

OPERATIONAL READINESS IN RURAL FIREFIGHTERS DURING BUSHFIRE SUPPRESSION

“AWAKE, SMOKY & HOT”



Five firefighters

One room

3 × 12-hour day shifts

Physical & Mental Work tasks

Health & Sleep measures



1. Work with key fire industry informants to **validate a three-day bushfire suppression** tour simulation;
2. Investigate the impact of, and interaction between, multiple fireground stressors (i.e., **sleep disruption, heat and smoke**) on firefighters' **physiological** responses, **physical** and **cognitive** work performance across a simulated three-day bushfire suppression tour;
3. Present the research findings to key fire industry stakeholders to inform comprehensive policy, best practice guidelines, and training and educational materials for the preservation of firefighters' health and safety.

AIM #1: SIMULATING FIREGROUND ACTIVITY

In a classroom

1. Why simulation:

- a) Control variables we are interested in
- b) Consistent assessment of key measures
- c) Repeatable conditions
- d) Comparable to previous research

2. How simulation:

- a) Collect information about the tasks done on fireground
- b) Design proxies for the tasks that can be done in classroom
- c) Piloted in two sites

TESTING VALIDITY OF THE SIMULATION

Fidelity workshop

Participants

9 subject matter experts - two provided fire-fighting expertise, two provided human factors expertise, two provided cognitive psychology expertise, and three provided physiology expertise.

Procedure

Half-day workshop:

- introduction to the aims and objectives of the ASH project
- describe specific objectives of the fidelity evaluation
- provided a detailed verbal introduction and demonstration of each task
- complete the simulation fidelity evaluation toolkit for each of the tasks and a “global” evaluation of the simulation as a whole

METHOD OF EVALUATION

Dimensions

The Toolkit

The fidelity evaluation utilised the *Simulation Fidelity Evaluation Toolkit*.

The tool is structured around four main axes of fidelity and sub-dimensions:

Psychological	Physical	Equipment	Environmental
Scenario realism	Biomechanical	Functional	Location
Cognitive skills	Dynamic load	Haptic	Performance/production pressures
Expertise	Static load	Visual	Distractors
Cognitive workload	Physical endurance	Auditory	Time of day
Team performance	Motion cues		Noise
Stressors			Temperature
			Visibility

Each dimension was rated by the subject matter experts using a 100mm Visual Analogue Scale with anchors “no resemblance” and “complete resemblance”.

EXAMPLE – PHYSICAL FIDELITY

Physical Fidelity

Biomechanical: The degree to which the simulation resembles the range of movements seen in the real task.

No Resemblance | _____ | Complete Resemblance

Dynamic Load: The degree to which the movements within the simulation resemble the dynamic load (active movement of muscles) seen in the real task.

No Resemblance | _____ | Complete Resemblance

Static Load: The degree to which the movements within the simulation resemble the static load (holding muscle groups tight) seen in the real task.

No Resemblance | _____ | Complete Resemblance

Physical Endurance: The degree to which the movements within the simulation resemble the physical endurance requirements of the real task.

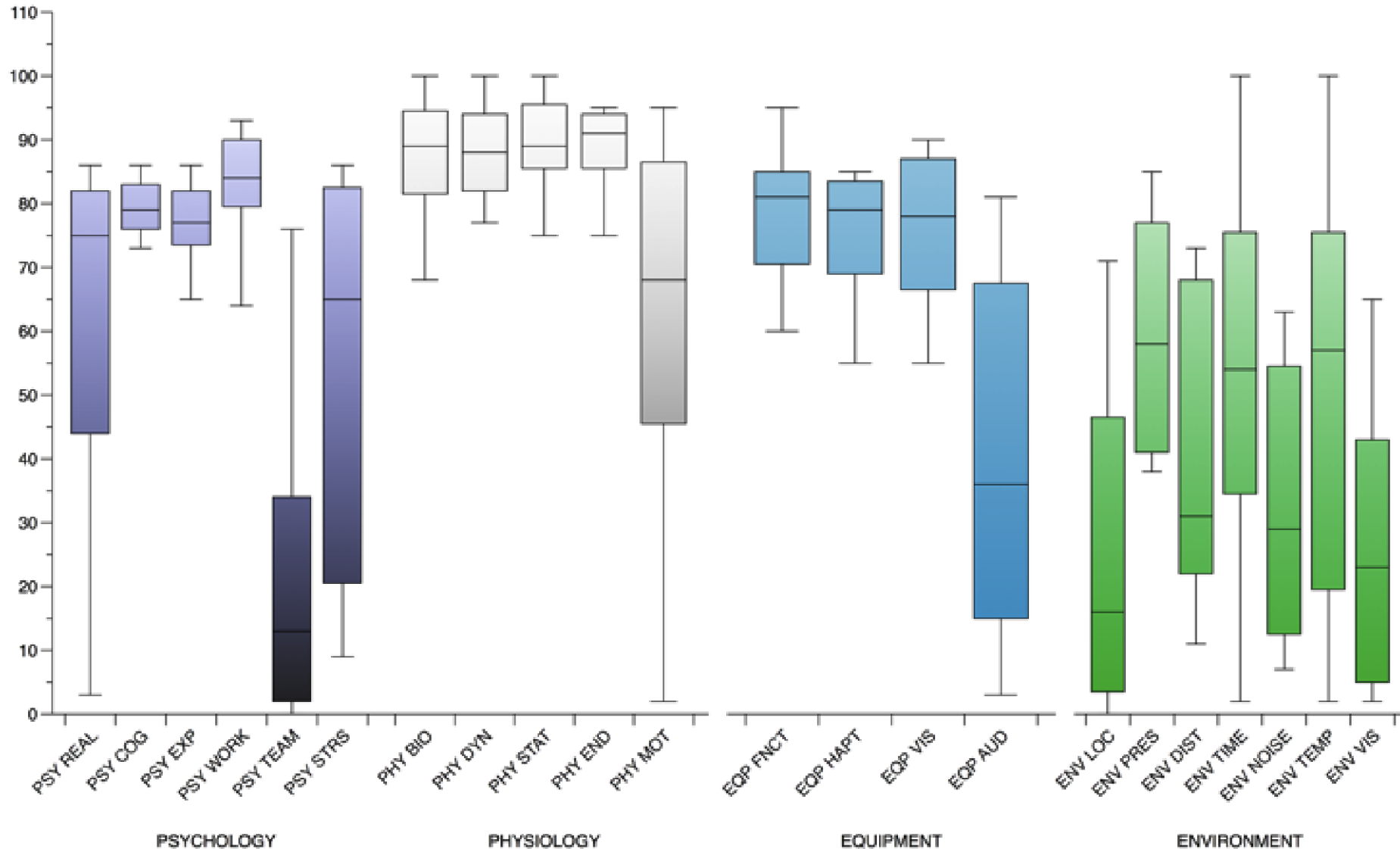
No Resemblance | _____ | Complete Resemblance

Motion Cues: The degree to which the motion cues represented within the simulation resemble the motion cues of the real task.

No Resemblance | _____ | Complete Resemblance

SIMULATION FIDELITY

Global Ratings of the simulation



FINDINGS

In a classroom

1. Generally high ratings of fidelity overall
 - a) Psychology, physiology and equipment average high
 - b) Low ratings in particular for team and motion cues from equipment

2. Moderate to low ratings on environment measures
 - a) In a classroom
 - b) Environmental conditions controlled as part of experiment, assessment done in control condition

3. Low ratings on physical and equipment dimensions for the cognitive tasks

1. Independent assessment by human factors researcher using half-day workshop
2. Nine subject matter experts from a number of fields
3. The ASH simulation has high level of fidelity, particularly in elements where high fidelity is important
4. Provides agencies and researchers surety about the design and the results

OBJECTIVE: *Measure **consistency** of physical performance during 'ASH' physical task circuit*

Specifically, **consistency:**

- Across a single day
- Between consecutive days
- Between consecutive weeks

***Nine participants** so far – more testing
December 2012 – March 2013 (n = 30)*

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Aim #1: Data collected, analysed, write-up commenced;
Data collection ongoing, write-up 2013

Aim #2: **Behind schedule**

Aim #3: Engaging well with industry but can't really progress
without Aim #2

Original Plan: n = 25 (each) in eight conditions:

Control:

12-h day
8-h sleep
18 - 22° C
No CO

Awake:

12-h day
4-h sleep
18 - 22° C
No CO

Smoky:

12-h day
8-h sleep
18 - 22° C
15 ppm CO

Hot:

12-h day
8-h sleep
33° C
No CO

Awake & Smoky:

12-h day
4-h sleep
18 - 22° C
15 ppm CO

Awake & Hot:

12-h day
4-h sleep
33° C
No CO

Smoky & Hot:

12-h day
8-h sleep
33° C
15 ppm CO

Awake, Smoky & Hot:

12-h day
4-h sleep
33° C
15 ppm CO

Control: n = 9

Awake: n = 8

Hot: n = 2

**No participants in
any other conditions**

Recruiting participants

Five firefighters

One room

3 × 12-hour day shifts

Physical & Mental Work tasks

Health & Sleep measures

Awareness Raising:

- **National presentations**
(Conference, RAF, OH&S Group);
- **Agency Presentations**
(FESA, TFS, CFS, NTPFES);
- **General Media**
(WA, Vic Radio, ACT print)



Direct communications

- **Fire agency media**
(internal magazines, communications);
- **‘Top Down’**
(Chief Officer ‘endorsements’);
- **‘Bottom Up’**
(Volunteer Associations, Brigade Meetings)

Time efficiencies

- **Victoria & SA testing sites first choice**
- **Australia-wide testing**
'Block' testing three weeks with 20 participants
- **Agency 'champions' required**

Additional Time

- October 2012-March 2013: **Direct Communications**
- March 2013 to October 2013: **Testing**

**Formal request for additional time
(to September 2014) in draft form**