

Introducing Project Konrad



Derek J. Smith, CEng, CITP
Chief Designer, High Tower Consultants Limited

<http://www.smithsrисса.co.uk>
smithsrисса@btinternet.com



An Online Tutorial
on the
Cognitive Simulation Software
specially prepared for
Shanghai Lectures 2011

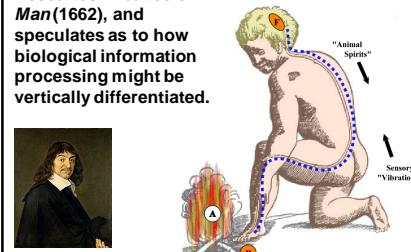
SECTION 1

THE PROBLEMS OF HIERARCHICAL COGNITIVE CONTROL



This image is from Rene

This image is from René Descartes' *Treatise of Man* (1662), and speculates as to how biological information processing might be vertically differentiated.



ABOUT THE AUTHOR

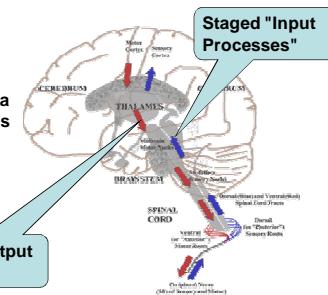


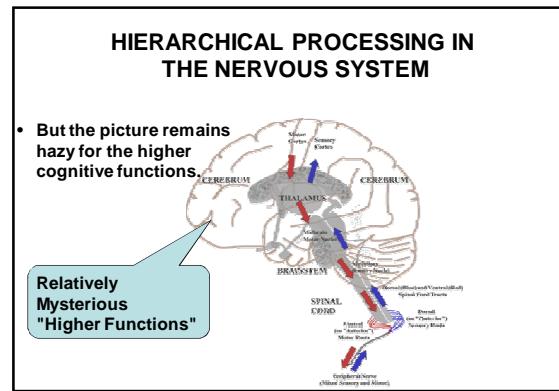
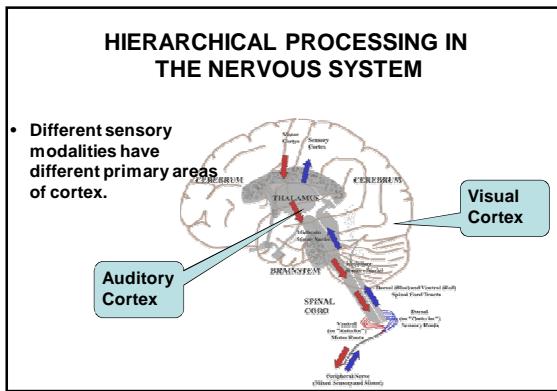
- During the 1980s Derek Smith worked for British Telecom, Cardiff, where he specialised in the design and operation of very large CA-IDMS "semantic network" databases. From 1991 to 2010 he taught psycholinguistics and cognitive neuropsychology to Psychology and Speech and Language Therapy undergraduates at University of Wales Institute, Cardiff.



HIERARCHICAL PROCESSING IN THE NERVOUS SYSTEM

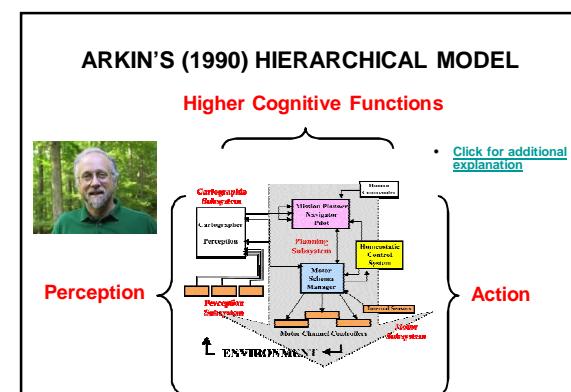
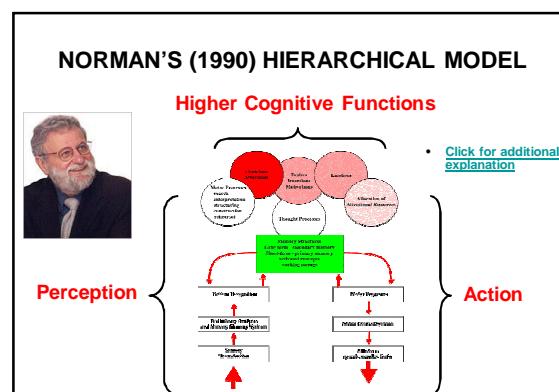
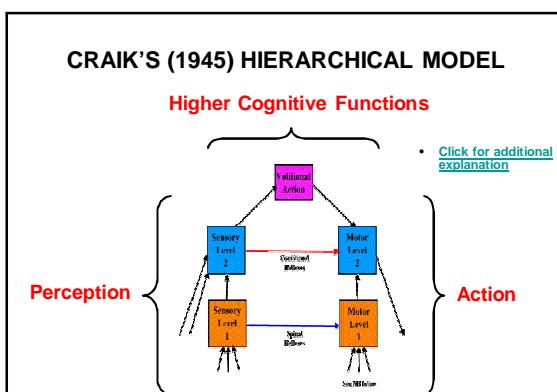
- By the late-19th century, neuropsychologists had a reasonable idea where many elements of higher cognition were located.





MODELLING HIERARCHICAL COGNITION

- Neuropsychological theory has been routinely held back over the years by the fact that there has never been a universally accepted graphical method to help us analyse the flow of mental information during cognition. Instead, different authors have presented their conclusions in different ways and at different levels of detail, to suit the thrust of their argument at the time.
- Here are three recent hierarchically structured diagrams, identical in intent, if not in detail. **NOTE THE COMMON UNDERLYING A-SHAPE**



BUT THERE ARE STILL MANY PROBLEMS

- (1) Cognition takes place so quickly that the interesting parts are over before they can be attended to.
- (2) Much of it – not least problem solving and sentence construction - is carried out subconsciously and therefore not available for conscious report or introspection.
- (3) There is no consensus as to the functional components of our cognitive architecture.

SO HERE IS OUR MISSION

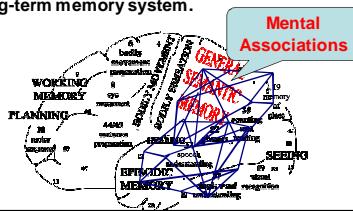
- (1) Guided by what is known about the biological nervous system, to show how complex mental functions can be built up from simple components in a CA-IDMS simulation of a mind.
- (2) To install some sort of "cognitive tracking" device within said simulation, **SO THAT WE CAN STUDY IT IN SLOW MOTION AFTER THE EVENT** (specifically, by having it record its actions to a hard copy time-stamped objective record).

SECTION 2

INTRODUCING PROJECT KONRAD

INTRODUCING PROJECT KONRAD

- *Konrad* is a machine consciousness project. It models the end-to-end flow of biological cognition, with especial emphasis on the **semantic network** nature of the biological mind's long-term memory system.



INTRODUCING PROJECT KONRAD

- The project is an entrepreneurial academic collaboration between the author and **International Software Products, Toronto**, and is so named as a tribute to the German engineer Konrad Zuse, one of the pioneers of digital computing.



INTRODUCING PROJECT KONRAD

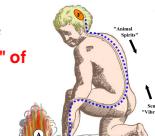
- The application platform is the CA-IDMS (Release 17) network database [[visit manufacturer's website](#)].
- The beauty of network databases is that they store each content item individually, with addressing pointers to and between each fragment. This allows you to spread your data around the available filestore while being able to go directly to it when you want it back again.
- For more on the explanatory potential of network databases as models of cognition, see Smith (2005a; 2005b).

INTRODUCING PROJECT KONRAD

- More than 250 mental domain entity types were identified during Konrad's Data Analysis. Fortunately, internal similarities and repetitions in the real world allow the 250 logical entity types to be abstracted down to only seven different physical record types.

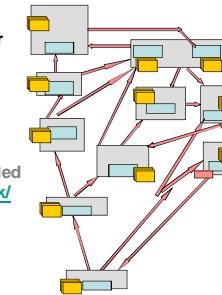
INTRODUCING PROJECT KONRAD

- The Processing Module (FDPX) and Long-Term Memory (LTM) records set up the basic cognitive architecture. 21 "occurrences" of the FDPX-REC are identified, containing between them a total of 36 functionally (but not physiologically) different types of LTM-REC.
- These 21 modules are the building blocks of Konrad's machine mind, and "animal spirits" of an electronic sort flow between them.



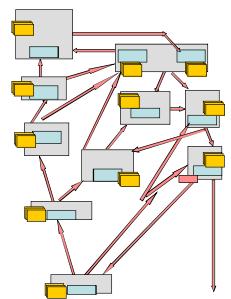
INTRODUCING PROJECT KONRAD

- Here are the 10 LTM-within-FDPX building blocks of cognition so far simulated, laid out as a cognitive processing hierarchy. Note the industry standard A-Shape.
- A fully captioned copy of the 21-module diagram can be downloaded from <http://www.smithsrиса.co.uk/PPTs/konrad-latest-cartesian.ppt>



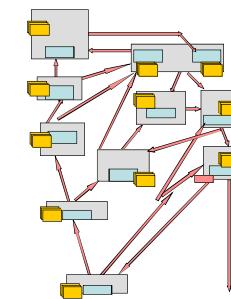
INTRODUCING PROJECT KONRAD

- Each module [FDPX, grey boxes] manages its own long-term storage [LTM, blue boxes].
- Neurotransmission takes place as pulsed short-term events [STM, pink arrows].
- Modules also maintain a medium-term record of recent activity [MTM, yellow boxes].



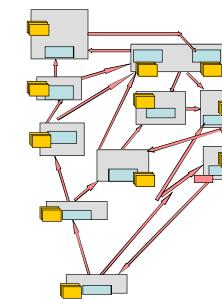
INTRODUCING PROJECT KONRAD

- BASIC DESIGN PRESUMPTION**
- Konrad presumes that biological LTM exists primarily to store associations.
- The software simulates this by storing two keys on every LTM record.



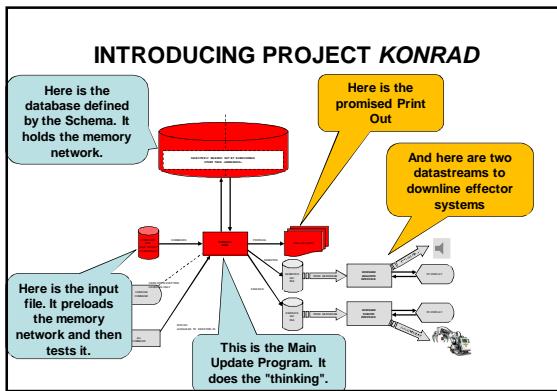
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- BASIC DESIGN PRESUMPTION**
- The A-Key is received from a precursor STM pulse and positions the LTM record itself. The B-Key is copied from the LTM record onto an output STM pulse so that the process can be repeated in the next module.



SECTION 3

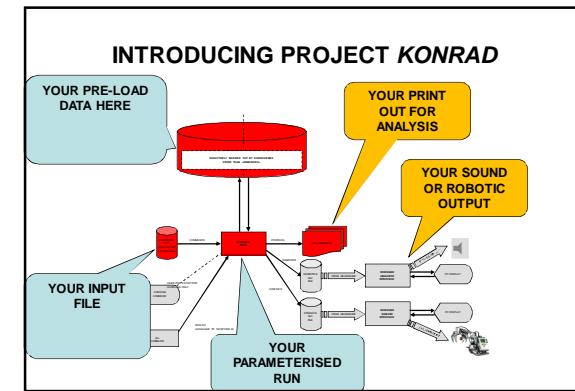
THE KONRAD PROCESSING CYCLE



INTRODUCING PROJECT KONRAD THE PRINT OUT

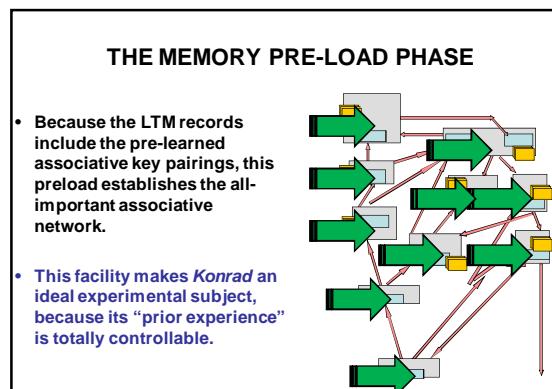
- Each posting line contains an item number, timing data, step identifier, physical (logical) record type, and both DB and External Keys. Comment lines are inserted to aid the explanatory narrative. COGNITION THUS BECOMES VISIBLE IN SLOW MOTION AFTER THE EVENT, AS PROMISED.

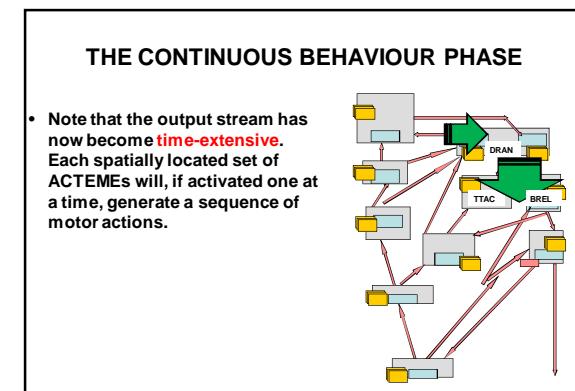
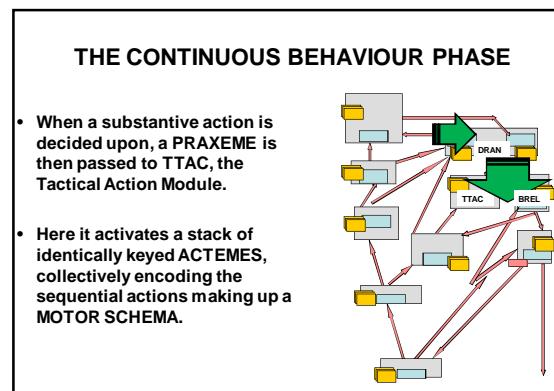
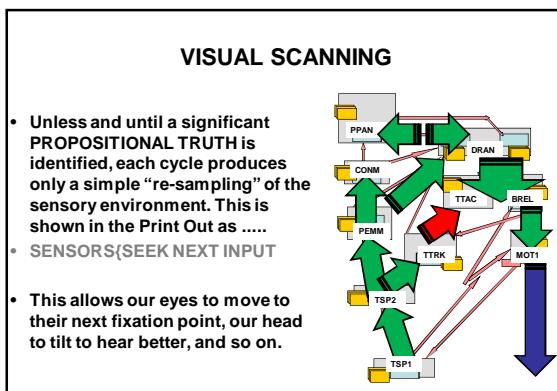
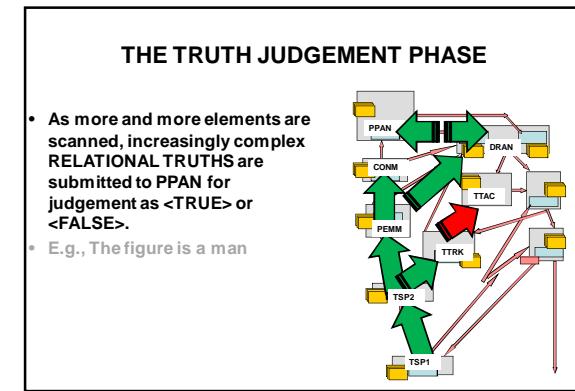
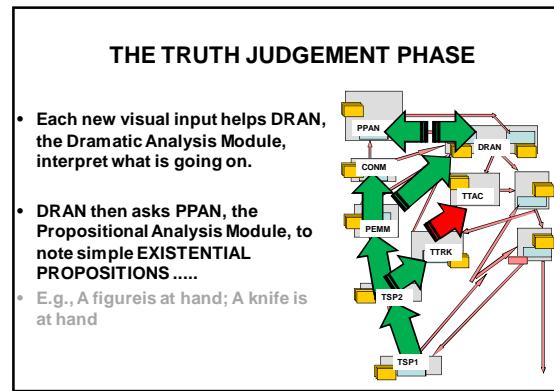
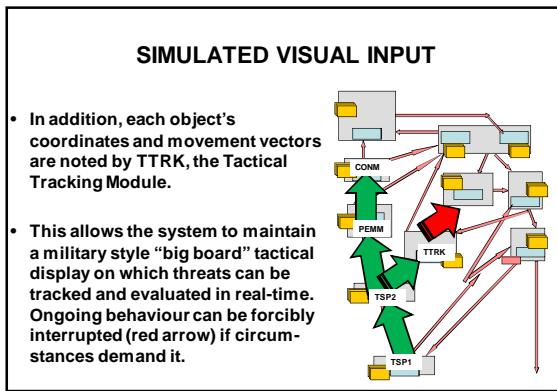
Item No	Time (thou)	Step Id	Rec Types	DB Kev	Error Status	External Kev Prefix	External Kev Body	External Kev Timestamp
P 015	00001226 2243	-	MOTV(MOTS)	P 011268(1001)	0000 MOTV-RECSOURCES	[SEEK	NEXT	INPUT] P 0248641
P 015	00001229 2244	-	STEV(MOTS)	P 010520(1001)	0000 MOTV-RECSOURCES	[SEEK	NEXT	INPUT] P 0248641
P 015	00001233 2245	-	STEV(MOTS)	P 011264(1001)	0000 MOTV-RECSOURCES	[SEEK	NEXT	INPUT] P 0248641
C	CONSIDER	-	-	-	-	NO LENGTH	DUPPLICATE	IN MOTH. Round. Depth to 0. MOTV COMPOSITION for this ACTEMENT

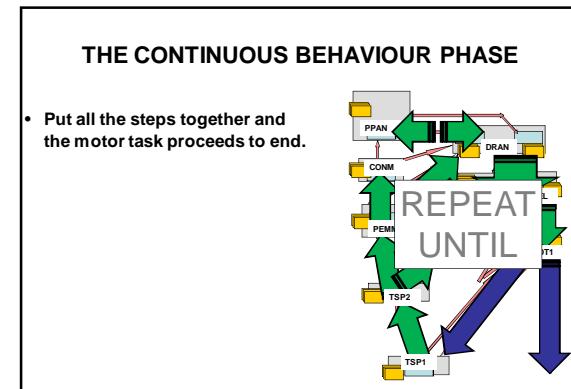
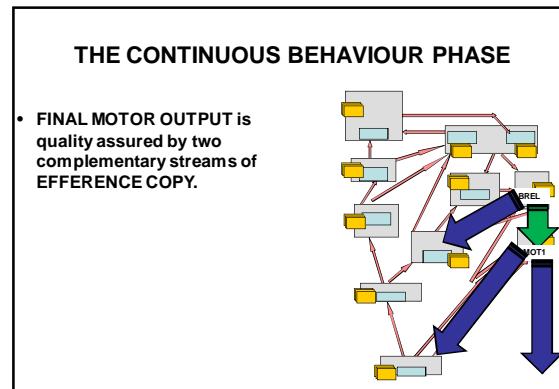
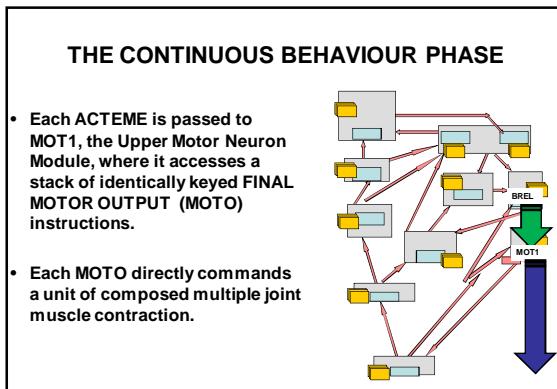


FIRST SIMULATED INPUT

- As in biological systems, sensory information is twice transcribed subcortically [once in the brain-stem and again in the thalamus].
 - In its “third sensory” form it is then physically recognised in PEMM, the Perceptual Memory Module, and conceptually cross-referenced in CONM, the Conceptual Memory Module.







STATE OF PLAY, SEPTEMBER 2011

- Konrad's unique selling points are
- It uses a network to simulate a network.
- Its storage capacity is effectively limitless.
- It delivers Craik's cyclical cognition.
- It simulates parallel processing without the expense of investing in a parallel architecture.

STATE OF PLAY, SEPTEMBER 2011

- Research "subjects" can be built to order, pre-loaded with controlled past experience. There are no practice or fatigue effects unless so required, allowing "impossible research" to be conducted. Konrad can also be deliberately "brain damaged" without ethical consequence.
- It is evidence-based. It follows the best available stage theories of perception and the best available schema theories of motor skill.
- IN OTHER WORDS, IT WAS BUILT BY A COGNITIVE SCIENTIST FOR USE BY COGNITIVE SCIENTISTS!

CALL FOR COLLABORATION

- ShanghAI colleagues with "impossible research" issues of their own may be interested in research collaborations. Konrad will be pleased to cooperate if it can. Simply e-mail the author at
smithsrисса@btinternet.com

THE END

ADDITIONAL READING

- Smith, D.J. (2005a). On database keys, with an application to the *Praxisproblem*. In Callaos, N., Lesso, W., and Palesi, M. (Eds.), *The 9th World Multi-Conference on Systemics, Cybernetics, and Informatics, (Volume IV)*. Orlando, FL: IIS. [[PLAY POWERPOINT](#)]
- Smith, D.J. (2005b). The problem of context in sentence production - Surely a case to re-convene the Data Base Task Group? In Chu, H.-W., Savoie, M.J., Sanchez, B., and Hong, S.-M. (Eds.), *The 3rd International Conference on Computing, Communications, and Control Technologies, (Volume III)*. Orlando, FL: IIS. [[PLAY POWERPOINT](#)]

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