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Auditory distraction: The resistible and the indomitable

Robert Hughes¹

Mark Hurlstone¹ Dylan Jones¹ Francois Vachon²

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¹Cardiff University ²Universite Laval

APCAM 2011

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- An adaptive cognitive system needs to strike a balance between two opposing forces (Allport, 1989; Neumann, 1987):
 - selectivity.....
 - ...vs. permeability
- The price of permeability is distractibility
 - irrelevant stimuli can sometimes compromise goal-driven behaviour

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• Focus on auditory distraction—disruption of goal-driven behaviour by task-irrelevant sound

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- Short-term memory—and serial recall in particular—is very vulnerable to auditory distraction (Jones, Hughes, & Macken, 2010)
- Irrelevant-Sound Paradigm
 - participants complete visual-verbal serial recall task, whilst exposed to task-irrelevant sound
- Evidence for two forms of auditory distraction:
 - *attentional capture*, brought about by a single unexpected auditory event (e.g., "AAAAAB"—*Deviation Effect*)
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• Two strands of evidence buttress the notion that these forms of auditory distraction are distinct (Hughes, Vachon, & Jones, 2007):

• Locus of irrelevant sound:

- deviation effect only observed during encoding phase—not during retention phase
- changing-state effect observed during both phases
- Serial order requirements of focal-task:
 - deviation effect observed on focal tasks that do and do not require retention of serial order
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- According to *duplex-mechanism account* (Hughes et al., 2007):
 - deviation effect is a resistible form of distraction
 - changing-state effect is a indomitable form of distraction
- Some (indirect) empirical support
 - high working memory capacity 'shields' against deviation, but not changing-state effect (Conway et al., 2001; Sorqvist, 2010)

Aim:

 Seek direct evidence for this viewpoint by exploring influence (or lack thereof) of top-down factors on the two forms of distraction

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- Experiment 2
 - impact of task-load and forewarning on deviation effect
- Experiment 3
 - impact of task-load (Exp: 3a) and forewarning (Exp: 3b) on changing-state effect

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- Is attention capture by an auditory-deviant brought under top-down control under difficult focal task conditions (high 'task-load')?
- Immediate serial recall of lists of eight visually conveyed digits
- Manipulated focal task sensory-encoding load:

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• Encoding of to-be-remembered visual lists accompanied by task-irrelevant sound:

no deviant trials (87%): L B M G A C K Q J S deviant trials (13%): L B M G A C K Q J S

Prediction:

• High focal task sensory encoding load should abolish the deviation effect

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Experiment 1: Data



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Experiment 1: Data



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Experiment 2: Task-load, warning, and the deviation effect

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- Does the impact of task-load on auditory attentional capture reflect an active or passive form of control?
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 - ...vs. passive perceptual gating (cf. Lavie, 2005)
- Experiment 2 co-manipulated task-load and foreknowledge of an impending auditory deviant

Load x Deviation x Warning

ogic:

• Similar (and independent) effects of load and warning would support the top-down blocking account

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• Immediate serial recall of eight visually conveyed digits

• Accompanied by task-irrelevant background sound

Steady-State (SS) trials (87%): B B B B B B B B B B B Changing-State (CS) trials (13%): L B M G A C K Q J S

• Experiment 3a:

• impact of task-load

• Experiment 3b:

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- Distraction by an auditory deviation is markedly attenuated by:
 - high task-load
 - foreknowledge of deviation
- Distraction by changing-state sound is insensitive to both factors
- Results support and flesh out the duplex mechanism account of auditory distraction (Hughes et al., 2007):
 - a resistible attentional capture process (deviation effect)
 - a indomitable conflict between sound and task process (*changing-state effect*)

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