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NEWSLETTER
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SEVENTH FRAMEWORK PROGRAMME

European Commission

Overview

Welcome to the third edition of the EU FP7 SAVE ME project newsletter.

SAVE ME is now in its third and final year! A significant amount of effort has gone into the project so far, and partners are now putting all their efforts into bringing everything together to successfully conclude the project by September 2012.

A significant part of the work has gone into developing an understanding of human behaviour in stress situations and how this information can be used to inform guidelines for evacuation planning. A report on this particular activity can be found on pages 2 and 3.

Consortium members have also been working hard on finalising the individual technological components of the project, carrying out communication tests between the components with a view to integrating everything into a single system very soon. More detail about the technological systems developed in the project can be found on page 4.

In addition to testing the underlying technological architecture, test activities have also been carried out on the interface to the system. Universität Stuttgart (USTUTT) and University of Newcastle (UNEW) undertook usability tests with operators at the Gotthard Strassentunnel and the Tyne and Metro Control Centre to help identify areas of improvement to the user interface. Read more about these tests on page 4.

Project partners have also been travelling to conferences nationally and internationally to promote the work in the project. Universidad Politecnica de Madrid (UPM) presented a paper at HCII2011 in Orlando, USA and UNEW presented an overview of the project at the inaugural transportNewcastle Industrial Advisory Board in Newcastle upon Tyne, UK. More information can be found on page 5.

For more information on the SAVE ME project, please visit the project webpage at http://www.save-me.eu or e-mail info@save-me.eu

A Study on Human Behaviour in Stress Situation

COAT-Basel is part of the Department of Psychiatry at the University of Basel, Switzerland. It conducted a study in their Virtual Reality laboratory (VR) with 28 healthy participants, 19 men and 9 women, age ranging from 18 to 52 years, in order to evaluate human performance under stress in a complex, tunnel-like environment that requires spatial orientation, learning aptitude as well as cognitive flexibility. Human behaviour and decision-making under life-threatening circumstances alters significantly in a way that needs to be considered for effective evacuation planning. States of strong emotional stress induce a 'fight or flight' condition, in which perception, memory, learning, cognitive flexibility and reasoning are affected in a way that enables the individual to react fast and strong to a threat, but severely impairs the ability to follow a set of instructions or an evacuation plan exceeding a certain degree of perceived complexity.

Read more on page 2

SAVE ME
www.save-me.eu
NEWSLETTER
ISSUE n.3 January 2012

SEVENTH FRAMEWORK PROGRAMME
European Commission

Human Behaviour in Stress Situations and Guidelines for Evacuation Planning

As already metioned, COAT-Basel conducted a study in their Virtual Reality laboratory (VR).

Main rationale of the investigation was to initially induce stress in the participants and subsequently observe their performance in a set of tasks, which were designed to challenge their learning aptitude and cognitive flexibility.

To objectively assess the level of stress throughout the tasks, heart rate (HR) and skin conductance response (SCR) were measured concurrently. The increase of these two physiological parameters from a baseline (quietly reading a neutral text) during stress induction and performance tasks indicates sympathetic activation, which is a measure of physiological stress response.

The study was carried out with one participant at a time. Being seated in a chair, the participants faced stereoscopic presentations on a powerwall and navigated through the VR by means of a gamepad.

From the results, a number of conclusions for the design of escape scenarios could be drawn, paying special consideration to the most vulnerable evacuees like children, seniors and physically challenged travellers.

Inducing Stress Under Laboratory Conditions

The Trier Social Stress Test (TSST) is an effective psychological method to induce high levels of emotional stress. The participants were exposed to a VR adaption of the TSST, which was developed for that purpose at COAT-Basel.

Participants first had to give a free speech in front of a virtual audience consisting of 80 avatars (image 1). After a preparation time of two minutes, they had to "advertise" themselves for five minutes like in a job interview either for a position as a "Professor for Ethics" or as a "Referee", corresponding to their educational background.

Image 1: The virtual auditorium. 80 avatars forming a virtual audience.

Afterwards, they had to rate their stress level and degree of exhaustion, as well as how unexpected they found the task, and how realistic they perceived the simulation. Each aspect was rated on a scale from 1 to 8 in a short questionnaire.

The outcome showed clearly that the TSST effectively induced stress in the participants. On the physical level, elevated heart rates and skin conductance response levels in all participants were observed. Subjectively, the participants rated themselves having been highly surprised by the task (median 8), very stressed (median 6) and found themselves very exhausted as a result (median 6).

Testing Memory Under Stress

Subsequently, the participants performed a complex learning aptitude test, which also was implemented in the VR. The task was to traverse as fast as possible a virtual labyrinth, consisting of square rooms by moving through gates from room to room, see image 2. Each room had a number of gates that were marked as exit gates by symbols, the gate on the back, the entry gate, was not marked. In total, there were nine different symbols occurring on the way, built by all combinations of three colours and three shapes. Three of the symbols were "correct", guiding the way to the exit. The other six symbols were "wrong", leading into blind alleys and occasional aversive feedback signals. In order to find the exit, the participants had to maintain a spatial orientation and to primarily learn, which symbols were not helpful. The urgency of fast task completion was increased by virtual water, flooding the labyrinth with a constantly rising level, up to a maximum 140 cm.

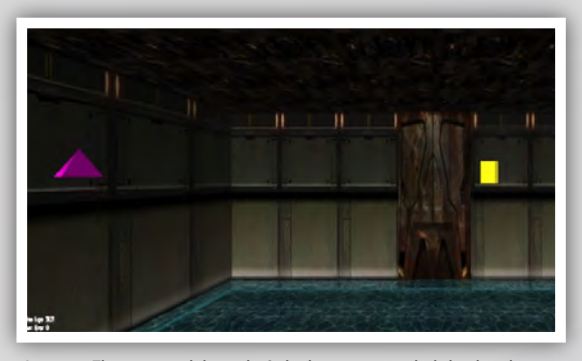

Image 2: The memory labyrinth. Only the correct symbols lead to the exit.

The main result was, that those participants who rated a high intensity of perceived stress after stress induction, lost the spatial orientation more often, and those who showed higher skin conductance response during the task - indicating higher stress - took less time to complete the labyrinth. The later may seem at first counterintuitive, since we expect an association of high stress level and decreased performance. However, participants who showed a stronger physiological response during stress induction had a higher error-by-time-ratio in this labyrinth, which indicates an increase of speed at the cost of higher error rates. This strategy of accepting collateral damage in favour of speed may have been without consequences in a virtual environment, where "error" meant just aversive auditory and visual feedback. In a real setting, this might have turned out fatal.

SAVE ME
www.save-me.eu
NEWSLETTER
ISSUE n.3 January 2012

SEVENTH FRAMEWORK PROGRAMME
European Commission

Cognitive Flexibility Under Stress

The second cognitive test measured cognitive flexibility under stress in a VR labyrinth design, and was based on the widely applied Wisconsin Card Sorting Test (Berg, 1948). The participants had to find the way through the labyrinth by choosing one of three gateways to enter the next room. Each gateway was marked by a different symbol, see image 3. The symbol consisted of two shapes representing one of the four possible combinations of equality and diversity of colour and form: (1) equal colour and different form, (2) equal form and different colour, (3) equal colour and equal form, (4) unequal colour and unequal form. The currently correct principle was either equal colour or equal form, and had to be figured out by the participants in order to avoid aversive, negative feedback while moving through the labyrinth. After four correct choices in a row, the current principle was changed to the other one without letting the participants know.
From the negative feedback the participants had to deduce the change, and determine the new current principle. Impaired cognitive flexibility shows in this paradigm as the phenomenon of perseveration errors, which means being stuck in the previously correct response concept, and unable to learn and adapt to a new concept. Further measures, which could be derived from the participants' reactions, were the amount of responses that were clearly based on a conceptual level reasoning (conceptual level responses), as opposed to random guessing, which was observed as arbitrary response switches despite the absence of negative feedback. Other important performance indicators were the number of rooms the participants crossed before they figured out the underlying concept for the first time, and the number of concept changes they generated during the test. Also in this labyrinth, a rising water level suggested swift completion.

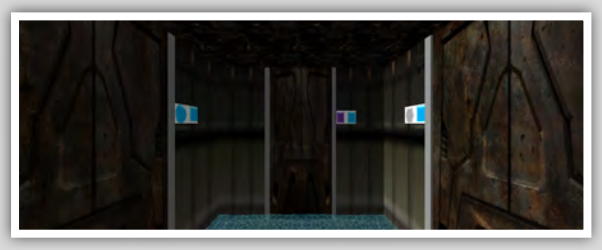

Image 3: The cognitive flexibility labyrinth. Find the key concept to the exit.

It turned out, that the degree of preceding stress induction had a stronger influence on the test performance than the concomitant physiological stress level. The total number of errors and perseveration errors was higher in the participants who exhibited a higher physiological stress response during the stress induction task. They also had a lower score for conceptual level responses and achieved less category changes, which is demonstrating an impairment in cognitive flexibility by previously elevated stress levels.

Conclusions for Evacuation Planning

In concordance with the study at COAT-Basel and previous studies on human behaviour and decision making under stress, the following conclusions can be drawn:

Intuitive guidance by straight routes

If the required action for a disaster evacuation scenario is simple, an easy panic reaction might be the best (e.g. running as fast as you can towards the end of a tunnel). However, if the demands in the evacuation phase are high and complex, panic might lead to a worse outcome. Beside the finding from the lab-tests at COAT-Basel, past panic scenarios have shown, that given a very strong stressor, it is likely that one will fall into panic, rather than keep the kind of complex behaviour s/he has been trained for. People very often are not able to think reflectively under stress. People hardly learn something new under stress.
Therefore, route guidance must be intuitive. Escape guidance must be in accordance with a fight or flight reaction (=intuitive), following **straight lines** and **avoiding situations of decision-making.**

Guidance in complex environments

In situations of high perceived complexity, human behaviour must be guided in a reactive and simplistic manner. From an evolutionary perspective, processes like learning and planning are not of primary concern in archaic stress scenarios, where immediate physical activation for defence or evasion is more important than an elaborate, appropriate reaction.
Therefore, it is important to keep evacuation plans and routes **as simple as possible** (E.g. only one evacuation route, concise symbols, one colour, combine visual and acoustic signals, not a whole, difficult map on the mobile smart phone).

Motivational Management

The performance under acute stress is two folded: Short term stress with a moderate task which is perceived to be challenging (Eustress) has a positive effect on the outcome. Long term stress or acute stress without the subject having the right coping skills (Distress) lets the performance drop, so it could be that people become irrational, afraid, start to panic or de-motivated, forgetful, fixed on a special exercise and lose the overview.
Therefore, it is important to **motivate the person** not to give up (try to motivate with something positive, like "preserve yourself!", instead of "you might die!" (Change Distress into Eustress)

- **positive comments** can cheer up when s/he achieved something (e.g. reaching a rescue ladder)
- **motivate** them when they got lost in a tunnel system
- use a **clear voice** and **short sentences**

Perceptual, Cognitive and Attention Management

Perceptual tunnelling is seen as one of the major effects of stress. During stress, the effective visual perceptual field is constricted and the items in the periphery are less attended.
Therefore, tunnelling can be overcome by **adding an acoustical information**, if information appears in the periphery, as tunnelling concentrates attention on the primary task and takes away attention from a secondary task. It will also lead to **performance improvement in complex environments**, where especially avoiding distractions improves performance.

Cognitive tunnelling appears when a limited number of possibilities are considered by central cognition.
Therefore, the declarative and procedural retrieval thresholds should be enlarged to overcome the cognitive tunnelling effect. The person needs **clear cues** on how to activate relevant acquired behaviour: A long phase of training is necessary so that a person can react appropriate.

Finally, basic **attentional function** is impaired under severe stress.
Therefore, it is important to **raise the attention** towards the relevant rescue stimuli in a way that the individual does not misperceive the decision situation when feedback delays occurred. Feedback has to be given as fast as possible.

www.save-me.eu

NEWSLETTER
ISSUE n.3 January 2012

Second SAVE ME Workshop

The second SAVE ME project Workshop will be held in Newcastle on June 27th 2012. UNEW and Università di Modena e Reggio Emilia (UNIMORE) are currently working closely to develop the final programme and decide on the venue for this workshop, so for now please make a note of this date in your diaries and keep an eye on the official project website, www.save-me.eu, for further information!

SEVENTH FRAMEWORK PROGRAMME

European Commission

Status of the Project: current situation

SAVE ME Technological Developments

In the second year of the SAVE ME project, the majority of the work has been concentrated on developing the individual technological components of the system.
Significant efforts have been made to enhance the agent framework, both at the server side and the client side, in order to provide the necessary functionality and innovative end-user functionalities such as the agent-based personalized traveller monitoring of the evacuation plan. In this first phase of the implementation, the SAVE ME system is able to detect whether a traveller does not follow the initial evacuation route provided by the Decision Support System (DSS) and can react immediately to inform the user in a friendly way, or to estimate a new evacuation route if necessary. Progress has also been made in the design and implementation of the functional components of the DSS itself, with refinements to the internal DSS architecture allowing the final system architecture to be delivered.
At the user end, the SAVE ME Symbian mobile application has been tested and is fully compatible with a range of different devices whilst the developed Android application supports all released versions of the Android OS from v1.5 (Donut) to the latest v2.3 (Gingerbread).
The key challenge facing the project as we enter the final year is to test, debug and integrate everything into one holistic system, bringing the individual inputs through the Wireless Sensor Networks and mathematical simulations, plus the range of outputs to different mobile devices together. All systems need to communicate with the DSS to form the complete SAVE ME system - 2012 is set to be a challenging and exciting year for the consortium!

SAVE ME Operator User Interface

As part of Work Package 6, a prototype Operator User Interface has been developed by Universität Stuttgart. This interface has undergone usability testing exercises conducted by Universität Stuttgart with operators at the Gotthard Strassentunnel, and by UNEW with operators at the Metro Control Centre at South Gosforth, Newcastle upon Tyne. The tests were compiled by Universität Stuttgart and were designed to ascertain how intuitive the Operator User Interface is without any form of training provided, to help identify improvements to the final version of the interface.

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NEWSLETTER
ISSUE n.3 January 2012

SAVE ME presented at Inaugural transportNewcastle Industrial Advisory Board

The transportNewcastle network, a University-wide initiative at Newcastle University developed to bring all transport research activities together, recently hosted their first Industrial Advisory Board (IAB) on December 6th-7th 2011 at Newcastle University. As part of the 'Safe and Secure' theme presentation to external guests and IAB members, Dr. Gareth Evans (UNEW) gave an overview of the SAVE ME project and the different technologies being developed to form the final system. The presentations generate some interesting and informative discussions during the refreshment breaks.

Chief Inspector Rae Jiggins of the British Transport Police is a member of the transportNewcastle IAB and was one of the invited speakers at the first SAVE ME workshop held in Roma in March 2010. Chief Inspector Jiggins gave some very useful feedback on the project's developments and provided some updates to working practices based upon findings from recent international terrorism events. We hope to invite Chief Inspector Jiggins and other personnel from the British Transport Police to attend the second SAVE ME workshop, which will be held in Newcastle in June 2012.

SAVE-ME at 14th International Conference on Human-Computer Interaction in Orlando, Florida (USA)

SAVE ME project was successfully presented during the 14th International Conference on Human-Computer Interaction in Orlando, Florida (USA). The event was organized in July 2011 jointly with several affiliated conferences, attracting nearly 2000 participants from 61 countries. The project contribution, prepared by UPM, Universität Stuttgart and CERTH-HIT was titled: "Development of Mobile Evacuation Guides for Travellers and Rescue Personnel". The objective of the article was to give an overview of the methodology and approach for the development of innovative HMIs within SAVE ME to save the lives of travellers and rescuers, including technical solutions, and user interface design & implementation issues. The receptive audience gave the presenters a very useful feedback that will be taken into account for further steps of the project. For more information about the conference, please check the web site: http://www.hcii2011.org/

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NEWSLETTER
ISSUE n.3 January 2012

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