8th Triennial International Aircraft Fire and Cabin Safety Research Conference

Educating Passengers about Life Preserver Donning

Effectiveness of Actively Exploring the Procedure on a Small Touchscreen

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Acknowledgements

- This research was partially supported by a grant of the Federal Aviation Administration (FAA)
- The study was carried out in collaboration with Cynthia Corbett, Mac McLean, and Nicola Zangrando





Contents

Motivations:

- Lack of passengers' knowledge about life preserver donning
- Scarce effectiveness of current instructional media
- Proposed instructional media: the Life Vest app

Study:

- Evaluating the effectiveness of the app
- Contrasting the app with the traditional safety briefing card
- Conclusions and future work



Life Preserver Donning

- Donning a life preserver efficiently is a fundamental survival factor in aviation emergencies (Corbett, Weed, Ruppel, Larcher & McLean, 2014)
- Lack of knowledge about life preservers has caused deaths in survivable conditions (Chang and Liao, 2010)
- Passengers are not well prepared:
 - donning illustrations provided by airlines: difficult to comprehend, even when study participants are given an unlimited amount of time (Corbett & McLean, 2008; Weed, Corbett, & McLean, 2013)
 - US Airways Flight 1549 case study: many passengers were not even able to retrieve the life preservers and, of those who retrieved it, the majority indicated that they had difficulty donning it (NTSB, 2010)



Proposed Interactive Media: The Life Vest app

- Virtual world: touchscreen-based, 3D aircraft cabin environment with virtual character
- Game-like design: the user's goal is to make the character don the life preserver
- Natural, direct interaction: users (i) touch the virtual object they want to act on, (i) touch and drag the character hands to perform actions
- Active Exploration: users actively explore the donning procedure, receiving instant feedback about their progress or lack of it
- Fidelity: virtual life preserver, cabin environment, movements of the character for donning the life preserver and their effects



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Goal

Wear the Life Vest



Proposed Interactive Media: The Life Vest app



- Designed for on-board (as well as off-board) use:
 - Non-scary, reassuring experience
 - Touchscreen interaction, e.g.:
 - Recent In-Flight Entertainment systems (IFEs)
 - Passengers' Personal Electronic Devices (PEDs) such as smartphones and tablets (latest FAA and EASA policies allow PED use to all phases of flight)



Study Goals

- Contrast the Life Vest app with the traditional safety card instructions
- Assess different aspects of effectiveness:
 - Knowledge transfer. Not just knowledge acquisition, but the ability to apply the acquired knowledge to the real world, by actually donning a life preserver
 - Subjective perceptions. Perceived simplicity and efficacy of the safety instructions, and level of engagement
 - Attitude Change. In addition to providing accurate knowledge, aviation safety education must cultivate passengers' attitudes that can positively affect their behavior when an emergency occurs (Chang & Liao, 2009). An important attitude is self-efficacy (Bandura, 2001)



Self-efficacy and Passengers' Safety

- Self-efficacy: the confidence on one's ability to perform a behavior
- Bandura's Social Cognitive Theory: self-efficacy affects performance, different people with similar skills may perform differently depending on their conviction that they can execute a behavior
- Different studies found positive associations between safety training, self-efficacy and attitudes toward safety, see (Grau, Martínez, Agut, & Salanova, 2002; Katz-Navon, Naveh, & Stern, 2007) for summaries
- Increasing self-efficacy is particularly important for passengers, because they tend to:
 - be pessimistic and fatalistic about aircraft accidents, mistakenly believing that there is little hope
 - shift the responsibility and capability of their safety to the cabin crew (Muir and Thomas, 2004)



Self-efficacy questionnaire

- Nine items about donning the file preserver, rated on a 7-point scale (1=not at all, 7=very)
 - "I feel confident about my ability to don it"
 - "I would be able to don it correctly"
 - "I would be able to don it fast"
 - "I believe I would be able to help other passengers in donning it"
 - "I feel able to don it in time if the aircraft lands on water"
 - "I would be able to carry out all the actions needed to don it...
 - ...even if the situation puts me under heavy pressure"
 - ...even in a serious emergency on a sinking aircraft"
 - ...even if most passengers are screaming or crying"



Subjective Perceptions questionnaires

- Rated on a 7-point scale (1=not at all, 7=very)
- Five items for Engagement: (i) "It was boring", (ii) "It was engaging", "It was fun", "The depicted situation looked real", "I felt immersed in the depicted situation"
- Three items for Instructions simplicity: The received instructions are (i) "simple", (ii) "easy to learn", (iii) "easy to carry out"
- Three items for Instructions efficacy: The received instructions (i) "...are useful for my safety", (ii) "...are effective to face a water landing", (iii) "...allow one to greatly reduce the probability of getting hurt in a water landing"



The Study

- Participants: 68 (61 M, 7 F), undergraduate students
- **Age**: from 20 to 24 (M=21.21, SD=0.64)
- Flights (last 2 years): from 0 to 10 (M=1.68, SD=2.54)
- **Design:** between-groups, half participants (App group) used the app on a smartphone, while the other half (Card group) used the life preserver section of the safety card of a major airline that presented the same knowledge

Measures:

- Knowledge transfer: After using the instructional media, participants were asked to try wearing the real aircraft life preserver. We measured:
 - time required to retrieve and don the life preserver
 - errors in executing the procedure
- Instructions simplicity, Instructions efficacy, Engagement
- Self-efficacy: measured three times (before instructions, after instructions, and after donning the real life preserver)



Knowledge Transfer: Time

- Statistically significant difference, ANOVA, F(1, 66)=6.05, p=0.017, $\eta_{\text{p}}{}^2\text{=}0.08$
- App group retrieved and donned the life preserver in less time (M=35.22 s, SD=11.06) than Card group (M=42.81 s, SD=14.22)





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Knowledge Transfer: Errors

App group made significantly fewer errors than Card group

| Step | Card | Арр | Mann-Withney test |
|--|------|-----|------------------------|
| Open Compartment | 0 | 0 | |
| Pull out Pouch | 0 | 0 | |
| Open Pouch | 4 | 0 | (Z=-2.05, p<0.05) |
| (error: trying to open bottom instead of top of the pouch) | | | |
| Pull out/Unfold Vest | 0 | 0 | |
| Slip Vest over Head | 14 | 6 | (Z=-2.11, p<0.05) |
| (errors: turning the life preserver more than once to figure out | | | (, , , , , , , |
| if the two sides are different and/or donning the vest with the | | | |
| buckle on their back) | | | |
| Pass around Straps | 2 | 1 | |
| (error: trying wrong manoeuvres with the straps before | | | |
| realizing how to pass them correctly) | | | |
| Buckle Strans | 0 | 0 | |
| Tighton Strong | 7 | 5 | |
| (error: not tightening and believing to have finished) | / | 5 | |
| | | | |
| Total Errors | (27 | 12 | (∠=-1.99, p<0.05) |

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Subjective Perceptions



- App (M=5.12, SD=1.10) much more engaging than card (M=2.96, SD=1.24), ANOVA, F(1, 66)=79.66, p<0.001, η_p²=0.47
- App instructions (M=5.58, SD=1.16) more simple than card (M=4.40, SD=1.34), ANOVA, F(1, 66)=15.00, p<0.001, η_p²=0.19
- App instructions (M=4.97, SD=1.37) more effective than card (M=4.13, SD=1.22), ANOVA, F(1, 66)=7.17, p<0.01, η_p²=0.10



Self-efficacy

- 2 x 3 mixed design ANOVA
- main effect of time, F(1.75, 115.30)=50.29, p<0.001, η_p²=0.43
- group by time interaction, F(1.75, 115.30)=3.34, p<0.05, η_p²=0.05





Self-efficacy

- Post-hoc analysis with ANOVAs and Bonferroni tests
- **Card**: difference between the first and its two subsequent values significant, no statistically significant difference between self-efficacy after using card and after donning
- App: statistically significant difference for each of the three pairs
- Difference in self-efficacy between the two groups after donning the life preserver statistically significant





Getting the Life Vest App

- We made the app available for all major mobile platforms (34'000 installations as of September 2016)
- It can be freely downloaded from: http://hcilab.uniud.it/lifevest











New features added: competition and leaderboards



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New features added: explore the life preserver











Conclusions

- Participants who used the Life Vest app were able to retrieve and don the real life preserver faster and with fewer errors than participants who used the traditional safety briefing card
- These positive results were consistent with subjective ratings by participants: the app was perceived as more engaging, simple and effective than the traditional safety briefing card
- Self-efficacy kept increasing after donning the real life preserver only in the App group. Possible explanation: unlike examining pictorials, the experience of donning the life preserver in the virtual world was similar to the real-world experience (confirmation and reinforcement)
- We are now working at applying the proposed approach to other cabin safety topics (wearing the oxygen mask, assuming the brace position, and opening the different types of aircraft emergency doors)

More Info

- Project Web Site: http://hcilab.uniud.it/aviation
- News (follow us on):
 - http://www.facebook.com/hcilabudine
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- Videos: <u>http://www.youtube.com/hcilabudine</u>
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