within easy sight of the average adult passenger. The top section of seatbacks (for all seats not containing a telephone) provides an ideal location. Seats with telephones are adjacent to those without telephones. If the telephone-free seats were to bear the safety cards and the illustrations were large, colorful and clear enough, passengers seated beside seatbacks with cards would still find them easily accessible. (p. 135)

Cultural studies on visual information. A pictorial representation, or icon, when carefully designed and applied, is a form of communication that has the ability to bypass language barriers and can, therefore, be absorbed by a wider audience than words (Wildbur, 1989). It is this careful design and application
that has been the brass ring for graphic designers, and the fact that the world is composed of four billion people speaking 2800 different languages adds to the challenge of creating and implementing universal icons (Dreyfuss, 1970). Many signs and symbols exist whose meanings differ by culture, such as wearing black to signify mourning. This is common in Europe and North America, while other cultures may wear white or red (Morgan & Welton, 1986). Studies have been conducted which show that these types of cultural differences could extend into the area of the perception of visual information.

In a study by Hudson (1967), a picture of a group of people was shown to various African cultures. Subjects were asked to interpret what they saw in the picture. Some subjects responded that the people in the picture were fighting. Others stated that the people were dancing. There was agreement among subjects that the forms in the picture represented people. It was the interpretation of the actions of the forms that differed by culture.

Gregory and Wallace (1963) provided an interesting account of the postoperative behavior of an adult who regained his sight after being near-blind almost from birth. Upon the first examination 48 days after the operation, the subject had trouble interpreting pictures and facial expressions. In addition, he would not visually scan the room, and he generally paid no attention to visual objects unless asked to do so. It was implicitly suggested that depth perception and picture interpretation were not present upon sight acquisition. Additional tests on the subject showed little or no susceptibility to various two-dimensional
optical illusions. This lead the researchers to infer that the illusions required some type of learned perceptual habit that was not possessed by the subject.

Segall, Campbell, and Herskovits (1966) examined the relationship between culture and susceptibility to five geometric illusions: the Muller-Lyer illusion, the Sander parallelogram illusion, two forms of horizontal-vertical illusions, and a perspective drawing. The study was based around three hypotheses. The first of these was the theory that people living in a "carpentered world" would tend to see two-dimensional acute and obtuse angles as representations of three-dimensional right angles. These people would then be more susceptible to the Muller-Lyer and Sander parallelogram illusions and, to a lesser extent, the perspective drawing. The second hypothesis was concerned with the foreshortening of receding horizontals. People living in areas such as flat plains with a minimum of vertical objects would tend to interpret vertical extensions as foreshortened lines in a horizontal plane. These people would be more susceptible to the two horizontal-vertical illusions. The third hypothesis was concerned with the symbolizing of three dimensions in two, such as in the perspective drawing. People with frequent exposure to pictures in childhood would tend to correctly interpret perspective drawings more often than people without this exposure. The researchers used these illusions and hypotheses to study 15 cultures. The hypotheses were generally supported, with European and American cultures being significantly more susceptible to the Muller-Lyer and Sander parallelogram illusions and significantly less susceptible to the horizontal-vertical illusions than non-Western cultures. However, no significant
differences were found with the perspective drawing. This led the researchers to conclude that the differences produced stemmed from differences in experience and that, therefore, perception, to a certain extent, is learned.

Although none of these studies should be viewed as being conclusive, they have given promising evidence as to a possible relationship between culture and visual perception.

Original study. A study performed by Jentsch (1992) brought together the two areas described above and examined the influence of culture on the interpretation and understanding of passenger safety briefing cards. Areas investigated were preferences in safety card design and emergency exit color coding as well as ability to interpret various graphics used on current safety cards. Subjects employed were either American, British, French, or German. Significant differences by culture were found for all areas studied. Therefore, it was concluded that even related cultures can influence the understanding of safety information. This study was used as the model for the current study examining American, Japanese, and Korean cultures.

Statement of the Hypothesis

It is hypothesized that there will be a significant difference between American, Japanese, and Korean cultures in their interpretation of icons used in airline passenger safety.
METHOD

Participants

The 116 participants who took part in the study were outbound international passengers departing from San Francisco International Airport (SFO). All were departing on flights to either Japan or Korea. Thirty-seven (31.9%) were from the United States, 41 (35.3%) were from Japan, and 38 (32.8%) were from Korea. All had previous flight experience, and none had either studied or worked in aviation.

Gender. The male to female ratio for all participants was 41 to 75, or 35.3% male and 64.7% female. This ratio is very similar to those found when separating the genders by culture. See Table 1.

Table 1

Gender Distribution by Culture

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>12</td>
<td>15</td>
<td>14</td>
<td>41</td>
</tr>
<tr>
<td>Women</td>
<td>25</td>
<td>26</td>
<td>24</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>41</td>
<td>38</td>
<td>116</td>
</tr>
</tbody>
</table>

Age. The age of the participants ranged from 18 years to 65 years, with a mean age of 36.5 years. Of the people responding to this question, 40
participants were 30 and under (35.1%), while 74 participants were over 30 (64.9%). However, these percentages varied when taken by culture. The majority of both the American and Korean participants were over 30, while the Japanese participants were split fairly evenly. See Table 2. 

Table 2

*Age Distribution by Culture*

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 &amp; under</td>
<td>7</td>
<td>19</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>Over 30</td>
<td>29</td>
<td>21</td>
<td>24</td>
<td>74</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>40</td>
<td>38</td>
<td>114</td>
</tr>
</tbody>
</table>

*Flight Experience.* When asked about their frequency of commercial flight, 94 participants (85.2%) stated they only fly once or twice a year, and 14 participants (13.0%) stated they fly several times a year. Only one participant (0.9%) flew at a frequency of once a month, and three participants (2.7%) stated they flew more often. All four of those participants were male Americans under the age of 30. See Table 3.
Table 3

*Flight Frequency Distribution by Culture*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once or twice a year</td>
<td>25</td>
<td>35</td>
<td>34</td>
<td>94</td>
</tr>
<tr>
<td>Several times a year</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Once a month</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>More often</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>38</td>
<td>38</td>
<td>112</td>
</tr>
</tbody>
</table>

When asked about their latest flight experience, 29 participants (25.2%) had flown within the past month, 57 participants (49.6%) had flown within the past year, and 29 participants (25.2%) had flown more than one year ago. These percentages are similar to those found in the individual cultures. See Table 4.

Table 4

*Latest Flight Distribution by Culture*

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the past month</td>
<td>11</td>
<td>8</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>Within the past year</td>
<td>16</td>
<td>22</td>
<td>19</td>
<td>57</td>
</tr>
<tr>
<td>More than 1 year ago</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>40</td>
<td>38</td>
<td>115</td>
</tr>
</tbody>
</table>

*Read card.* When asked if they read the briefing card on their last flight, 51 participants (44.0%) stated they had read the card, while 65 participants (56.0%) said they had not read the card. These percentages are similar to that
of Korean subjects, while the American percentages were more diverse and the Japanese percentages were almost equal. See Table 5.

Table 5

Card Reading Distribution by Culture

<table>
<thead>
<tr>
<th>Read card</th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not read card</td>
<td>14</td>
<td>21</td>
<td>16</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>20</td>
<td>22</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>41</td>
<td>38</td>
<td>116</td>
</tr>
</tbody>
</table>

Why not. When the passengers who did not read the card were asked why they did not do so, 15 participants (23.4%) stated there was no card available to read, 14 participants (21.9%) stated they were not interested, and 35 participants (54.7%) stated they were already aware of the contents of the card. These percentages varied when taken by culture. The majority of American participants stated they already knew the contents of the briefing card, Japanese participants were split fairly evenly on their reasons for not reading the briefing card, and most Korean participants stated either there was no card available or they already knew the contents. See Table 6.
Table 6

Why Not? Distribution by Culture

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Japan</th>
<th>Korea</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No card available</td>
<td>2</td>
<td>5</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Not interested</td>
<td>3</td>
<td>7</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Already know its contents</td>
<td>18</td>
<td>7</td>
<td>10</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>19</td>
<td>22</td>
<td>64</td>
</tr>
</tbody>
</table>

Instrument

The instrument used for the study was adapted from the questionnaire developed and tested by Jentsch (1992) which was used to study Western European and American cultures. See Appendices A, B, and C. Native speakers translated the instrument into Japanese and Korean and the responses into English. The instrument was administered by the researcher to outbound international passengers waiting in the departure terminal at SFO.

Demographic information was collected at the beginning of the questionnaire. This included gender, age, and experience with aviation. In addition, passengers were asked how often they fly, when their latest flight was taken, whether or not they read the briefing card, and, if no, why not.

The Jentsch (1992) study examined current briefing cards from various airlines and airplanes and simulated on the questionnaire 13 of the icons found on the cards. The icons were chosen because they were either ambiguous or critical to survival during an emergency (Jentsch, 1992). An additional icon was chosen for use as an example. Passengers were asked to describe what they
believed was being represented by each icon. These same icons were used in the current study.

Design

The comparison groups were already different and predetermined on the independent variable of culture, so it was not necessary for the researcher to manipulate either the groups or the variable. This predetermination of the groups as well as the data collection site ruled out in advance an absolute random selection process. Because the causal-comparative design lacked randomization, manipulation, and control, results of the data analysis should be interpreted cautiously (Gay, 1981).

Icon interpretation scores were used as ordinal data since they identify degrees of passenger understanding and order interpretations on a continuum of most to least correct. This resulted in the use of the nonparametric chi-square test for data analysis. The responses were grouped into frequencies by culture and comprehension score (3x3), and the two-way chi-square test was used to compare the observed frequencies with the expected frequencies.

Procedure

Before data collection began, permission to conduct the study was obtained from both the airport (SFO) and the participating airline (United Airlines). The questionnaire was administered at the international terminal of SFO to passengers waiting for departure to Japan and Korea. Each passenger was informed that the researcher was a student conducting a survey on passenger safety. Passengers were then asked to participate in the study.
Those who declined were thanked for their consideration. If a passenger agreed to participate, an instrument and a pen were provided, and the participant was given as much time as needed to complete the questionnaire. The introduction on the survey gave information on the purpose of the study, so it was not necessary to explain this verbally. Upon completion, the surveys were collected by the researcher, and responses were translated into English by native speakers of Japanese and Korean. The researcher then scored the responses and entered the data into a spreadsheet for analysis. The chi-square test was used to analyze the data.
ANALYSIS

Scoring

The response to each icon was scored on a three point scale: -1, 0, or +1. A score of -1 meant there was no response given, or the response given was incorrect and possibly unsafe. The main reason for this score was the absence of a response. A score of 0 meant the response given was not entirely complete but would probably result in a safe action being taken on the part of the passenger. A score of +1 meant the response given was both correct and complete. In the case of the example icon, a response such as "smoking allowed" would have been scored a -1, a response such as "do not smoke" would have been scored a 0, and a response such as "do not smoke cigars or pipes" would have been scored a +1. See Figure 1.

Figure 1. Example Icon - Do Not Smoke Cigars or Pipes.
Examples of each type of response for each of the icons can be found in Table 7 below.

Table 7

**Response Examples for Each Icon and Score**

<table>
<thead>
<tr>
<th>Icon number</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Seats detach</td>
<td>Emergency exit</td>
<td>Emergency exit floor lights</td>
</tr>
<tr>
<td>2</td>
<td>Do not slide down rails</td>
<td>No sliding</td>
<td>Jump to get off</td>
</tr>
<tr>
<td>3</td>
<td>Do not remove your shoes (No response)</td>
<td>No shoes</td>
<td>No high heels</td>
</tr>
<tr>
<td>4</td>
<td>No radios without headphones</td>
<td>Gas mask</td>
<td>Oxygen mask</td>
</tr>
<tr>
<td>5</td>
<td>No shoes</td>
<td>No electronic equipment</td>
<td>Use of electronics forbidden</td>
</tr>
<tr>
<td>6</td>
<td>Please do not remove shoes (No response)</td>
<td>No shoes</td>
<td>No high heels</td>
</tr>
<tr>
<td>7</td>
<td>Crawl if smoke present</td>
<td></td>
<td>Crawl along lighted aisle to exit if smoke</td>
</tr>
<tr>
<td>8</td>
<td>Sit to slide down</td>
<td>Do not sit in exit opening</td>
<td>Jump to get down</td>
</tr>
<tr>
<td>9</td>
<td>Plane floating on water</td>
<td>Landed on sea</td>
<td>In case of water landing ...</td>
</tr>
<tr>
<td>10</td>
<td>OK to wear heels</td>
<td>Remove your shoes</td>
<td>Remove high heels</td>
</tr>
<tr>
<td>11</td>
<td>Caution where you walk</td>
<td>Emergency exit</td>
<td>Follow lights to emergency exit</td>
</tr>
<tr>
<td>12</td>
<td>(No response)</td>
<td>No radio</td>
<td>Do not use radio</td>
</tr>
<tr>
<td>13</td>
<td>No smoking</td>
<td>No lighters</td>
<td>No butane lighters</td>
</tr>
</tbody>
</table>
Results

Upon analysis of the icon score data, it was found that responses for five of the 13 icons (3, 5, 7, 10, 11) differed significantly by culture. See Figure 2.

Figure 2. Chi-square Results for Each Icon.

Icon 1. This icon depicted an overwing emergency exit located between seat rows as indicated by a lighted floor path. See Figure 3.

Figure 3. Icon 1 - Follow Floor Lights to Exit.
The analysis for icon 1 yielded $\chi^2(4) = 7.998$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 4.

**Figure 4. Score Distribution by Culture for Icon 1.**

**Icon 2.** In this icon, passengers were instructed to jump onto the exit slide as opposed to sitting at the top when exiting. See Figure 5.

**Figure 5. Icon 2 - Jump - Do Not Sit.**
The analysis for icon 2 yielded $\chi^2(4) = 8.207$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 6.

![Bar graph](image)

*Figure 6. Score Distribution by Culture for Icon 2.*

*Icon 3.* Removal of high-heeled shoes was shown in this icon. See Figure 7.

![Icon 3](image)

*Figure 7. Icon 3 - Remove High-heeled Shoes.*
The analysis for icon 3 yielded $\chi^2(4) = 24.077$, $p \leq 0.001$. Post hoc tests showed significant differences between American and Japanese cultures ($\chi^2(2) = 13.219$, $p \leq 0.005$) and between American and Korean cultures ($\chi^2(2) = 23.240$, $p \leq 0.001$). See Figure 8.

![Figure 8. Score Distribution by Culture for Icon 3.](image)

**Icon 4.** The location and operation of the emergency oxygen mask were indicated in this icon. See Figure 9.

![Figure 9. Icon 4 - Oxygen Mask.](image)
The analysis for icon 4 yielded $\chi^2(4) = 5.539$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 10.

![Figure 10. Score Distribution by Culture for Icon 4.](image)

**Icon 5.** This icon was meant to communicate the prohibition of the operation of certain electronic equipment while onboard the aircraft. See Figure 11.

![Figure 11. Icon 5 - Do Not Use Certain Electronic Equipment.](image)
The analysis for icon 5 yielded $\chi^2(4) = 10.106, p \leq 0.05$. Post hoc tests showed a significant difference between American and Korean cultures ($\chi^2(2) = 8.540, p \leq 0.025$). See Figure 12.

![Figure 12. Score Distribution by Culture for Icon 5.](image)

**Figure 12.** Score Distribution by Culture for Icon 5.

**Icon 6.** This icon held the same meaning as icon 3. See Figure 13.

![Figure 13. Icon 6 - Remove High-heeled Shoes.](image)

**Figure 13.** Icon 6 - Remove High-heeled Shoes.
The analysis for icon 6 yielded $\chi^2(4) = 8.749$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 14.

![Figure 14](image14.png)

*Figure 14. Score Distribution by Culture for Icon 6.*

*Icon 7.* In case of smoke and fire, this icon instructed passengers to follow the emergency exit floor markings while crawling along the aisle. See Figure 15.

![Figure 15](image15.png)

*Figure 15. Icon 7 - Crawl Under Smoke and Follow Floor Markings.*
The analysis for icon 7 yielded $\chi^2(4) = 17.312$, $p \leq 0.005$. Post hoc tests showed significant differences between American and Japanese cultures ($\chi^2(2) = 14.581$, $p \leq 0.001$) and between American and Korean cultures ($\chi^2(2) = 9.642$, $p \leq 0.01$). See Figure 16.

*Figure 16. Score Distribution by Culture for Icon 7.*

*Icon 8.* This icon held the same meaning as icon 2. See Figure 17.

*Figure 17. Icon 8 - Jump - Do Not Sit.*
The analysis for icon 8 yielded $\chi^2(4) = 2.190$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 18.

![Score Distribution by Culture for Icon 8](image)

*Figure 18. Score Distribution by Culture for Icon 8.*

*Icon 9.* This icon was used to indicate that the instructions following the icon were to be implemented in the case of an emergency water landing. See Figure 19.

![Icon 9 - In Case of Water Landing](image)

*Figure 19. Icon 9 - In Case of Water Landing.*
The analysis for icon 9 yielded $\chi^2(4) = 6.143, p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 20.

![Image of Figure 20](image)

*Figure 20. Score Distribution by Culture for Icon 9.*

_ICON 10._ This icon held the same meaning as icons 3 and 6. See Figure 21.

![Image of Figure 21](image)

*Figure 21. Icon 10 - Remove High-heeled Shoes.*

The analysis for icon 10 yielded $\chi^2(4) = 13.584, p < 0.01$. Post hoc tests showed significant differences between American and Japanese cultures ($\chi^2(2) = 6.642$, $p < 0.01$).
p \leq 0.05) and between American and Korean cultures (\chi^2(2) = 11.074, p \leq 0.005). See Figure 22.

Figure 22. Score Distribution by Culture for Icon 10.

Icon 11. Emergency exit floor lighting was depicted in this icon. See Figure 23.

Figure 23. Icon 11 - Colored Lights Indicate Emergency Exit.
The analysis for icon 11 yielded $\chi^2(4) = 26.391$, $p < 0.001$. Post hoc tests showed significant differences between American and Japanese cultures ($\chi^2(2) = 20.860$, $p \leq 0.001$) and between American and Korean cultures ($\chi^2(2) = 18.458$, $p \leq 0.001$). See Figure 24.

![Figure 24. Score Distribution by Culture for Icon 11.]

**Figure 24.** Score Distribution by Culture for Icon 11.

**Icon 12.** This icon held the same meaning as icon 5. See Figure 25.

![Icon 12 - Do Not Use Certain Electronic Equipment.]

**Figure 25.** Icon 12 - Do Not Use Certain Electronic Equipment.
The analysis for icon 12 yielded $\chi^2(4) = 9.139$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 26.

*Figure 26. Score Distribution by Culture for Icon 12.*

*Icon 13.* Prohibition of the use of butane or gas lighters was the intention of this icon. See Figure 27.

*Figure 27. Icon 13 - Do Not Use Butane/Gas Lighters.*
The analysis for icon 13 yielded $\chi^2(4) = 2.704$, $p > 0.05$. Therefore, culture did not influence the interpretation of the icon. See Figure 28.

![Figure 28. Score Distribution by Culture for Icon 13](image)

**Other Factors**

It is possible that other factors besides culture played a role in the way passengers interpreted the safety icons. Though culture was the primary factor under consideration in this study, it was also considered prudent to briefly examine the possibility of gender as a contributing factor. Each icon was analyzed using the chi-square test using the frequencies of comprehension score and gender (3x2). Four of the 13 icons were found to have significant differences by gender.

*Icon 5.* The analysis for icon 5, Do Not Use Certain Electronic Equipment, yielded $\chi^2(2) = 6.960$, $p \leq 0.05$. See Figure 29.
Icon 9. The analysis for icon 9, In Case of Water Landing, yielded $\chi^2(2) = 7.786$, $p \leq 0.025$. See Figure 30.

Icon 10. The analysis for icon 10, Remove High-heeled Shoes, yielded $\chi^2(2) = 8.815$, $p \leq 0.025$. See Figure 31.
Figure 31. Score Distribution by Gender for Icon 10.

**Icon 12.** The analysis for icon 12, Do Not Use Certain Electronic Equipment, yielded $\chi^2(2) = 11.668$, $p < 0.005$. See Figure 32.

Figure 32. Score Distribution by Gender for Icon 12.

**Mean scores**

In an effort to assess the comprehension of each icon by the subjects, the mean scores were computed to obtain an overall level of understanding. It was assumed that averaging the scores would give meaningful results with respect to overall comprehension by all passengers and would therefore be an
appropriate statistic to employ. See Figure 33. Effectiveness was also examined for icons with similar meaning. See Figures 34, 35, 36, and 37.

Figure 33. Mean Scores for Each Icon.

Exit lighting. To examine the relative effectiveness of the three icons depicting emergency exit lighting (1, 7, and 11), the mean scores by culture were computed for each. Overall, the simple depiction used in icon 11 was the most effective in communicating the correct message, primarily due to the high US average. Icon 7 proved to be the least effective in all three groups and overall. See Figure 34.
Exit slides. The proper use of exit slides was shown in icons 2 and 8. Icon 2 was more effective than icon 8 overall and for the American and Korean groups. The Japanese group had the same mean score for both icons. See Figure 35.
High Heels. Instructions to remove high-heeled shoes was depicted in icons 3, 6, and 10. Overall and in each group, icon 3 was the most effective. Icon 10 was not only the least effective overall and in each group, it also had a negative mean score in all four categories. See Figure 36.

![Figure 36. Mean Score Distribution by Culture for Icons 3, 6, and 10.](image)

Electronic equipment. Icons 5 and 12 depicted the prohibition of the operation of electronic equipment. The mean scores for each icon were similar within each group. Icon 5 was slightly more effective in the American group, while icon 12 was slightly more effective in both Asian groups and overall. See Figure 37.
Study Comparison

The US data from this study were compared to the US data available from the original study (Jentsch, 1992). The score trends for each icon were identical between studies, as were the mean score trends for each icon group. In addition, many of the results of the two studies were similar. See Table 8.
Table 8

Comparison of US Data from Present Study and Jentsch (1992) Study

<table>
<thead>
<tr>
<th>Available Data</th>
<th>Present Study Results</th>
<th>Jentsch Study Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>US subjects scoring -1 on Icon1</td>
<td>8.1%</td>
<td>8.1%</td>
</tr>
<tr>
<td>US subjects scoring 0 on Icon 1</td>
<td>54.1%</td>
<td>64.9%</td>
</tr>
<tr>
<td>US subjects scoring +1 on Icon 1</td>
<td>37.8%</td>
<td>27.0%</td>
</tr>
<tr>
<td>US subjects scoring -1 on Icon 2</td>
<td>10.8%</td>
<td>8.1%</td>
</tr>
<tr>
<td>US subjects scoring 0 on Icon 2</td>
<td>43.2%</td>
<td>10.8%</td>
</tr>
<tr>
<td>US subjects scoring +1 on Icon 2</td>
<td>45.9%</td>
<td>81.1%</td>
</tr>
<tr>
<td>US subjects scoring -1 on Icon 5</td>
<td>2.7%</td>
<td>2.7%</td>
</tr>
<tr>
<td>US subjects scoring 0 on Icon 5</td>
<td>67.6%</td>
<td>75.7%</td>
</tr>
<tr>
<td>US subjects scoring +1 on Icon 5</td>
<td>29.7%</td>
<td>21.6%</td>
</tr>
<tr>
<td>US subjects scoring -1 on Icon 7</td>
<td>5.4%</td>
<td>8.1%</td>
</tr>
<tr>
<td>US subjects scoring 0 on Icon 7</td>
<td>86.5%</td>
<td>70.3%</td>
</tr>
<tr>
<td>US subjects scoring +1 on Icon 7</td>
<td>8.1%</td>
<td>21.6%</td>
</tr>
<tr>
<td>US subjects scoring -1 on Icon 12</td>
<td>2.7%</td>
<td>0.0%</td>
</tr>
<tr>
<td>US subjects scoring 0 on Icon 12</td>
<td>73.0%</td>
<td>94.6%</td>
</tr>
<tr>
<td>US subjects scoring +1 on Icon 12</td>
<td>24.3%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Mean US score for Icon 1</td>
<td>0.30</td>
<td>0.19</td>
</tr>
<tr>
<td>Mean US score for Icon 7</td>
<td>0.03</td>
<td>0.14</td>
</tr>
<tr>
<td>Mean US score for Icon 11</td>
<td>0.68</td>
<td>0.62</td>
</tr>
<tr>
<td>Mean US score for Icon 2</td>
<td>0.35</td>
<td>0.73</td>
</tr>
<tr>
<td>Mean US score for Icon 8</td>
<td>0.03</td>
<td>0.68</td>
</tr>
<tr>
<td>Mean US score for Icon 3</td>
<td>0.60</td>
<td>0.87</td>
</tr>
<tr>
<td>Mean US score for Icon 6</td>
<td>0.22</td>
<td>0.70</td>
</tr>
<tr>
<td>Mean US score for Icon 10</td>
<td>-0.05</td>
<td>-0.05</td>
</tr>
<tr>
<td>Mean US score for Icon 5</td>
<td>0.27</td>
<td>0.19</td>
</tr>
<tr>
<td>Mean US score for Icon 12</td>
<td>0.22</td>
<td>0.05</td>
</tr>
</tbody>
</table>
CONCLUSIONS

This study was conducted to examine the relationship between culture and the ability to interpret 13 icons similar to those used on passenger safety briefing cards. Participants consisted of 116 passengers departing SFO for either Japan or Korea and were American, Japanese, or Korean. It was hypothesized that culture would have a significant influence on the interpretations given.

*Significant Differences by Culture*

Culture was found to have significantly affected the interpretation of five of the 13 airline safety icons (3, 5, 7, 10, and 11) used in the study. Therefore, the research hypothesis was accepted for those five icons. In all five of those cases, the significant differences were found to be between the American group and either one or both of the Asian groups. However, as stated earlier, results of the study should be approached with caution. Culture may not have been the only factor to affect the interpretation scores.

*Icon 3.* Removal of high-heeled shoes was shown in this icon. See Figure 38.
Although more than half of the participants interpreted this icon correctly and completely (50.9%), significant differences were still found. The differences for icon 3 were between the American and Japanese participants, as well as the American and Korean participants. American participants specified the removal of high-heeled shoes more often, resulting in more complete and correct responses (+1), while Japanese and Korean participants interpreted the icon as a removal of any type of shoe, resulting in the relative increase in incomplete answers (0) for these two groups.

Icon 5. This icon was meant to communicate the prohibition of the operation of certain electronic equipment while onboard the aircraft. See Figure 39.
Figure 39. Icon 5 - Do Not Use Certain Electronic Equipment.

The majority of participants (57.8%) gave responses for this icon that scored 0, stating that the electronic equipment itself was not allowed instead of the use of such equipment, which was the correct response. American and Korean participants differed significantly in their interpretations of icon 5. Korean participants had more incorrect answers (-1), all resulting from a lack of response.

Icon 7. In case of smoke and fire, this icon instructed passengers to follow the emergency exit floor markings while crawling along the aisle. See Figure 40.

Figure 40. Icon 7 - Crawl Under Smoke and Follow Floor Markings.
There were very few correct and complete responses given for this icon. Most responses (72.4%) stated the need to crawl when smoke is present, resulting in a score of 0. The differences for icon 7 were between the American and Japanese participants, as well as the American and Korean participants. Japanese and Korean participants had more incorrect answers (-1), all resulting from a lack of response, as in icon 5.

*Icon 10.* This icon held the same meaning as icons 3 and 6. See Figure 41.

![Icon 10](image)

*Figure 41.* Icon 10 - Remove High-heeled Shoes.

Most participants gave a response to this icon that was either incomplete and scored 0 (41.4%) or incorrect and scored -1 (40.5%). The differences for icon 10 were between the American and Japanese participants, as well as the American and Korean participants. As in icon 3, American participants specified the removal of high-heeled shoes more often, resulting in more complete and correct responses (+1), while Japanese and Korean participants interpreted the icon as
a removal of any type of shoe, resulting in the relative increase in incomplete answers (0) for these two groups.

*Icon 11.* Emergency exit floor lighting was depicted in this icon. See Figure 42.

![Figure 42. Icon 11 - Colored Lights Indicate Emergency Exit.](image)

While there were more correct and complete responses given for this icon (44.0%), there were also a fair number of incomplete (31.9%) and incorrect (24.1%) responses. The differences for icon 11 were between the American and Japanese participants, as well as the American and Korean participants. American participants had more correct responses (+1) specifying the floor lighting, while Japanese and Korean participants had more incorrect responses (-1), mostly due to a lack of response, or incomplete answers (0), specifying only the emergency exit and not the floor lighting.
Significant Differences by Gender

Although culture was the primary focus of this study, the effect of gender on icon interpretation was briefly examined. Four of the 13 safety icons (5, 9, 10, and 12) were found to have significant differences by gender. Two of those icons (5 and 10) were the same icons that showed significant differences by culture. For both of those icons, the differences were greater for culture than for gender.

Icon 5. This icon depicted the prohibition on the operation of certain electronic equipment. Women had a higher percentage of both incorrect answers (-1), mostly due to a lack of a response, and correct answers (+1). Men had a higher percentage of incomplete answers (0), stating that the electronic equipment itself was not allowed instead of the use of such equipment.

Icon 9. This icon was used to indicate that the instructions following the icon were to be implemented in the case of an emergency water landing. Men had a higher percentage of incorrect responses (-1), many stating that the airplane would float, while women had a higher percentage of incomplete responses (0).

Icon 10. This icon instructed women to remove their high-heeled shoes. Women had a higher percentage of incorrect responses (-1), most resulting from a lack of a response. Men had a higher percentage of both incomplete (0) and complete responses (+1).

Icon 12. This icon held the same meaning as icon 5, and as in icon 5, women had a higher percentage of both incorrect (-1) and correct (+1) answers, while men had the higher percentage of incomplete responses (0).
Original Study

Upon comparing the US group from the Jentsch (1992) study with the US group from the present study, some striking parallels were discovered. Identical trends were found for both US groups in all score and mean score distributions for which data were available. In addition, many of these numbers were very similar. This led the researcher to conclude that the present study was comparable to the original. See Table 8. The original study also found culture to have a significant influence on the interpretation of airline safety icons. Five of the 13 icons showed significant differences. Of these five icons, three (icons 5, 7, and 11) were the same icons that showed significant differences in the present study. This leads the researcher to conclude that, although causal-comparative results are tenuous, it is likely that culture was the primary cause of the significant differences in icon interpretation, especially in the case of the three icons that showed significant differences in both studies.
RECOMMENDATIONS

Further study

Since culture was found to have a significant influence on the interpretation of some airline safety icons by groups from the US, Asia, and Western Europe, the following recommendations for further study in the area are given:

1. It is recommended that further studies be conducted with people from other cultures, such as Africa or South America. This may provide additional evidence that culture does in fact play an important role in safety icon interpretation.

2. It may be prudent to update the icons used for the study since airlines change their briefing cards from time to time. Alternatively, a single briefing card could be used for the study as opposed to icons from various cards.

3. Responses could be scored by many people to aid in the elimination of any biases that may arise if the scoring is done by only one person. The scoring could also be done by people of different cultures to eliminate biases even further.

4. A more experimental type of design could be used to study how the icons that show significant differences actually affect behavior. The
5. present study examined the concept of cultural differences in interpretation, but this does not necessarily show how well subjects would be able to perform the actions presented in the icons.

6. Another study could examine one particular safety instruction, such as use of the evacuation slide, to find the best standard icon for use in a wide range of cultures. This would necessitate compiling many different versions of the icon used for the particular safety instruction.

7. Studies could be conducted to develop a set of principles to use when designing safety icons. These principles, when followed correctly, would result in an icon easily understood by people from many cultures.

8. Yet another study could have subjects from different cultures draw their own icons for a given safety instruction. Upon consolidating the drawings into a single picture, that icon could then be tested on other subjects to validate its ability to be understood by various cultures.

9. If further study is to be conducted in the airport environment, it is recommended that the instrument used be as short and concise as possible. This could increase the likelihood that passengers will participate in the study and could also allow for more responses to be gathered.

Safety Icon and Briefing Card Design

In addition to further study, the following recommendations are given concerning the design of safety icons and briefing cards:
1. The results of the present study have lead the researcher to believe that some type of international standard should be established for the design of passenger safety briefing cards and the icons used on those cards. This standard should be based upon extensive study of the subject, possibly conducted by the International Civil Aviation Organization (ICAO) or some joint effort comprising aviation representatives from many nations. Standardization of icons and instructions will help to ensure that all passengers are fully aware of what to do in the event of an emergency, no matter what their background.

2. Once developed, the standard should be used by all airlines, whether international, national, regional, or commuter. This will help eliminate any confusion passengers may experience when transitioning from one type of airline to another, which can be fairly common in this age of the hub and spoke system.

3. Guidelines for briefing card design should include standards for card size, colors to be used, uses for each color, format of the icons and wording, languages incorporated, etc.

4. The cards should employ only those icons that were found to be easily recognized by the greatest number of subjects and cultures, as assessed by studies like those recommended above.
REFERENCES


Appendix A

English Survey
Aviation Safety Survey

Thank you for participating in this aviation safety test. The data collected from this study will aid in the improvement of passenger safety briefing cards. These cards are intended to provide passengers with emergency information and can usually be found in the seat pocket in front of each passenger.

This survey should take approximately 10 minutes, and your answers will be held in confidence. Please do not write your name on the survey.

What is your gender? Male _____ Female _____

What is your age? __________

What is your native language? ___________________________________________

What is your home country? ___________________________________________

Do you study or work in aviation? Yes _____ No _____

How often do you fly commercially? Once or twice a year _____
Several times a year _____
Once a month _____
More often _____

When was your latest commercial flight? Within the past month _____
Within the past year _____
More than 1 year ago _____

On that flight, did you read the safety briefing card? Yes _____ No _____

If no, why not? No card available _____
Not interested _____
Already know its contents _____

Below you will find 13 graphics similar to those used on current passenger safety briefing cards. For each symbol, please specifically describe what you believe is being represented.

Example:

Do not smoke cigars or pipes
Appendix B

Japanese Survey
航空安全調査
この度は航空安全のアンケートにご協力頂き、ありがとうございます。このアンケートの結果は民間航空機に常備されている安全のしおりの改良に利用させて頂きます。
このアンケートはお答え頂くのに約10分程かかります。あなたのアンケートの内容は秘密にさせて頂くので名前は書かないで下さい。

性別？
男______ 女______

年齢
______

自国語？
________________

国籍？
________________

航空関係の仕事／勉強をしておりますか？ はい____ いえ____

どのぐらい頻繁に民間航空機をご利用されますか？ 1年間に1、2度____
1年間に数回____
1ヶ月に1度____
それ以上____

前回民間航空機をご利用されたのはいつですか？ 過去1ヶ月以内____
過去1年以内____
1年以上前____

その時のフライトで安全のしおりをご覧になられましたか？ はい____
いえ____

いえの場合は、どうしてですか？ 安全のしおりがなかった_____
興味がなかった_____
内容をすぐに知っていた_____

下に安全のしおりに使われている13の様々なシンボルがありますがその1つ1つが何を意味しているように見えますか。

例：
禁
禁
禁
Appendix C

Korean Survey
항공 안전 설문조사

항공 안전 설문에 응해주시서 감사합니다. 본 설문의 결과는 승객 항공 안전 카드를 개선하는데 쓰이게될 것입니다. 승객 항공 안전 카드는 긴급시 승객들이 취해야 할 사항들이 설명되었는 척자로 앞좌석의 뒷주머니에 붙혀있습니다.

본 설문은 10분정도가 소요되며 결과는 신중히 다루어질 것입니다. 설문에는 이름을 쓰지 않으시길 바랍니다.

****************************************************************************

성별: 
남 _____  여 _____

나이: 

모국어: 

국적(모국): 

항공에 관한 직업, 또는 공부를 하고 계실니까? 예 _____ 아니오 _____

상업 항공 횟수:  일년에 한두번 _____
일년에 열번정도 _____
한달에 한번 _____
1 이상 _____

마지막 상업 항공 시기: 한달 내 _____
일년 내 _____
1 이상 _____

마지막 상업 항공시 항공 안전 카드를 읽으셨습니까? 예 _____ 아니오 _____

아니라면, 왜 읽지 않았습니까? 카드가 없어서 _____
관심이 가지 않아서 _____
이미 이는 내용이므로 _____

밑에 나열된 13가지의 표지들은 현재 항공 안전 카드에서 사용되는 표지들입니다. 각 표지앞에 표지의 뜻을 쓰주시기 바랍니다.

보기: 

이상


