PROGRAM D

Using the Networked Fire Chief (NFC) Wildfire Scenario Generator to Investigate Decision Making

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Overview

1. D2.3 Project Aims
2. Safety Interviews
3. Networked Fire Chief (NFC)
4. NFC Study 1
5. NFC Study 2
6. Where to Next?
7. How Agencies can help

D2.3 - Project Aims

1. Increase the understanding of the human factors affecting decision making that could compromise safety on the fireground
   - Physical and mental stress
   - Group pressures at crew and agency level
   - Individual thought processes
2. Approach is twofold:
   a) Safety Interviews using the Human Factors Interview Protocol
   b) Controlled experiments using the NFC wildfire scenario generator and experienced firefighters as participants

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Safety Interviews

1. Collected data from **112** firefighters
   - Crew Leaders to Incident Controllers
2. Data constitutes approximately **1000** hours of transcription and **100,000** words
3. Interviews are yet to be systematically analysed
4. Findings from the interview analyses to guide the development of controlled experiments of decision making using the **Networked Fire Chief** program

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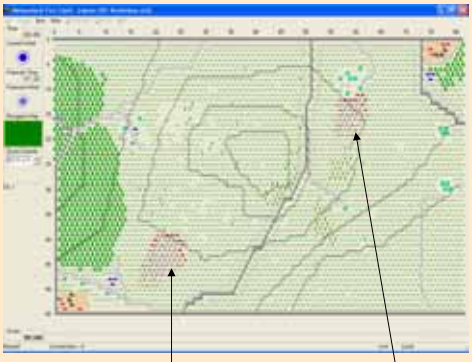
Networked Fire Chief (NFC)



1. Cellular automata wildland fire fighting scenario generator

Fire outbreak 1 – Western Sector

Fire outbreak 2 – Eastern Sector

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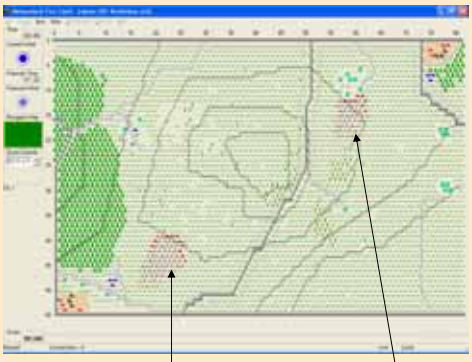
Networked Fire Chief (NFC)



1. Cellular automata wildland fire fighting scenario generator
2. Research tool for studying mental processes involved in decision making

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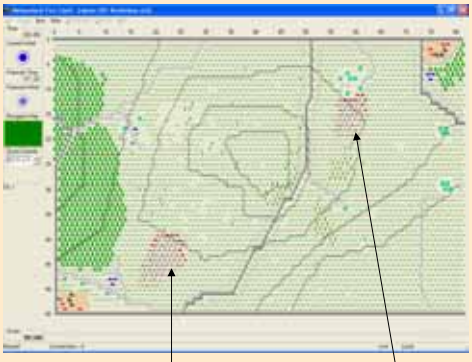

1. Cellular automata wildland fire fighting scenario generator
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3. Suitable for individual and team decision making

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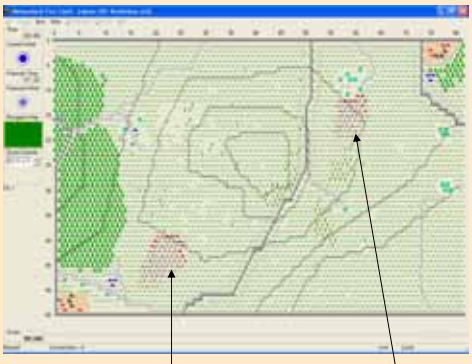
Networked Fire Chief (NFC)



1. Cellular automata wildland fire fighting scenario generator
2. Research tool for studying mental processes involved in decision making
3. Suitable for individual and team decision making
4. Not a tool for operational decision support or training in fire spread and fire suppression techniques

Fire outbreak 1 – Western Sector

Fire outbreak 2 – Eastern Sector

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NFC Studies – General Aims

- To test the **physical and psychological realism** of NFC as reported by experienced wildfire instructors and firefighters
- To assess NFC's **suitability** for the controlled experimentation of potential decision making errors

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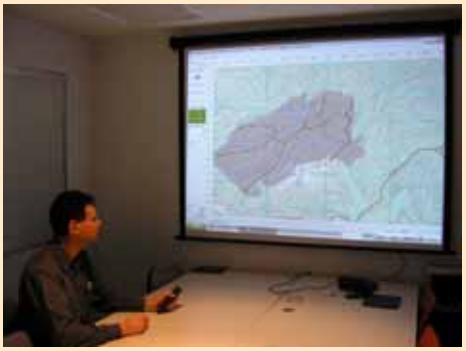
NFC Studies – General Procedures



1. Experienced wildfire instructors as participants

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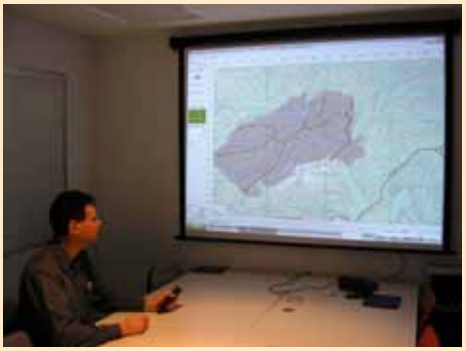
NFC Studies – General Procedures



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2. Introduction to program, fire parameters and available resources

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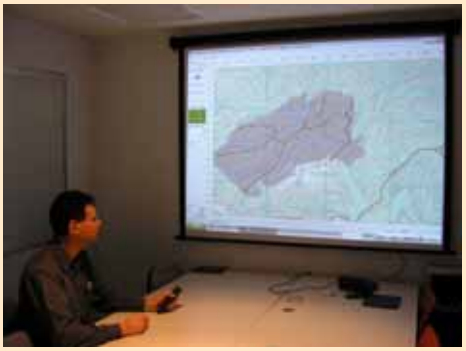
NFC Studies – General Procedures



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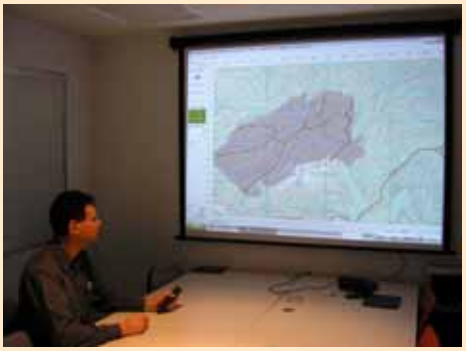

1. Experienced wildfire instructors as participants
2. Introduction to program, fire parameters and available resources
3. Series of practice trials to ensure participants are comfortable with procedures
4. Run test scenarios and fill out questionnaires

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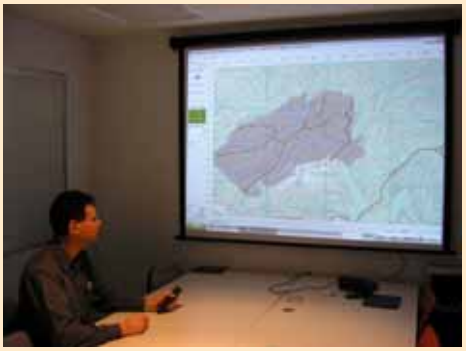
NFC Studies – General Procedures



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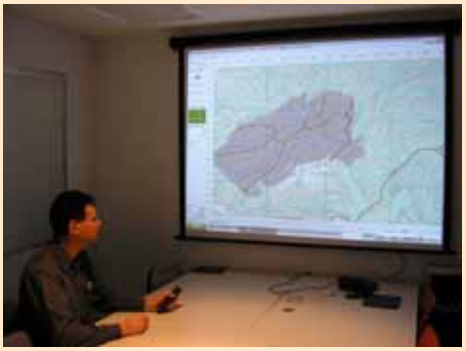
5. Full on-screen replays with cued recall debrief

NFC Studies – General Procedures



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2. Introduction to program, fire parameters and available resources
3. Series of practice trials to ensure participants are comfortable with procedures
4. Run test scenarios and fill out questionnaires
5. Full on-screen replays with cued recall debrief
6. General feedback about the realism of scenarios

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Study 1 - Aims

- To assess the **realism** of the basic NFC fire spread shape
- To investigate how **realistic** and **immersive** experienced firefighters would find participating in NFC scenarios
- To encourage suggestions for enhancing the realism of future NFC scenarios

Study 1 - Fire Spread Shape was Evaluated over a Simple Landscape

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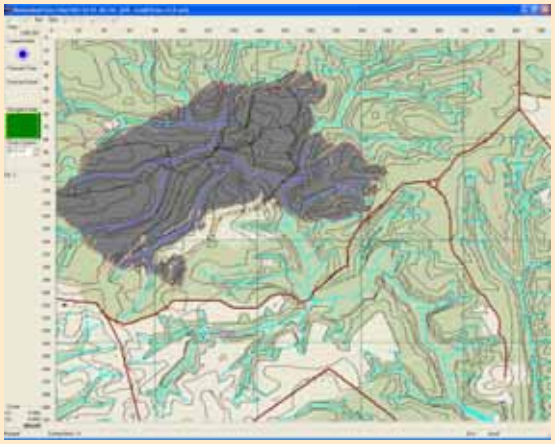
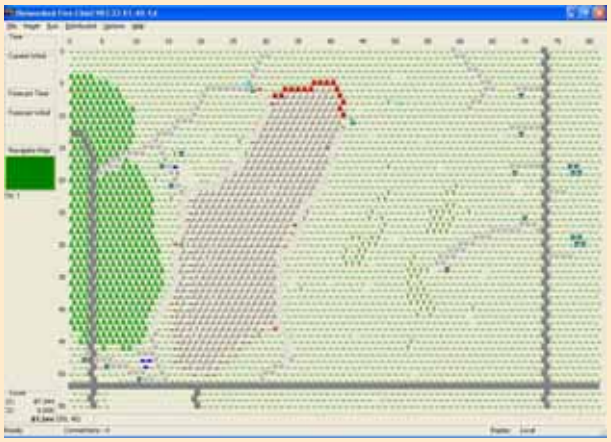
Study 1 - Fire Spread Shape was Evaluated over a Complex Landscape



Study 1 - Participants were Required to Suppress a Going Fire



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Study 1 - Results

- Participants rated the fire spread shape as being realistic over both the simple and complex landscapes
  (Some minor concerns about the shape were reported but were not severe enough to detract from levels of realism and immersion)
- When asked to engage in fire suppression, participants rated measures of **physical realism** and **psychological realism** as being very high
  (significantly higher than average)
- When asked to engage in fire suppression, participants rated their level of **immersion** in the task as being very high
  (significantly higher than average)
- Participants offered useful suggestions for enhancing the realism of the scenarios
  (Overall comments about the NFC scenarios were positive)

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Study 1 – Suggestions for Enhancing Realism

- More sophisticated options for fire suppression
  (e.g. enabling trucks to engage in backburning)
- More complexity in weather conditions
  (e.g. changes in wind direction and strength)
- More complexity in terrain layout
  (e.g. heterogeneous fuels)
- Multiple threats to deal with
  (e.g. multiple fire ignition points)

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Study 2 - Aims

1. To incorporate suggestions from Study 1 and to reassess ratings of **physical realism**, **psychological realism** and **immersion**
2. To test NFC's suitability to investigate a potential decision error, namely:
   - **Inflexibility in adapting plans** (c.f. Johnson, 2005)

Study 2 - Procedure

1. We took the most tractable suggestions from Study 1 and re-designed the NFC scenarios to include:
   - Changes in wind direction and strength
   - More complex terrain
   - Multiple fire ignition points
2. We included a second fire ignition point of **higher priority**, requiring participants to display **planning flexibility**

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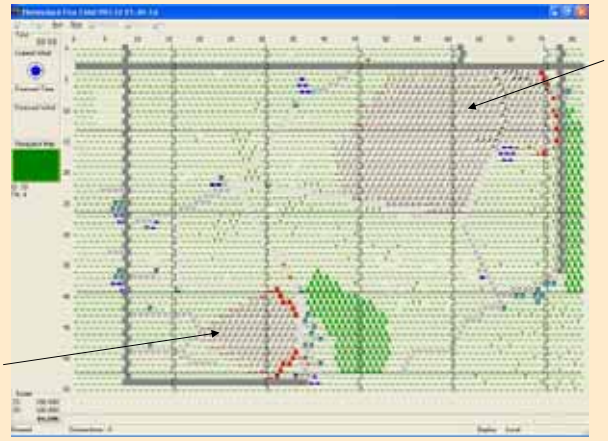
Study 2 - Experimental Trial in Progress



Study 2 – Results (1)

1. Participants rated the scenarios used in Study 2 as being significantly higher in **psychologically realism** than the scenarios used in Study 1

2. No differences were found in reported levels of **physical realism** or **immersion** between the scenarios used in Study 1 and Study 2
   (potential ceiling effect?)

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Study 2 – Results (2)

Full replays of each participant's experimental scenario were viewed and rated by a panel of NFC experts

1. Of the **12** participants tested **7** were deemed as requiring a significant shift in strategy upon the outbreak of the second fire

2. Of these **7** participants, **4** were judged as being reluctant to change their current strategy revealing **planning inflexibility**

Conclusions

1. The reported levels of **physical** and **psychological realism** were sufficiently high in both studies to suggest that NFC is suitable for use with experienced firefighters
2. Firefighters report becoming **highly immersed** when controlling the simulated fires
3. Networked Fire Chief is likely to be **suitable** for investigating a range of potential errors in decision making

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Where to Next?

1. Systematically analyse the interview data to highlight other candidate decision making problems that can be investigated using Networked Fire Chief

How Fire Agencies Can Help

1. Particular assistance will be required for
   - Ongoing feedback with respect to the development of realistic NFC scenarios
   - Providing access to research participants of varying rank and experience