Motivational and Emotional Controls of Cognition

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Psychological Review, 1967, 74, No. 1, 29-39

Presentation on 9/9/2004 for COGS 6962

Impact of the paper

- The first paper to try and integrate affect with the information processing view of human cognition
- Citation analysis shows that this paper started off work in the areas of
  - Control theory
  - Impact of affect on information processing
  - Impact of motivation on information processing

Introduction

- Motivation:
  - “gross differences between human behavior and the behavior of existing simulation programs”
- Bite the bullet and defend the information processing paradigm

Introduction

- Goals of the paper
  - “To show how motivational and emotional controls over cognition can be incorporated into an information processing system, so that thinking will take place in intimate association with emotions and feelings and will serve a multiplicity of motives at the same time”.

Key terms

- Motivation: The mechanism by which a tightly organized goal hierarchy is created and controlled. Motivation controls attention, the ordering or the goal hierarchy, the criteria for determining when a goal is complete (satisficing, impatience) and which can be applied to each of the goals associated with the behavior (multifaceted criteria).

Key terms

- Emotion: An *interrupt system* which can set aside ongoing programs when real-time needs of high priority are encountered. Emotion is a response to sudden intense stimuli from the environment which stems from an arousal of the autonomic nervous system.

Part I: Organization of behavior

“Motivation” of behavior in a serial processor

- If emotion is an interrupt system, need to understand the system (the organization of behavior) before the interruption occurs
- Two central assumptions about this system:
  - A) Organized in serial fashion
  - B) Regulated by a “tightly organized hierarchy of goals”

Serial organization

- Serial = “only a few things go on at a time”
- What defines a “thing”?
  - 1) Some elementary-ish symbol
  - 2) Indivisible unit of time
- Draw on memory research & use chunks as basic symbols
- Take 100msec as basic time unit

Serial organization (aside)

- Chunks and cycle times… sounds a lot like ACT-R
- The serial operation of the brain corresponds to serial operations on chunks (production firings)
- Though claims ~7 chunks can be modified in 100msec (current estimate is 2)

Hierarchical organization

- "More macroscopic processes are synthesized from sequences of elementary processes"
- These macroscopic processes can be thought of as programs
  - Ex: "Walk to the 1400 block" program
- Programs can call other programs -- large amount of nesting possible

Goal completion

- Need conditions for programs to terminate & return control to the next higher level
  - Aspiration achievement: Subgoal has been achieved
  - Satisficing: Close enough
  - Impatience: Takes too much time
  - Discouragement: Too difficult

Multiple goals

- On the surface, this seems like a pretty poor model of cognition (rote behavior, single-mindedness, etc)
- But not necessarily the case: Attention to multiple goals can be achieved through at least two mechanisms:
  - Queuing of goals
  - Multifaceted criteria

Goal queuing

- “If the organism is already occupied with achieving another goal, the new goal may be postponed and activated when the … earlier goal has been terminated.”
- Assuming goals are periodically completed, allows the organism to manage multiple tasks simultaneously
- (Same way computers simulate multitasking)

Multifaceted criteria

- “A goal need not be a unitary thing”
- Task A and Task B can be collapsed under the single goal “Complete tasks A and B”
- The goal “Get a PhD” hierarchically encompasses many subgoals

Conclusion Part I

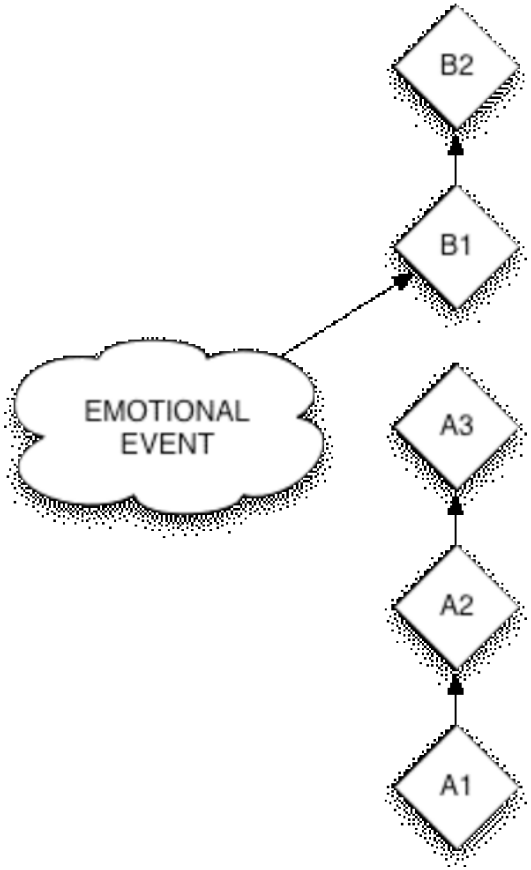
- Most models of the day exhibit rote, single-minded behavior
- But this is a limitation by choice, not necessity
  - Goal queuing, multifaceted goals, and termination criteria can implement complex behavior in pursuit of multiple simultaneous goals

Part II: Interruption and emotion

Emotion as an Interrupt System

- Three kinds of real time needs occur
  - Uncertain environmental events
  - Physiological needs
  - Cognitive associations
- These sudden intense stimuli interrupt the interpreter that manages the goal hierarchy, i.e. they focus all the available attention on themselves

Emotion as an Interrupt System



Emotion as an Interrupt System

- This interrupts the current goal program and substitutes it with a new goal program geared towards dealing with these real time needs.
- It also arouses the autonomic nervous system and causes emotional behavior
- The response program will depend on the nature of the interrupting stimulus and its intensity

Learning and Emotional Behavior

- Responses to stimuli can be genetic or adaptive
- Efficacy of the interrupting stimulus can change as it becomes more predictable or a modified response is learned
- Interruptions can be reduced by adding side programs (multifaceted goals)

Learning and Social Interaction

- Sophisticated cues about which responses from another person require an interruption are learned through socialization. With more such cues, more interruptions will occur.
- The responses to the early interruptions will lead to a modified response program which can predict interruptions and anticipate them

Latent learning

- Person may learn things irrelevant to their original goal but
  - Relevant to the interrupt mechanism and the response
  - Relevant to the side constraints of the goal
  - Any environmental event or artifact that attracts attention

Conclusion

- A goal-terminating mechanism permits the processor to satisfice, dealing generally with one goal (albeit a complex one) at a time, and terminating action when a satisfactory situation has been achieved
- An interruption mechanism, that is emotion, allows the processor to respond to urgent needs in real time.