Cognitive Psychology

PSYC230

Lecture # 3

REVIEW

Cognitive psych can trace its roots to back to early questions about the mind. First experimental studies used introspective method.

Functionalists then asked what was the mind used for?

Behaviourists argued it wasn't appropriate to have a science about an unobservable entity.

Cognitive Psych.
Behaviourism
Functionalism
Structuralism
Philosophy

Modern cognitive psychology came about because of difficulties addressing emergent issues in the study of behaviour.

Today's topic

Attention & Consciousness

Selective attention
Divided attention
Attentional capacity
Automaticity & attention

and this week's laboratory demonstration
The Duration of the Icon

"Attention is the taking possession of the mind, in clear and vivid form, of one of what seem several simultaneously possible objects or trains of thoughts…It implies withdrawal from some things in order to deal effectively with others"

William James, 1890

Attention transfers information into conscious awareness

sights & sounds
touch & taste
memories
thoughts

The 'Cocktail Party' Phenomenon
E. Colin Cherry (1953)

Shadowing task, dichotic listening

Target information (shadowed)

two varieties of sensory memory we will...

"The two varieties of sensory memory we will discuss are auditory and visual."

"In today's healthcare environment more and more New Zealanders are having to pay for care."

Demonstrated Selective Attention, participants could focus on one message, shutting out another

Non-shadowed information was 'rejected'
Subjects couldn't perceive changes from English to German to backwards speech

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Selective Attention

Cherry's participants did detect some things in the non-shadowed channel (*automatically*)
their name   changes in loudness
switch from male to female speaker

and they could track the shadowed message if it was switched from one ear to the other

Target information (shadowed)

two varieties of sensory memory had a great fall we will discuss are...

"The two varieties of sensory memory All the king's horses and all the king's men couldn't

"Humpty Dumpty sat on a wall, Humpty Dumpty had a great fall we will discuss are auditory and visual."

and they would pick up the last few words of the non-shadowed message as well! (automatic "read out" of echoic memory)

Selective Attention

Inattentional blindness (change blindness)
(Neisser 1976, Simons & Chabris, 1999)

Attention has both voluntary and automatic components

"Top-Down" and "Bottom-Up" processes

Top-down processes include a person's intentions and expectations (voluntary)

Bottom-up processes are directed by stimuli in the world that "catch" our attention (automatic)

Selective Attention
It has voluntary and automatic components

What else do we know about attention?

Attention is a limited capacity resource
(only so much to spend)

How do we know that?

Divided attention studies
(dual task paradigm)

Trying to attend to more than 1 thing at a time leads to poorer task performance

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Divided Attention

Dual Task Paradigm

Task 1: Tone counting
count aloud the number of tones you hear

Task 2: Signal detection
press a button every time red light comes on

Performance is pretty good on both tasks

Perhaps because Task 2 is discrete,
you can switch your attention back and forth
task switching

Divided Attention

Trying to attend to two different messages or tasks at the same time

Gertrude Stein's *automatic writing*

Ulric Neisser's multiple task paradigm
Students read stories
(comprehension test at end)
and   took dictation
and   categorised the dictated words
and   found dictated words that rhymed
With practice, they could do all the tasks simultaneously!

Attentional Capacity
How far can you spread your attention?
Central Capacity Theory
(Norman & Bobrow, 1975)

A single, central processor with limited resources, all inputs and tasks have to share the resources *(mental fuel)*

"*Like a pot of jam, can spread
all of it on a single piece of toast,
or put a little bit on lots of
pieces*."

Attentional Capacity

But we seem to be able to be share some tasks more easily than others

Talking (auditory/verbal) while playing tennis (eye-hand coord.) is easy

Conversing (auditory/verbal) while reading a textbook (auditory/verbal.) is hard

Task similarity affects our ability to divide attention between multiple tasks

Attentional Capacity
Task similarity affects our ability to
divide attention between multiple tasks

Multiple Resource Theory
(Navon & Gopher, 1979; Wickens, 1984)

Attention is composed of a set of processors
or modules, each with their own pool of
limited resources, one for visual, one for
auditory, one for motor coord, etc

"*Different pots of jam for different
kinds of toast*."

Attentional Capacity

Multiple Resource Theory predicts that tasks will
compete (be difficult to combine) whenever they
have to share the same attentional resources
(sensory modality)

How many different attentional resources do we have?

One way to find out is to see what kinds of
tasks compete for attention
(show sustained performance decreases)

Spatial Synergy Experiment
Driver & Spence (1994)

Presented 3-word "triplets"
simultaneously on right and left speakers
Participants had to repeat either
left or right triplets

On some trials a visual image of someone
saying the words was shown
Sometimes it matched the side they were
supposed to repeat, sometimes it was from
the opposite side

Spatial Synergy Experiment
Driver & Spence (1994)

Multiple Resource Theory predicted
no interference
between auditory and visual modalities

Results showed 68% accuracy for consistent
trials, 52% accuracy for inconsistent trials

Multiple Resource Theory responds….

Wickens argued that the different pools of
attentional resources aren't just
different sensory modalities

They are:
stage of processing
code of processing
modalities of input and output

But it is hard to specify how different tasks
will call on these different pools

An alternative:
Structural Theory

Interference between two tasks results
from competition for the same mental
structures, not just attentional resources

A lot of competition comes
at the response selection stage

*Can't begin to hit the brakes until you've
finished changing the CD
(even though you see the car ahead stopping)*

Psychological Refractory Period

Stimulus 1 | **perception** | **response selection** | **response production**

Stimulus 2 | **perception** | Refractory Period | **response selection**

Response selection for stimulus 2 can't
begin until response selection for Stimulus
1 is complete

But remember, you find divided attention
effects even if no response is required
(listening to or reading multiple inputs)

Attentional Capacity

1. Attention is a limited resource

2. Attention has both top-down (selective) and
bottom-up (automatic) components

3. Task similarity affects our ability to
divide attention between multiple tasks

4. Task familiarity (practice) affects our ability to
divide attention between multiple tasks

*Once a task is proceduralised (automatic)
it requires less attention*

Attention and Automaticity

Automatic processes:

Occur without intention
Occur without awareness
Occur without effort
Occur rapidly (< 1 sec)

What determines automaticity?
Practice

Alan Turing estimated it took 2,000 to 5,000
hours of practice to become expert enough to
have fully automatic responses

Attention and Automaticity

Practice determines automaticity

What else determines automaticity?
Task complexity (difficulty)

Long-duration complex tasks, that require
lots of processing resources,
will take a much longer to become automatic

Automaticity develops through the process of
proceduralisation
Individual thoughts and actions repeated together
often enough become combined into a single unit

Attention and Automaticity

Open-loop program (ballistic)
cognitive procedures & motor programs

procedures and programs can be executed as
a single unit, without pausing for feedback

Automaticity as 1-step retrieval from memory
(Gordon Logan,1980)

With practice, you develop a memory trace of
what, when, and how you did something
More practice = more memory traces (a schema)
Automaticity is single-step retrieval
of past responses to situations

Automaticity

Can lead to *action slips*

Go to the garage to get your gumboots,
end up getting in the car by mistake

Putting the milk back in the fridge
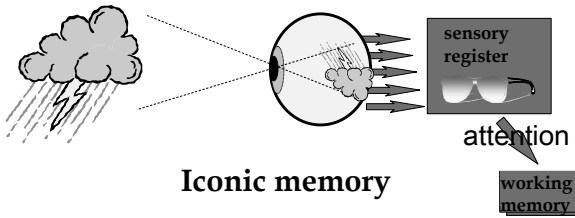put the teapot in too

Throwing dirty laundry in the rubbish bin
instead of the laundry hamper

Driving Without Awareness
Highly practised routes (to and from home
and work) leads to proceduralisation

Automaticity

A lot of cognitive processes are automatic

Sensory Register

attention

sensory register

working memory

Iconic memory

Helps to 'smooth out' visual input

This week's laboratory demonstration:
Duration of the Icon
George Sperling (1960)

Asked *"How much does iconic memory hold?"*
"How long does it last?"

Presented arrays of letters for 50 msec

C	F	P	Y
J	M	B	X
S	G	R	L

Participants had to report as many letters as they could recall

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Partial Report Technique

Participants could only recall
about 4-5 letters correctly, unless they
used the partial report technique

When the array was followed by a high, medium
or low tone, participants recalled top, middle or
bottom row, depending on the cue.

Recall was nearly 100% for any of the rows!

If the recall cue (tone) was delayed, performance
deteriorated as the icon faded.

Cognitive principle: visual sensory register holds
everything you look at, briefly.
You can bring any part of it into
consciousness before it decays
(*if you know where to look*).

Hypothesis: the percent of letters recalled
will be higher for partial report technique,
and better for shorter cue delays

**Remember, iconic memory is automatic
(and very short)
*go with the flow***

Independent variables:
Partial report vs full report (cue vs no cue)
and amount of cue delay (0, 150, or 500 msec)

Dependent variable:
Percent of letters recalled in each condition

Write down your results on the data sheet

Also write down your subjective impressions
(any strategies you used, what it felt like)

Next time

What attracts your attention?

Preconscious Processing

Theories of Attention