HAMPSHIRE COLLEGE

Attentional Biases for Cigarette and Anti-cigarette Cues in Ex-smokers

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Objectives

- Examine the process of attentional bias to cigarette-related stimuli over the course of cigarette addiction
  - ***Hypothesis***: Recent ex-smokers will elicit an attentional bias for cigarette-related and anti-cigarette images in comparison to neutral images.
- Determine whether or not anti-smoking advertisements that clearly display an image of a cigarette induce cravings for cigarettes in current smokers and ex-smokers.

Background

- Substance-related stimuli induce reactions similar to those elicited when using the actual substance such as pleasure, subjective craving, and neurophysiological activation[1,2,3,4]
  - These stimuli also attract and hold substance users' attention, a phenomenon known as an attentional bias[3]
- If an attentional bias is present, substance users will pay more attention and elicit a greater P300 to substance-related images as opposed to the neutral images (attentional bias)[5]
  - The presence of this attentional bias triggers a conditioned response of craving for the substance which has the ability to actually induce drug use in current users as well as relapse in ex-users[3,4]
- Past research has found:
  - Cigarette smokers show an attentional bias for cigarette-related images as compared to neutral images[6,7,8]
  - Cigarette smokers show an attentional bias for anti-cigarette images as compared to neutral images[9,10]
  - Ex-cigarette smokers show an attentional bias for cigarette-related images as compared to neutral images[11,12]

Fig. A

Fig. B

Methods

- EEG signals were recorded while participants viewed three sets of 42 (or 43) images on a computer screen.
  - Each set contained 14 cigarette-related images, 14 anti-cigarette images, and 14 neutral images presented one at a time in a random order at 2000ms intervals.
- In order to make sure participants were paying attention, they were told to be on the lookout for an image of a black cat. At the end of each of the three blocks, participants were asked to write down on a piece of paper whether or not they saw a black cat in that block.
- The ERP component investigated was a positive waveform elicited within the 300-400ms timeframe at the PZ electrode site.

Participants

- **13 Non-Smokers (NS):** Never smoked a single cigarette in their lifetimes
- **16 Smokers (S):** Smoked an average of ten or more cigarettes per day at the time of study participation
- **10 Recent ex-smokers (RXS):** Quit smoking between six months and ten days prior to study participation without smoking a single cigarette within that period
- **12 Established ex-smokers (EXS):** Quit smoking at least nine months prior to study participation without smoking a single cigarette within that period

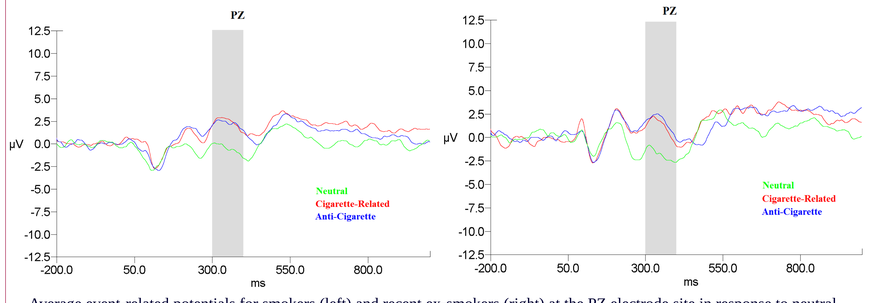
Fig. C

Fig. D

Fig. E

Figures A-G: These are some examples of images used as anti-cigarette stimuli in the study. Images were considered anti-cigarette as long as they contained an easily visible cigarette and revealed the negative aspects of smoking and/or associated cigarettes with death. All images were labeled as anti-cigarette images by a randomized group of 52 judges.

Results



Average event-related potentials for smokers (left) and recent ex-smokers (right) at the PZ electrode site in response to neutral (green), cigarette-related (red), and anti-cigarette (blue) images. The shaded area indicates the 300 – 400 ms timeframe.

- Smokers and Recent ex-smokers:
  - P300 amplitudes were significantly higher in response to cigarette-related (S: $p \leq .001$; RXS: $p < .05$) and anti-cigarette (S: $p \leq .01$; RXS: S: $p \leq .001$) images as compared to neutral images.
  - There was no significant difference in P300 amplitudes between cigarette-related and anti-cigarette images.
- Established ex-smokers:
  - P300 amplitudes were significantly higher in response to anti-cigarette images as compared to neutral images ($p \leq .001$).
  - There were no other significant differences found.
- Non-Smokers:
  - No significant differences between P300 amplitudes and image types were found.
- All participants were correct in reporting whether or not a black cat was present for each block.

Discussion

- Both, smokers and recent ex-smokers showed attentional biases for cigarette-related and anti-cigarette images as compared to neutral images.
- Established ex-smokers displayed an attentional bias for anti-cigarette images in comparison to neutral images.
- Non-smokers did not show any attentional biases for cigarette-related or anti-cigarette images.
- **Overall, this study supports the original hypothesis and suggests:**
  - **Anti-cigarette images clearly displaying an image of a cigarette could possibly induce craving in current smokers, recent ex-smokers, and established ex-smokers.**
  - **Attentional biases and sensitization to cigarette-related and anti-cigarette stimuli change in ex-smokers depending on duration of time since quitting.**

Next Steps

- More care should be taken in the design and dissemination of anti-smoking advertisements in order to make sure they are efficient in their purpose and do not make it harder for users to quit.
- Further studies need to be conducted to better understand the line between recent ex-smokers and established ex-smokers in order to develop more personalized ways to help them remain abstinent.
- This study should be conducted with other methods of measuring attentional bias such as the Stroop task and the eye-tracking device.

Fig. F

Fig. G

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* See handout for image references.

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