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# Gumming up earworms and other unwanted thoughts

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## Earworms

"...the definition of an earworm is a piece of music that repeats a number of times in the head, without being recalled voluntarily. The piece of music can be either a part or a whole piece and may be known or novel."

Williams (in press)

The majority of such experiences are not unpleasant (e.g., Beaman & Williams, 2010; Halpern & Bartlett, 2011) but some may be:

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## E. A. Poe - The imp of the perverse (1845)

"I could scarcely get rid of it for an instant. It is quite a common thing to be thus annoyed with the ringing in our ears, or rather in our memories, of the burthen of some ordinary song, or some unimpressive snatches from an opera. Nor will we be the less tormented if the song in itself be good, or the opera air meritorious."

<https://www.youtube.com/watch?v=TZQebWbcI44>

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## A number of assumptions:

1. Apart (perhaps) from the "automatic" repetition and involuntary appearance, earworms are auditory images like other auditory images and subject to the same processes and constraints.
2. They are also governed by processes of ironic mental control (Wegner, 1989) - some evidence for this in Beaman & Williams (2013)

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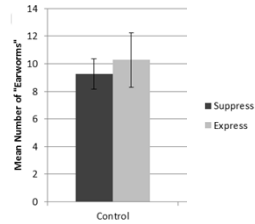
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## Therefore:

- Playing participants a tune and then asking them NOT to think about it for the next three minutes should pretty much guarantee that they will be unable NOT to think about it over that period (from [2])
- Anything which is already known to reduce people's ability to *voluntarily* generate an auditory image will also reduce the quality and/or number of *involuntary* auditory images (from [1])

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## Thought suppression and earworms:



Data from Beaman, Powell & Rapley (2015, Exp. 1) QJEP

## Auditory imagery

- What do we know about auditory imagery *and what interferes with auditory imagery?* Imagery and working memory seem to involve similar resources (Baddeley & Andrade, 2000).
- Verbal working memory is disrupted by concurrent articulation (Murray, 1966 & others *ad nauseam*)
- The voluntary generation and manipulation of auditory images is impeded by concurrent tasks intended to load up subvocalisation and rehearsal processes such that:

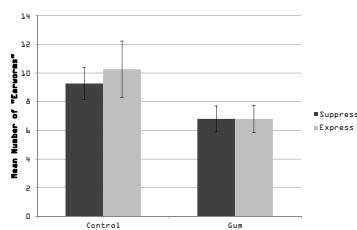
## Interference with auditory imagery

- The rated vividness of auditory imagery is reduced (Baddeley & Andrade, 2000)
- Ambiguities within an auditory image are difficult to resolve (Reisberg, Smith, Baxter, & Sonenshine, 1989)
- It becomes difficult to scan familiar melodies in search of a target note (Smith, Wilson & Reisberg, 1995)
- Additionally: Activation of supplementary motor area (SMA) during imaging of pitch (Halpern & Zatorre, 1999) and timbre (Halpern, Zatorre, Bouffard & Johnson, 2004). Vividness of auditory imagery also correlates with grey matter density in SMA, amongst other areas (Lima et al., in press).

## A non-vocal interference technique: Chewing

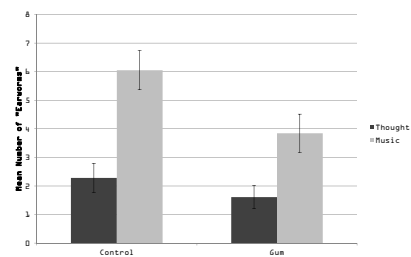
- Kozlov, Hughes & Jones (2012) showed that chewing gum can impair verbal short-term memory
- Studies by Smith and colleagues used chewing-gum as a means of disrupting subvocalisation with subsequent effects on auditory imagery (e.g., Smith et al., 1995)
- One online anecdotal report recommended chewing a cinnamon stick to erase earworms

## The effects of chewing (1)



Beaman et al. (2015) Exp. 1

## The effects of chewing (2)



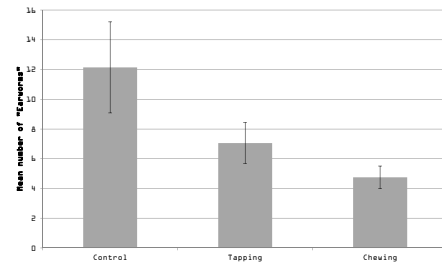
Beaman et al. (2015) Exp. 2

## Expertise and a control condition

- Experiments 1 & 2 compare chewing to a “do-nothing” control - This may not be appropriate
- Experiment 3 compares chewing to a tapping control (a generalised distractor, cf. Baddeley & Andrade, 2000)
- Informally - what are the effects of musical expertise? Musical activities predispose towards involuntary musical images (e.g., Liikkanen, 2012) but might not musicians be better able to manipulate and suppress unwanted musical images (earworms)?

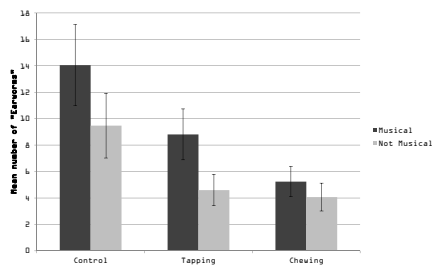
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## Experiment 3 - published results



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## Post-hoc breakdown



Musical = > 2 years experience with musical instrument (n=21/36)

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## Conclusions

- Specific earworms can be “planted” by means of ironic mental control
- Earworms (or unwanted and involuntary musical images) are supported and maintained by similar cognitive mechanisms to other auditory-musical images - even though their appearance may be undesired
- It *may be* that musicians are not only more prone to earworms than those who do not engage in musical activities but also find them harder to dismiss.

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