Comprehension of Symbolic Exit Signs I: Effects of Context

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Symbolic Exit Sign Exemplars

Collins & Lerner ©, 1983
• 14CFR 25.811 – Emergency Exit Marking
  (d) (1) A sign located above the aisle
  (2) Next to each exit
  (3) On each obstructing bulkhead or divider

• 14CFR 25.812 – Emergency Lighting
  (a) (1) Illuminated emergency exit marking and locating signs
  (b)(1) (i) Red letters 1.5” high on white background, 21 sq in., stroke width between 6 and 7:1 contrast ratio 10:1, 25 ft. Lamberts, internally illuminated w/high to low background contrast < 3:1.
Symbolic Exit Sign

14CFR 21.21- Issue of Type Certificate

(b)(1) the type design and product [must] meet the applicable airworthiness requirements of the Federal Aviation Regulations or... any provisions not complied with [must be] compensated for by factors that provide an equivalent level of safety.
# Test Booklet Contents

(6 Booklet Formats)

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ANSI Z535 Symbols</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Briefing Card Pictorials</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>25.811 – Required Exit Sign</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Symbolic Exit Sign Exemplars</td>
<td>3</td>
</tr>
</tbody>
</table>
ANSI Z535 Symbols
ANSI Z535 Symbols
• Who do you think these people are?

• What are they doing?
## Response Categories & Weights

<table>
<thead>
<tr>
<th>Category</th>
<th>Response Type</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No response</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Don’t Know</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Opposite to the intended meaning</td>
<td>-1.00</td>
</tr>
<tr>
<td>3</td>
<td>Wrong</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>Related but understanding is doubtful / suspect</td>
<td>0.25</td>
</tr>
<tr>
<td>5</td>
<td>Related but understanding is arguable</td>
<td>0.50</td>
</tr>
<tr>
<td>6</td>
<td>Understanding is likely</td>
<td>0.75</td>
</tr>
<tr>
<td>7</td>
<td>Understanding is certain</td>
<td>1.00</td>
</tr>
</tbody>
</table>
## Comprehension Score Algorithm
(Modified ISO 9186 Convention)

<table>
<thead>
<tr>
<th>Category</th>
<th>Frequency</th>
<th>Usable %</th>
<th>Weight</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>11</td>
<td>3.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>1.7%</td>
<td>*-1.0</td>
<td>-1.7%</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>13.2%</td>
<td>0.0</td>
<td>0.0%</td>
</tr>
<tr>
<td>4</td>
<td>47</td>
<td>13.2%</td>
<td>*.25</td>
<td>3.3%</td>
</tr>
<tr>
<td>5</td>
<td>97</td>
<td>27.2%</td>
<td>*.50</td>
<td>13.6%</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>3.9%</td>
<td>*.75</td>
<td>2.9%</td>
</tr>
<tr>
<td>7</td>
<td>134</td>
<td>37.6%</td>
<td>*1.0</td>
<td>37.6%</td>
</tr>
</tbody>
</table>

**Total Comprehension Score** 55.8%

Usable N= 356
Non-Contextual Symbols
• Describe exactly what you think this symbol means.

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
Comprehension Score = 96.9%

N=537
• Describe exactly what you think this symbol means.

________________________________________

________________________________________

________________________________________

________________________________________
Comprehension Score = 43.3%

Response Category

N=351
• Describe exactly what you think this symbol means.
Comprehension Score = 50.4%
• Describe exactly what you think this symbol means.
Comprehension Score = 55.8%

N=364
Comparison of Comprehension Scores

- Exit Ahead: 30%
- Exit Here: 50%
- Exit Here: 70%
- Exit Here: 90%

Symbols:
- Green and white sign with a person running up
- Green and white sign with a person running
- Black and white sign with a person running
- Red sign with the word "EXIT"
Contextual Symbols
• Describe exactly what you think this symbol means.

______________________________
______________________________
______________________________
______________________________
______________________________
______________________________
Exit Straight Ahead

Comprehension Score = 63.7%
### Exit Straight Ahead

<table>
<thead>
<tr>
<th>Statement</th>
<th>Certainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>emergency exit that way (straight ahead)</td>
<td>(7) Certain</td>
</tr>
<tr>
<td>this is an emergency escape</td>
<td>(6) Likely</td>
</tr>
<tr>
<td>shows where the closest exit is to where you are sitting</td>
<td>(5) Arguable</td>
</tr>
<tr>
<td>proceed in this direction</td>
<td>(4) Suspect</td>
</tr>
<tr>
<td>The floor between the compartments is not level and requires a step up.</td>
<td>(3) Wrong</td>
</tr>
</tbody>
</table>
• Describe exactly what you think this symbol means.

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
Exit Both Sides

Comprehension Score = 71.8%
## Exit Both Sides

<table>
<thead>
<tr>
<th>Emergency exits either side</th>
<th>(7) Certain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which directions you can go</td>
<td>(6) Likely</td>
</tr>
<tr>
<td>You can walk either way</td>
<td>(4) Suspect</td>
</tr>
<tr>
<td>Caution when approaching...</td>
<td>(3) Wrong</td>
</tr>
<tr>
<td>...people may be moving</td>
<td></td>
</tr>
<tr>
<td>...back and forth and</td>
<td></td>
</tr>
<tr>
<td>...crossing in that area.</td>
<td></td>
</tr>
</tbody>
</table>
• Describe exactly what you think this symbol means.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Comprehension Score = 74.9%
### Exit Here

<table>
<thead>
<tr>
<th>Action</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>that’s the get out door</td>
<td>(7) Certain</td>
</tr>
<tr>
<td>exit possibility</td>
<td>(6) Likely</td>
</tr>
<tr>
<td>exit is clear and free from debris. Safe to use exit since the green is indicated</td>
<td>(5) Arguable</td>
</tr>
<tr>
<td>go one at a time through door</td>
<td>(4) Suspect</td>
</tr>
<tr>
<td>no running in this area</td>
<td>(3) Wrong</td>
</tr>
<tr>
<td>do not leave the plane</td>
<td>(2) Opposite</td>
</tr>
</tbody>
</table>
Comparison of Comprehension Scores
Context-Based Conclusions

- Traditional Part 25.811 / .812 EXIT Sign Universally Understood
- Symbolic Signs Without Context Had Mean Comprehension of About 50%
- Addition of Contextual Cues Improved Mean Comprehension to About 70%
- Symbolic Signs Were Shown NOT to be Equivalent to Traditional EXIT Sign
- Additional Compensating Factors Would be Required to Establish an Equivalent Level of Safety
BREAK
Comprehension of Symbolic Exit Signs II: Effects of Passenger Attributes

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## Correlation Matrix for Subject Demographics

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Gender</th>
<th>Age</th>
<th>Education</th>
<th>Flights</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>r</em></td>
<td>.055</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>p</em></td>
<td>.122</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>N</em></td>
<td>785</td>
<td>785</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>r</em></td>
<td>.078*</td>
<td>.734**</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>p</em></td>
<td>.029</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>N</em></td>
<td>785</td>
<td>785</td>
<td>785</td>
<td></td>
</tr>
<tr>
<td><strong>Number of flights</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>r</em></td>
<td>.029</td>
<td>.183**</td>
<td>.189**</td>
<td></td>
</tr>
<tr>
<td><em>p</em></td>
<td>.420</td>
<td>.000</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td><em>N</em></td>
<td>781</td>
<td>781</td>
<td>781</td>
<td>781</td>
</tr>
<tr>
<td><strong>Expertise Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>r</em></td>
<td>.061</td>
<td>.784**</td>
<td>.750**</td>
<td>.335**</td>
</tr>
<tr>
<td><em>p</em></td>
<td>.090</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td><em>N</em></td>
<td>785</td>
<td>785</td>
<td>785</td>
<td>781</td>
</tr>
</tbody>
</table>

(Pearson $r$; 2-tailed)
ANSI Z535 Symbols

Mean Comprehension = 94.4%
ANSI Z535 Symbols

Mean Comprehension = 51.2%
Non-Contextual Demographic Effects
Comparison of Comprehension Scores

- Exit Ahead
- Exit Here
- Exit Here
- Exit Here
## Response Categories & Weights

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<tr>
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<tr>
<td>2</td>
<td>Opposite to the intended meaning</td>
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<tr>
<td>3</td>
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<td>0.00</td>
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<tr>
<td>5</td>
<td>Related but understanding is arguable</td>
<td>0.50</td>
</tr>
<tr>
<td>6</td>
<td>Understanding is likely</td>
<td>0.75</td>
</tr>
<tr>
<td>7</td>
<td>Understanding is certain</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Expertise Effects
(p=.213)

**EXIT**

**All Responses**

- N=537
- Frequency distribution

**Experts**

- N=83
- Frequency distribution

**Non-Experts**

- N=113
- Frequency distribution

**Students**

- N=341
- Frequency distribution
All Responses

Experts*

Non-Experts

Students**

Expertise Effects

(p<.001)
Expertise Effects
(p<.002)

All Responses

Experts*

N=359

Non-Experts**

N=56

Students**

N=75

N=228

Response Category

Frequency

Response Category

Frequency

Response Category

Frequency

Response Category

Frequency
Expertise Effects

(p<.02)

All Responses

Experts*

N=364

Response Category

0 1 2 3 4 5 6 7

Frequency

8 11 10 50 49 115

Response Category

0 1 2 3 4 5 6 7

Frequency

1 0 0 5 3 22 6

Response Category

0 1 2 3 4 5 6 7

Frequency

20 15 10 5 0

Response Category

0 1 2 3 4 5 6 7

Frequency

15 10 7 6 5 4 2

Response Category

0 1 2 3 4 5 6 7

Frequency

20 15 10 7 6 5 4 2

Response Category

0 1 2 3 4 5 6 7

Frequency

N=57

N=83

N=224

Expertise Effects
Contextual Demographic Effects
Primary Language Spoken at Home

![Bar chart showing the percentage of people speaking different languages at home. English is the primary language spoken by a majority, followed by Spanish, Vietnamese, and other languages.](chart.png)
Subjects’ Gender Split

- **Male**: Frequency
- **Female**: Frequency
Subjects’ Age Distribution

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-30 yrs</td>
<td>150</td>
</tr>
<tr>
<td>31-50 yrs</td>
<td>50</td>
</tr>
<tr>
<td>51+ yrs</td>
<td>10</td>
</tr>
</tbody>
</table>
Subjects’ Education Level

- **Education Level Frequency**
  - Education Level: 12
  - Frequency: 200
  - Education Level: 13
  - Frequency: 50
  - Education Level: 14
  - Frequency: 50
  - Education Level: 15
  - Frequency: 50
  - Education Level: 16
  - Frequency: 50
Subjects’ Flight History

Number of Flights in Last 24 Months

Frequency

0-2
3-6
7-12
13+

Number of Flights in Last 24 Months
Expertise Effects

(p = .01)
Expertise Effects

\( p < .04 \)
Expertise Effects

(p < .001)
Demographics-Based Conclusions

- Inter-Correlations Existed Among All Demographic Variables

- Symbolic Exit Sign Comprehension Scores Were Positively Associated with All Demographic Variables, Particularly with Cabin Safety Expertise

- Increasing Age, Education, and (Especially) Flight History Produced Apparent Increases in “Cabin Safety Expertise”

- Trained Cabin Safety Experts Generally Showed Greater Comprehension of Symbolic Signs
Demographics-Based Conclusions

- The Results Indicate That the Cabin Safety Expertise Effects are Based on “Familiarity” with the Cabin Interior Environment

- The Results Also Suggest That Improvements in Comprehension Related to Context Are Explained by That Increased Familiarity

- Selection of Compensating Factors to Establish an Equivalent Level of Safety to the Traditional EXIT Sign Should be Based on the Degree to Which Such Factors Can Improve the Familiarity of Symbolic Exit Signs

- Such Factors Would Include Special Briefings, Training, and Repeated Exposure, Especially in Multiple Contexts
SeaTac Transit Station