

1. “It is not what you teach, but what they learn that counts!”
2. 1st Acquire information, 2nd Remember it, 3rd Use it!

New Frontiers in Computer Supported Education

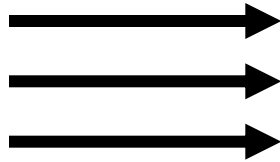
Dr Itiel Dror

i.dror@ucl.ac.uk

for more information, see:

<http://cognitiveconsultantsinternational.com/index.php?sub=drdror>

Understanding of
the brain/mind



Specific and practical
ways to construct and
enhance learning

TECHNOLOGY

must

built to fit

→ Takes more than an hour...

Tell the trainees exactly and clearly what to do (after, of course, you yourself are clear on that...)

→ Not so straight forward, more complicated

What colour is the ink?

RED

Why did you say 'red' the colour is clearly green...

→ It is not enough to clearly and exactly instruct...

→ You must take into account how the brain works

Look at the chart and say the COLOUR not the word

YELLOW	BLUE	ORANGE
BLACK	RED	GREEN
PURPLE	YELLOW	RED
ORANGE	GREEN	BLACK
BLUE	RED	PURPLE
GREEN	BLUE	ORANGE

You develop learning, great....., but:

1. Do they follow and do it the way you designed/intended? (not only in terms of content/instruction, but deeper issues, such as... does your learning motivate and engage the learner?)

And even if it does...

2. Do they get out of it what you designed/intended?

3. And... will they remember it? Will they use it back at the workplace?

These are critical questions that we as experts in learning must be able to answer, and to use in our work!

To answer these questions we need to understand the human brain. The brain carries all the secrets, insights, and operations involved in learning!

So, what do we need to know?

- We are a machine with **limited resources**
- Limited cognitive/computational/information processing capacity

→ → A key to all aspects of training

Let's see an example: Please count the number of appearances of the letter 'F' in the paragraph below

FINISHED FILES ARE THE RE
SULT OF YEARS OF SCIENTI
FIC STUDY COMBINED WITH
THE EXPERIENCE OF YEARS...

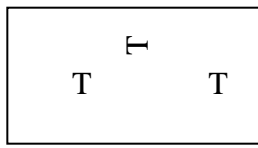
Let's see another example: Please count how many times the white team passes the ball (without it bounding off the ground)



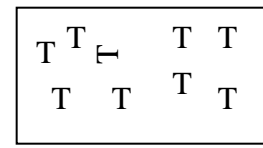
Let's see another example: Please read the below

THE PWEOR OF COGITVIE KONLWDEGE

Which is better?



VS.



Well, it really depends....

- If you put the ‘target’ with just a few more pieces of information, then you are more likely to:

- Capture the learners’ attention and focus it on the target,

But...

- At the price of minimising additional information, which may be important.

- If you put the ‘target’ within more information, then you can:

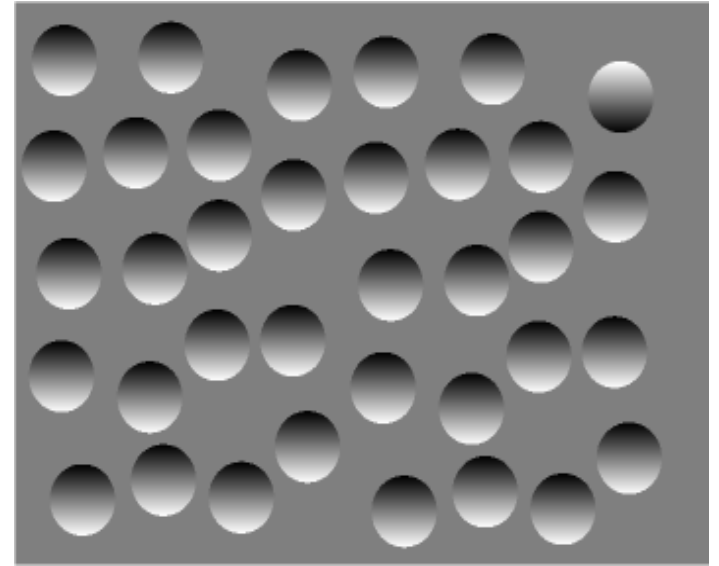
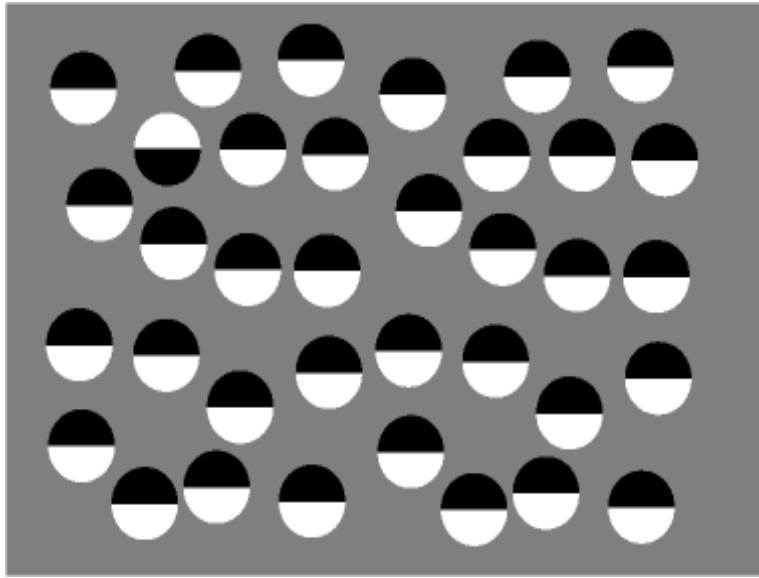
- Provide a lot of additional information,

But...

- At the price of possibly missing the target altogether.

So, which is better???

→ The correct balance is dependant on the specific situation



The cognitive system is **active and dynamic**. It is important to **engage** the cognitive system on its own terms, remember **RED**... work with it, definitely not against it!

What is the 'practicality' of this?

Must understand cognitive underpinning to make informed decisions how to construct training.

For example, be aware of cognitive load

→ not surpass the limited capacity of the system

→ does not mean less (quantitative), just work with it (qualitative, e.g., pop out effects) to convey the information more efficiently and effectively.

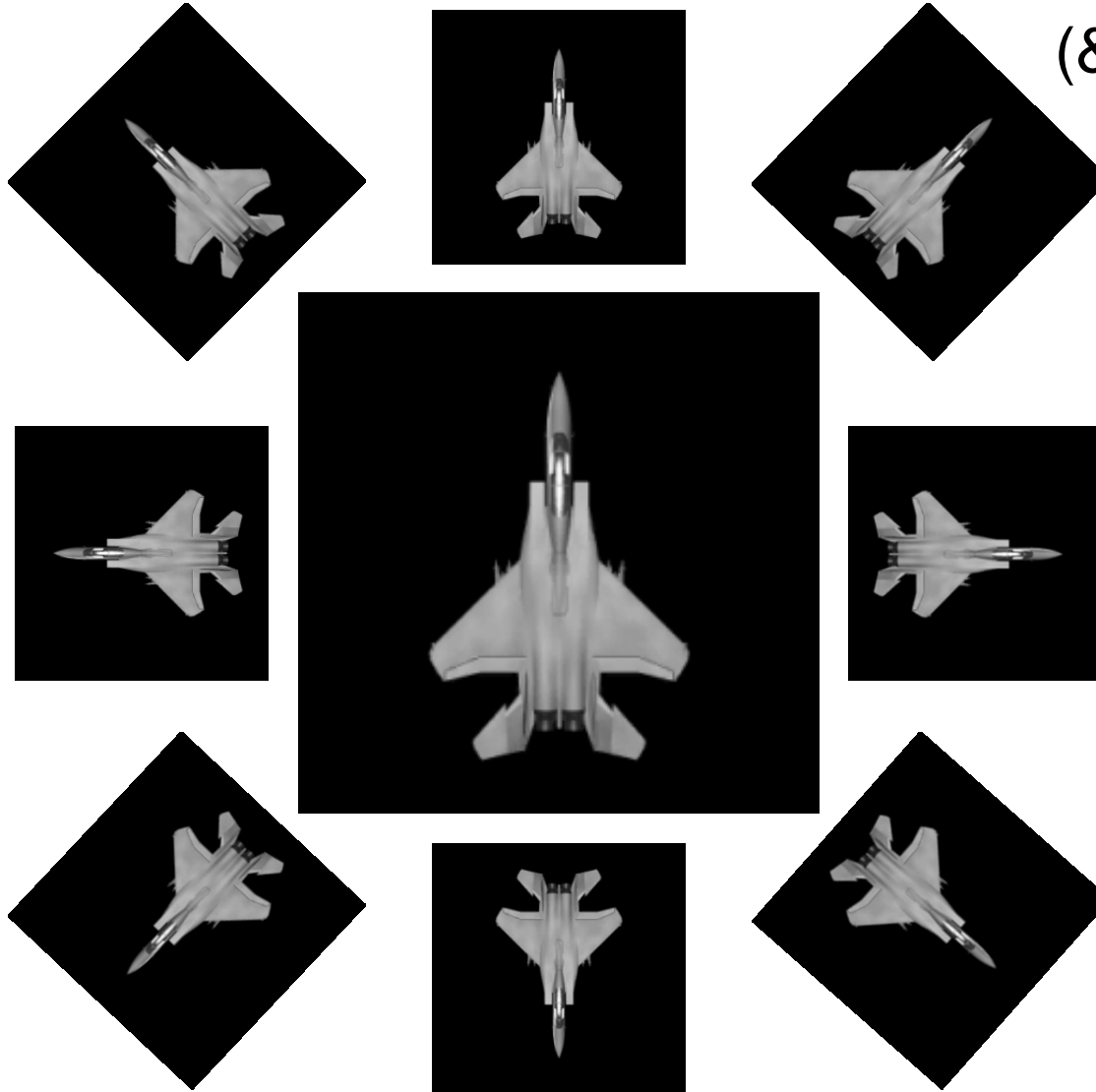
But there is much more!

Let's see a real world example and another way to properly harness and utilise the cognitive system to benefit and enhance learning. Be wise and sophisticated in how you design and deliver learning!

Training to identify aircraft

What orientations
are best to
use during
training?

And in what order
(& progression)
are they most
effective?



Object Identification as a Function of Discriminability and Learning Presentations: The Effect of Stimulus Similarity and Canonical Frame Alignment on Aircraft Identification

Alan R. S. Ashworth III
United States Air Force Research Laboratory
and University of Texas at San Antonio

Itiel E. Dror
University of Southampton

Aircraft that were relatively similar (homogeneous) and relatively dissimilar (heterogeneous) in appearance were studied at orientations either consistent (canonical) or inconsistent (noncanonical) with the environmental frame of reference. At test, participants' identification performance was measured with stimuli rotated to novel orientations within the picture plane. During learning and testing, identification of heterogeneous aircraft was better than that of homogeneous aircraft. At test, only identification of homogeneous aircraft revealed a strong linear degradation of performance as angular disparity between the novel test orientations and the original learning orientations increased. During learning and testing, identification was better for aircraft studied at canonical orientations than for those studied at noncanonical orientations. The results are discussed in terms of object identification, aircraft recognition training, categorization, mental representations, and visual mental rotation.

In this study, we examined two factors that bear on object identification theory and its application. First, we considered the overall visual similarity of a set of objects. Second, we considered the presentations of the objects during learning, specifically, the alignment of their internal reference frame with that of the environment. The general context in which we studied these factors was that of shape constancy across orientation manipulations. We measured identification performance as a function of orientation disparity between aircraft images presented during learning and, later, during testing.

identification theories: viewpoint-dependent theories (e.g., Tarr, 1995; Tarr & Bülthoff, 1995; Tarr & Pinker, 1989) and viewpoint-invariant theories (e.g., Biederman, 1987; Biederman & Gerhardstein, 1993). In the former, the object representations maintain the specific viewer-centered properties of the images presented during learning. In the latter, the object representations are object-centered abstractions derived from the images presented during learning. This difference in representational format entails distinct patterns in how learning presentations transfer to novel orientations. Viewpoint-dependent theories entail that the novel orienta-



F-15



F-18



Mig 29



SU-27

Optimising learning:

What aircraft, what order, what orientations, but also....

‘clever’ and sophisticated ways to making learning efficient!

Increase learning, but memory too... and its application!

APPLIED COGNITIVE PSYCHOLOGY

Appl. Cognit. Psychol. (in press)

Published online in Wiley InterScience

(www.interscience.wiley.com) DOI: 10.1002/acp.1383



Helping the Cognitive System Learn: Exaggerating Distinctiveness and Uniqueness

ITIEL E. DROR^{1*}, SARAH V. STEVENAGE¹
and ALAN R. S. ASHWORTH²

¹*University of Southampton, Southampton, UK*

²*United States Air Force Research Laboratory, USA*

SUMMARY

The caricature advantage demonstrates that performance is better when exaggerated stimuli are presented rather than a faithful image. This can be understood with respect to a theoretical framework in which caricaturing maximises the distinctiveness and thus minimises any perceptual or representational confusion. In this study we examine the possibility to harness caricatures to enhance learning. Thus, during learning the caricatures help the cognitive system pick up the unique and distinctive features of the learned material. This in turn helps to construct representations that correctly direct attention to the critical information. We trained 113 participants to identify aircraft

To Recap:

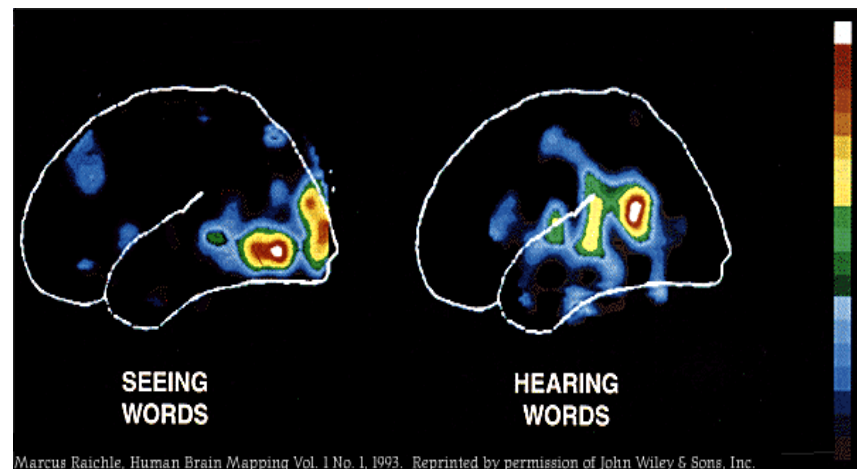
- The move from the *quantitative* to the *qualitative* approach!
- Not only a matter of *how much information*, but also (if not more) *how efficiently it is conveyed*.
- Not only a matter of how efficiently it is conveyed, but *what it conveys*!

(and, will it be remembered? will it be used?)

All of these, and more, depend on the brain!

We know the brain sub-specialises:

- Selective brain damage
- Dual task paradigm
- Functional brain scans



What is the practicality of 'modularity'?

- What parts of the brain are we 'targeting'?
- What are their characteristics?
- How can we spread the learning load among different modules?

→ Qualitative approach

→ Where we use our knowledge of the human brain to enhance learning, to maximise its efficiency!

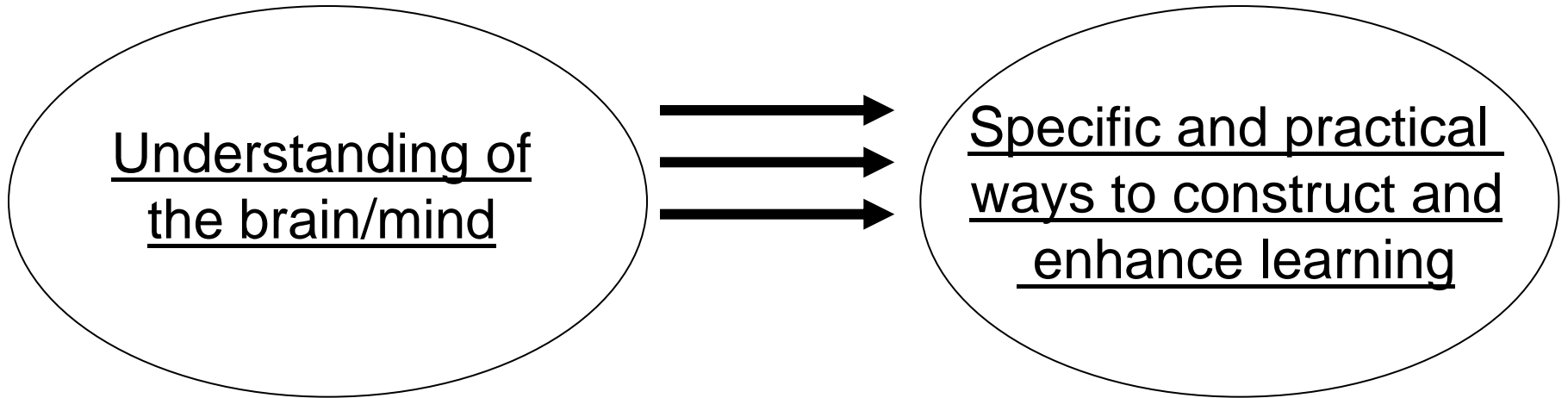
So, what do we need to know?

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→ → A key to all aspects of training

You need to use it!

But this is only one aspect there are many many more..



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- *Takes more than an hour...*
- ***Two more examples***

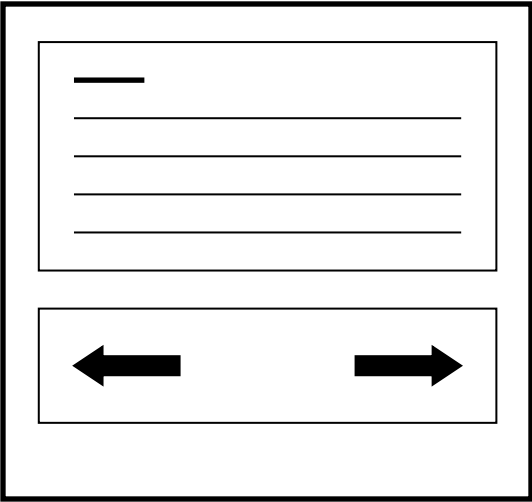
What determines whether people remember?

- The person:
 - Individual differences (ability, age, gender, etc.)
 - Motivation
 -
 - The material:
 - Relevance
 - Complexity
 -
 - Delivery/packaging:
 - Cognitive load
 - Mental representations
 - Feedback
 - Control
 -
- INTERACT!**
-
- A diagram consisting of three lines that originate from the underlined category names 'The person:', 'The material:', and 'Delivery/packaging:' and converge at a single point on the right side of the slide, directly above the word 'INTERACT!'.

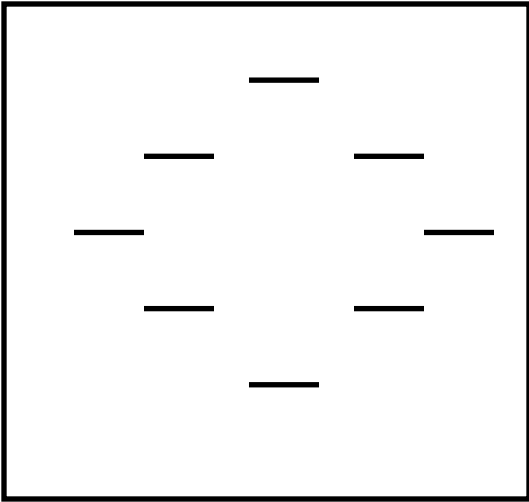
Did an experiment !

- Teach the same information to 180 learners
- Manipulate how it is delivered/packaged

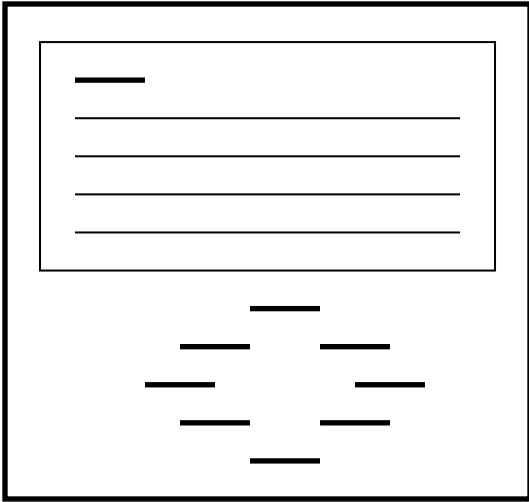
Manipulation



Linear layout



Index page in Star layout



Interconnected layout

Did an experiment !

- Teach the same information to 180 learners
- Manipulate how it is delivered/packaged
- Test how well the learners acquired and remembered the information (immediate recall tests)
- Test how well the learners retained the information in the longer term (delayed recall tests)
- Looked at material complexity effects (simple vs. complex)
- Looked at learners' age effects (young vs. older)
- Took a whole load of other measures! (overall time, time per page, repetitions, users' experiences, etc.)

What did we find?

- The ANOVA showed a significant main effect of layout on performance *only after the two week retention* test delay!
- A Bonferroni test revealed that the participants recalled significantly more information when it was presented to them in the *linear layout* than when it was presented in a fully connected layout, $F(2,70) = 3.51, p < .05$.
- The interaction between recall time and complexity was found to be significant, in immediate recall the participants who were presented with *simple information* recalled more than those who were given complex information, $t(74) = 2.91, p < .05$.
- However, *after two weeks there was no longer a significant difference in recall performance* between participants who studied the complex information and participants who studied the simple information $t(74) = 0.16, ns$.

Conclusions:

- It is complicate!!!
- Do the research and base your decisions on science! (intuition is not always right)
- Collect the 'right' data (e.g., what they remember after a delay, at work, etc.)
- Material 'delivery/packaging' affects learning and memory (is critical)

Interactive videos!

- Why
- What
- How
- Examples
- Scientific experimental testing/evaluation data

Why interactivity?

- When the learning is interactive, the learners are not passive, thus they are:
 - Involved
 - Engaged
 - Participating
 - Motivated
 -
- Good for 'brain' stuff:
 - Attention
 - Depth of processing and encoding
 - Utilises and efficiently uses the brain's limited resources
 -
- But.... not always good....!!!!

Innovative use of video → turn them interactive!

Rather than have learners watch a video:

- Asking them to pay attention
- Hoping they are engaged
- Praying they are not sleeping
- Having them memorise things to deal with later
- Not knowing *what* they are doing
- Not knowing *how* they are doing

Why not:

- Make sure they are paying attention
- Engage them!
- Don't let them sleep
- Know *what* they are doing
- Know *how* they are doing

What makes videos interactive?

The learners need to 'do things' and 'get things' while watching the video

'Do things'???

- Point with the cursor to a ...
- Detect
- Explain
- Answer questions
 - Multiple choice
 - Short answers
 -
-
-

'Get things'???

- Feedback
 - Self enhancing feedback
 - Informative feedback
- Rewards for meeting challenges
- Advancing in competitions
-
-

How to make videos interactive?

For film editing:

- **Adobe Premiere Pro CS3**

For creating the interactivity:

- **Adobe Flash CS3 Professional**
- **Adobe Photoshop CS3**

Purchase them as a bundle in one go, might be cheaper, for example the "Creative Suite 3 Production Premium", see: <http://www.adobe.com/products/creativesuite/production/>

– Example 1

– Example 2

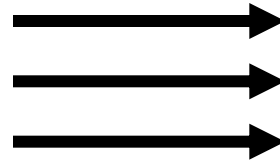
Scientific testing

Conditions:

Results:

- | | |
|--|-------|
| • Non interactive video | 40.83 |
| • Interactive video | 73.22 |
| • Non interactive video
with lecture/discussion | 64.44 |

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