



Dedicated to innovation in aerospace

**On-Demand Skills Training to Support Regular
Continuation Training for Fighter Pilots**

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On-demand training

Organisational perspective

- New systems
- New procedures
- Acute recovery training gap

Personal perspective

- Individual need
 - What
 - When
 - Where



Personalised Continuation Training?

- Core goal: **maintain combat readiness**
- Current approach: **time-based currency training**
 - Restore proficiencies through incremental part tasks (building blocks)
 - Check in the box
 - Limited personalisation

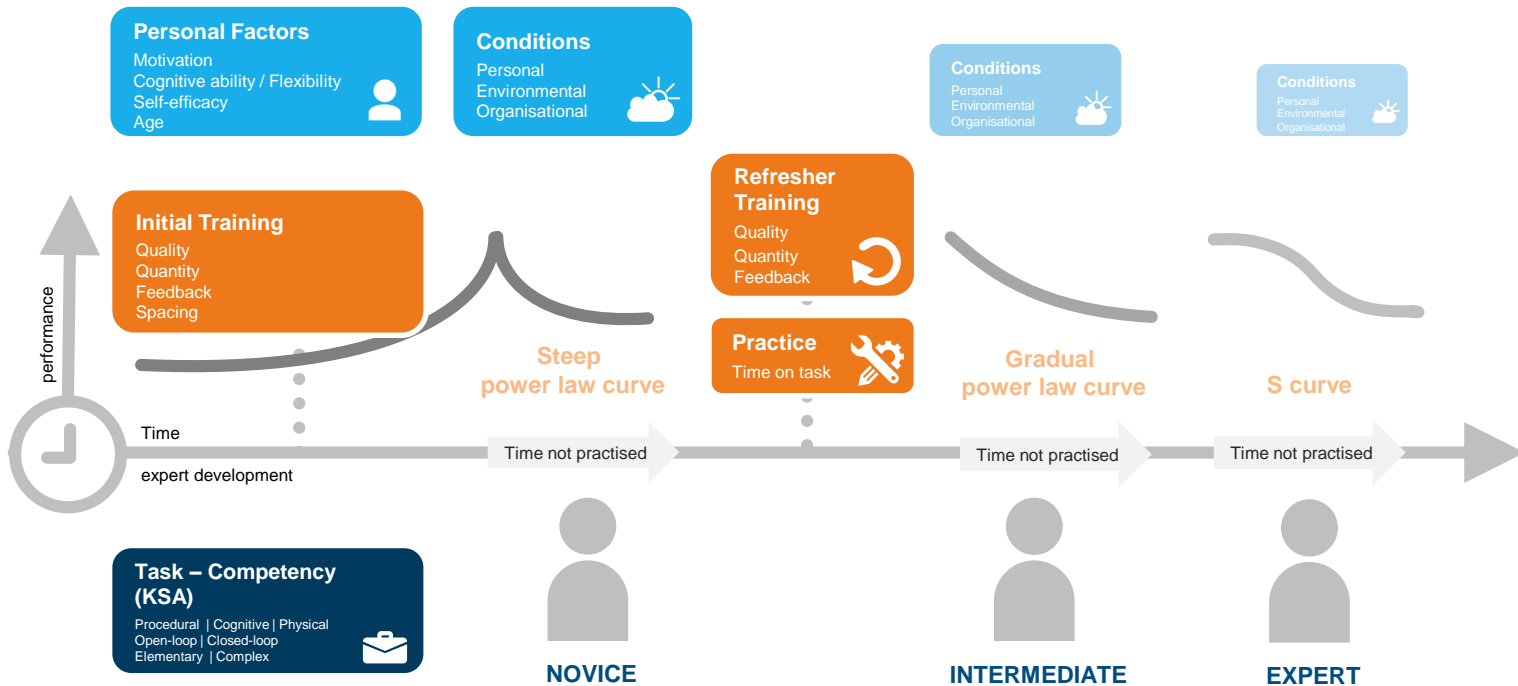
Personalisation in context



Grounded in a evolutionary framework of training theories

- Basis: understanding task demands / competencies required
- Fuel: performance data of every event (& context) from any source
- Enablers:
 - Variety / plenty training devices
 - Models of performance, instruction

Conceptual Retention Model



Towards personalised training in practise - to do list

- Determine the optimal timing of training for an individual
 - Develop computational retention model
 - Deal with whole task/part task difference
 - Integrated competency sets ~ full missions
 - Specific/elementary competencies ~ training missions or elements (TTPs, knowledge items)
 - Deal with transfer of training between tasks / competencies
- Select the optimal training device
- Optimise scheduling over time and resources for the unit / all pilots

This presentation

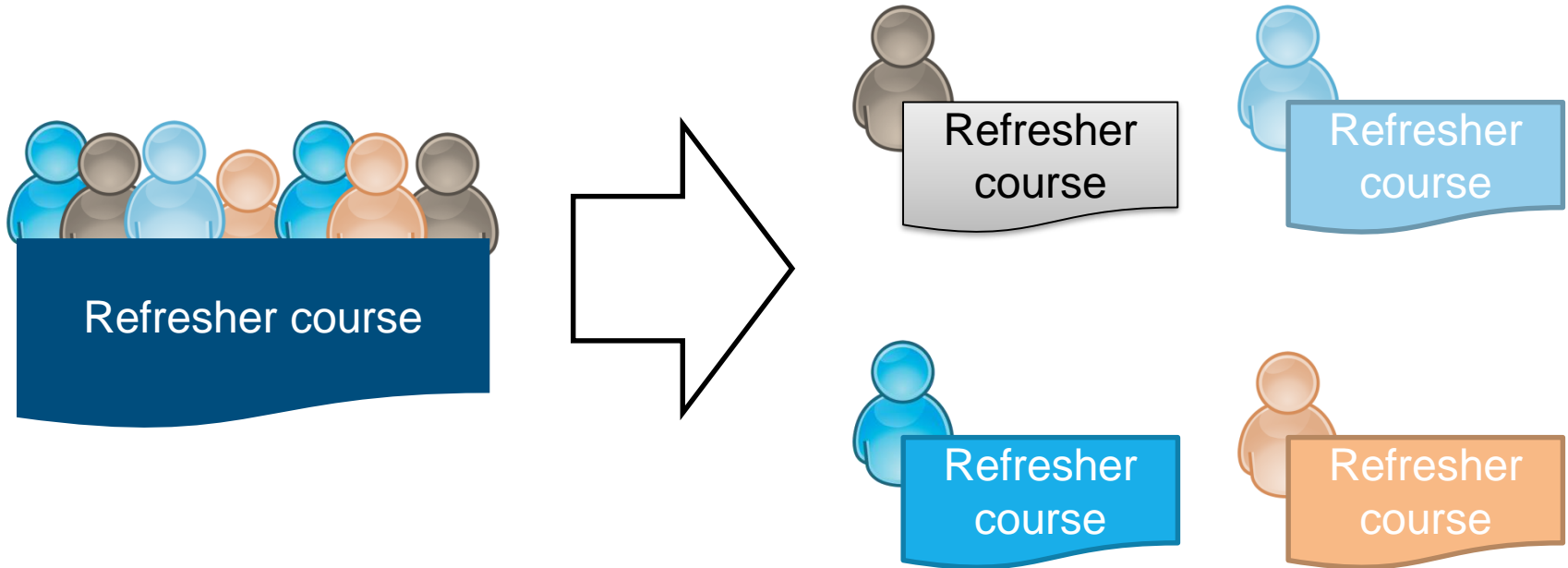
Next
presentation



Application: Fighter Pilot Continuation Training

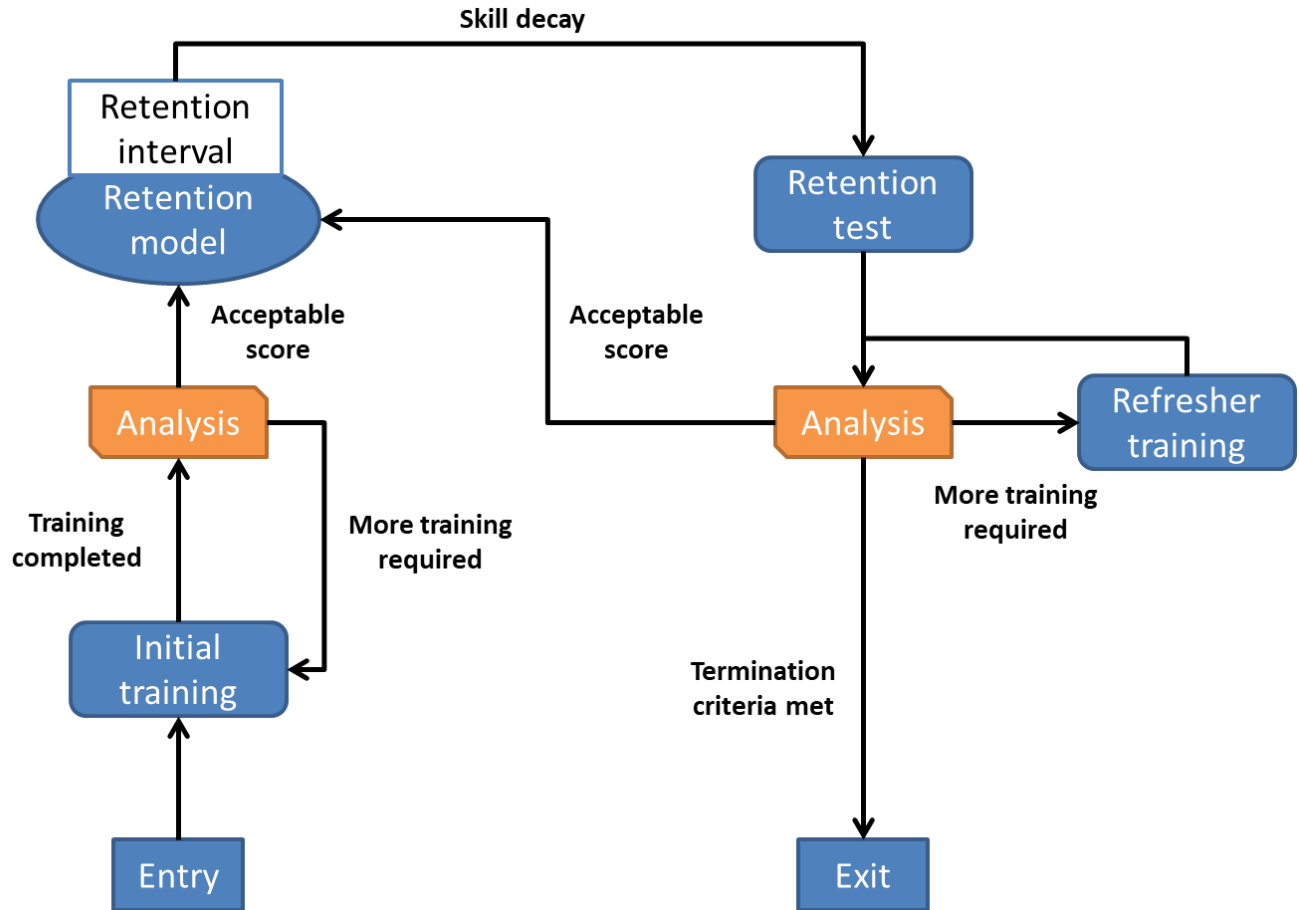


Performance-Based Training (PBT) core for personalisation of training



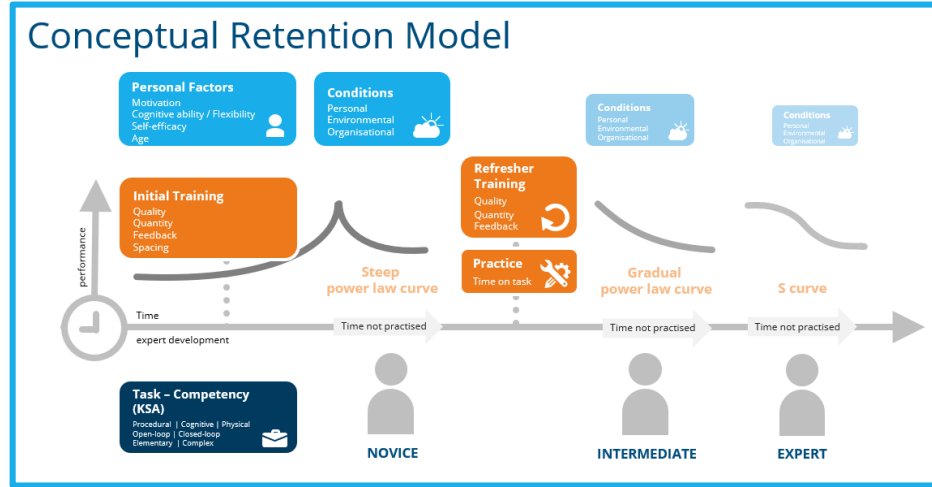


Personalised Training



Modelling retention

Modelling retention



- Two challenges:
 - Sparse data
 - Highly dimensional data



Challenge: Sparse data

- We measure performance at time A and at time B
- No measurements in between! Measurement = training / practice

- Result:
 - many test subjects required
 - with many different personal properties
 - with many different retention intervals



Challenge: Highly dimensional data

- The more complex the skills, the harder it is to:
 - **Define success** – what scores must be reached?
 - **Model retention per subskill** – interaction effects?



Modelling skill retention

- Bootstrapping approach
 - First model: simple rules based on $\frac{\text{retention test performance}}{\text{initial performance}}$
 - Second model: include assumptions about skill types and personal factors (such as game experience)
 - Third model: machine learning (deep learning) to predict optimal moments for retention training

A complex task

Space Fortress

- Video game by Mané & Donchin (1989):
 - “an experimental task for the study of complex skill and its acquisition”
- Our changes
 - Slightly simplified game settings
 - Better looks and sounds
- Fly a spaceship, destroy the fortress
- Requires complex skills to achieve high scores





Space Fortress

Perceptual skills

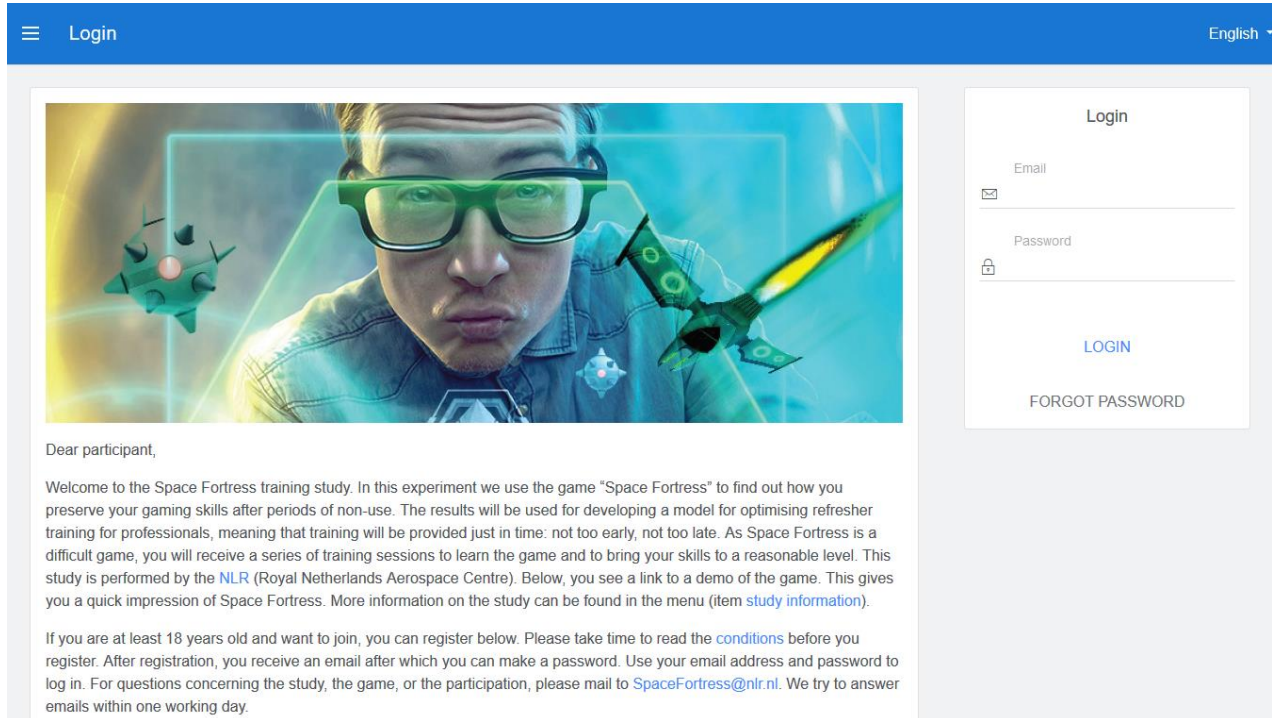
Cognitive skills



Motor control skills

Procedural knowledge

The SF adaptive instructional system

A screenshot of a web browser showing the login page for the Space Fortress training study. The page has a blue header with a menu icon, the text 'Login', and a language dropdown set to 'English'. The main content area features a large image of a person wearing VR goggles, with a futuristic green jet flying in a virtual space. Below the image is a text block starting with 'Dear participant,' followed by a welcome message and registration instructions. On the right side, there is a white login form with fields for 'Email' and 'Password', a 'LOGIN' button, and a 'FORGOT PASSWORD' link.

Dear participant,

Welcome to the Space Fortress training study. In this experiment we use the game "Space Fortress" to find out how you preserve your gaming skills after periods of non-use. The results will be used for developing a model for optimising refresher training for professionals, meaning that training will be provided just in time: not too early, not too late. As Space Fortress is a difficult game, you will receive a series of training sessions to learn the game and to bring your skills to a reasonable level. This study is performed by the [NLR](#) (Royal Netherlands Aerospace Centre). Below, you see a link to a demo of the game. This gives you a quick impression of Space Fortress. More information on the study can be found in the menu (item [study information](#)).

If you are at least 18 years old and want to join, you can register below. Please take time to read the [conditions](#) before you register. After registration, you receive an email after which you can make a password. Use your email address and password to log in. For questions concerning the study, the game, or the participation, please mail to SpaceFortress@nlr.nl. We try to answer emails within one working day.

<https://spacefortress.nlr.nl>



Data collection

Performance measures

- Total score
- Specific scores related to specific skills

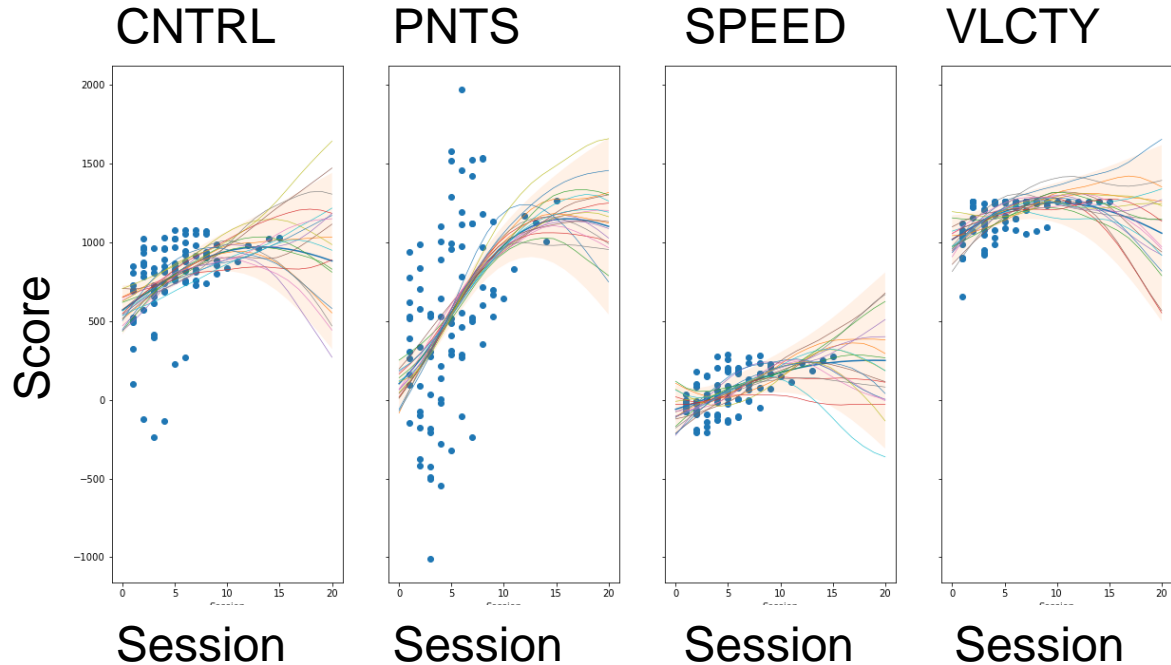
Selection of influencing factors

- Age
- Background (education, shooter games experience)
- Motivation

Second model: first results + simulated data (regression with built-in assumptions)

We assume different decay per:

- Subskill
- Age group
- Prior experience (e.g. gaming)



Third model: deep learning

- Non-linear function approximators
- Great at finding important features automatically

- Data-hungry
- Long runtimes

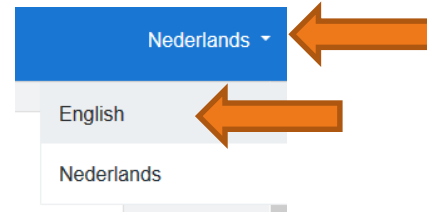




Results are pending

More participants needed

- <https://spacefortress.nlr.nl>
- Web-based (not on mobile devices)



Contact

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Acknowledgement

This study is part of the program Education and Individual Training (L1806) funded by the Dutch Ministry of Defence.



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Fully engaged

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