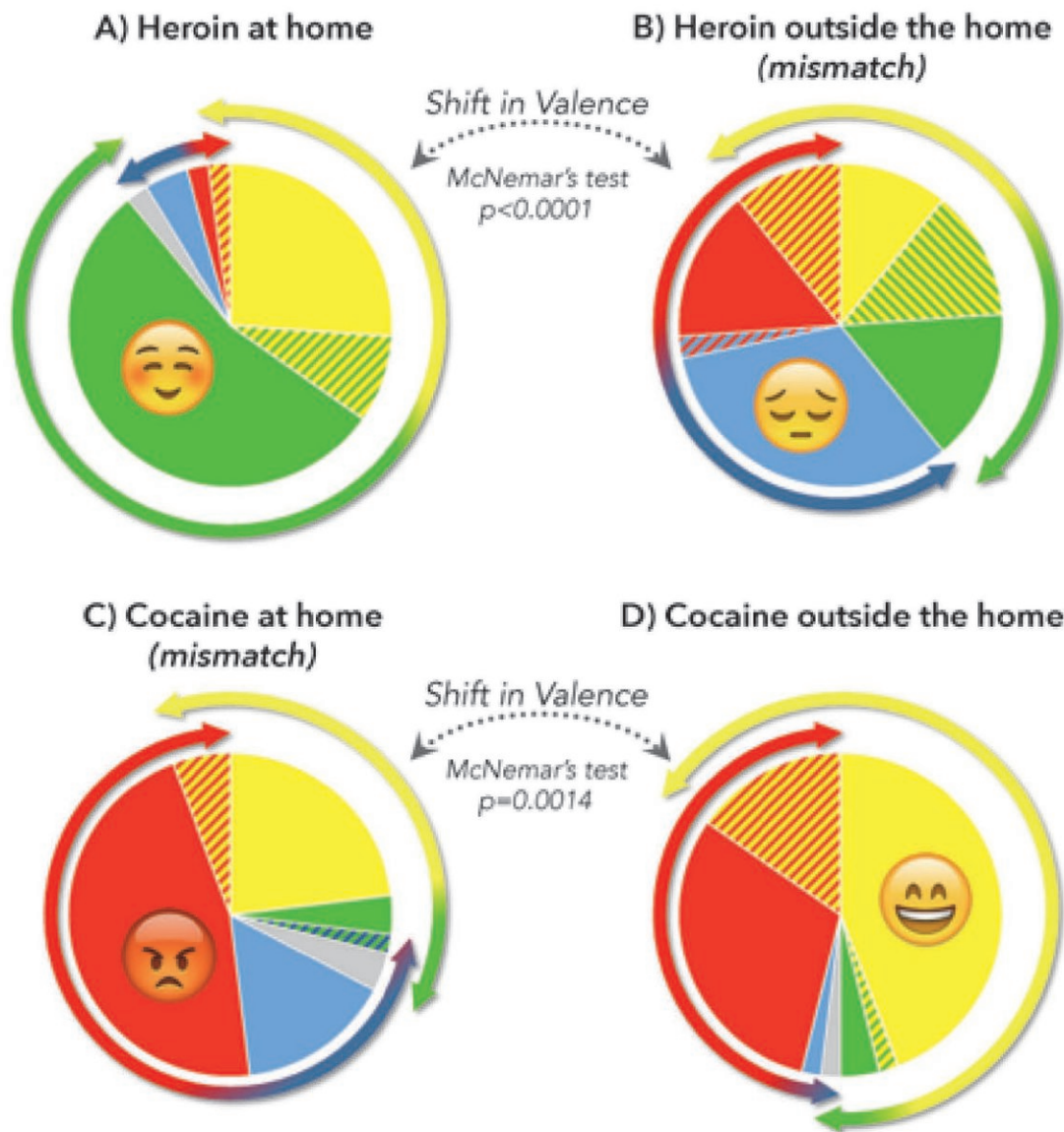


Revealed: Why drug users prefer heroin at home, but cocaine while out

May 14 2018



Subjective appraisal of the emotional valence of drug experience as a function of drug and setting. The pie charts show the proportion of participants reporting the affective states detailed in the legend and illustrated in Figure 6 (see text for details) after heroin (A and B) or cocaine (C and D) use. The McNemar's test indicated significant shifts in valence as a function of the setting of drug use. Notice that a small proportion of participants reported two affective states (hatched lines) or more (grey). Credit: De Pirro et al., *JNeurosci* (2018)

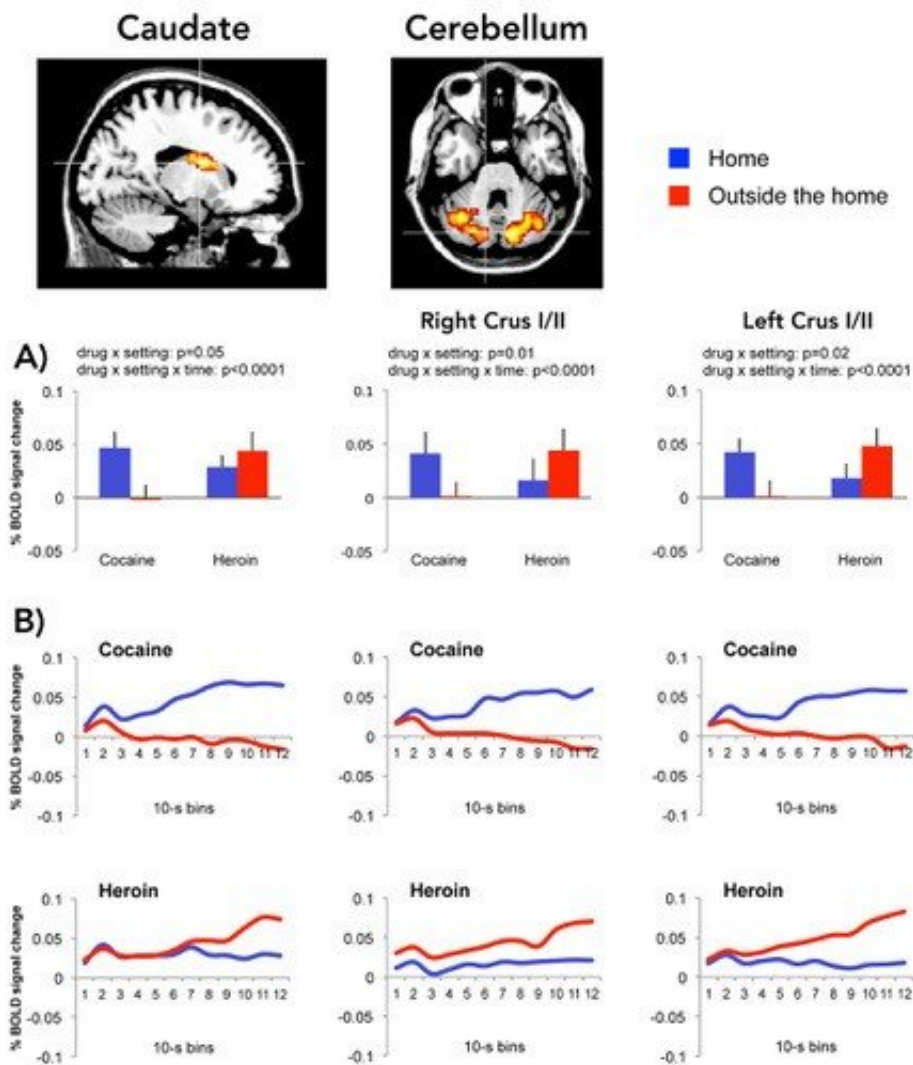
Neuroscientists at the University of Sussex have shown by using brain scans of drug users that heroin stimulates a more pleasurable response when taken at home but cocaine is more pleasurable outside the home, such as in a club. The findings demonstrate for the first time that the setting of drug-taking is an important factor in how the brain processes the experience, and could have important implications for the treatment of drug addiction.

The study is published today, Monday 14 May, in the *Journal of Neuroscience*, the official journal of the Society for Neuroscience. Dr. Silvana De Pirro and Professor Aldo Badiani at the Sussex Addiction Research and Intervention Centre (SARIC) at the University of Sussex, in collaboration with colleagues at Sapienza University of Rome, Italy, recruited people with addiction to both cocaine and heroin who receive treatment at a medical centre in Rome.

The researchers tested the 'mismatch hypothesis': that taking heroin—which induces a sedative state—while in a stimulating context like a club, and taking cocaine—which is a stimulant—in a private context, creates an emotional state that is at odds with the environment. This mismatch prevents the drug feeling pleasurable.

The neuroscientists asked the first group of 53 people to recall a typical drug episode and indicate how arousing and pleasant their experience

was with each drug (heroin or cocaine) in two different settings (at home or outside the home). With guidance, the second group of 20 people imagined using the drugs in each setting while their brain activity was measured with functional magnetic resonance imaging.



The results from the Study 2 (the brain imaging). Panel A. shows the mean (and the standard error) of BOLD signal changes in the brain during drug imagery. Panel B. shows the same results but with the time-course of the BOLD signal during drug-imagery. Credit: Silvana De Pirro

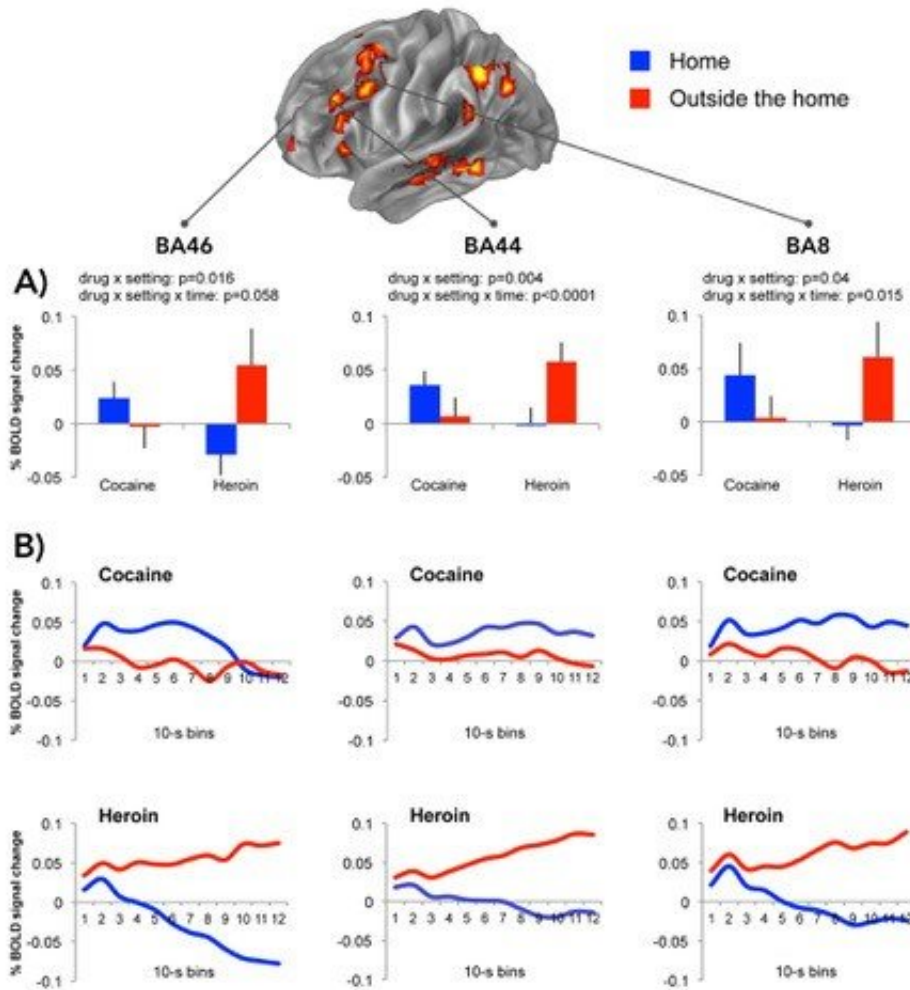
The results show:

- Nine in ten (89.1%) of the drug users reported a pleasurable experience when using heroin at home
- Fewer than four in ten (39.1%) of the drug users reported a positive state when taking heroin outside the home
- A little over a quarter (26.9%) of the drug users reported a positive state when taking cocaine at home
- Half (50%) of the drug users reported a pleasant or mixed state (17.3%) when taking cocaine outside the home

The brain scans showed that during drug imagery that the same setting produced opposite neural responses for each of the two drugs in the brain regions involved in processing reward and context: the prefrontal cortex, caudate and cerebellum. The researchers conclude that the emotional and neural response to addictive drugs changes as a function of both the substance and of the setting of use.

The neuroscientists are calling on governments and therapy providers to take into account the impact of different environmental factors on different classes of addictive drugs. They hope this will lead to more effective treatment and fewer people suffering relapses.

Left Prefrontal Cortex (middle frontal gyrus)



The results from the Study 2 (the brain imaging). Panel A. shows the mean (and the standard error) of BOLD signal changes in the brain during drug imagery. Panel B. shows the same results but with the time-course of the BOLD signal during drug-imagery. Credit: Silvana De Pirro

Dr. De Pirro, who undertook this study for her Ph.D. at the University of Sussex, said: "The findings related to the cerebellum are particularly interesting because that part of the brain helps us understand the context of our emotional experiences, so it may explain why the effects of drug taking vary by setting.

"This also has important implications for the therapeutic treatment of drug abusers. Considering the interaction between drug type and location could help to prevent relapse. Governments should adapt policies to ensure that therapies take into account the impact of the environmental factors on the risk of relapsing, and on its role in supporting recovery from addiction."

Professor Badiani, Director of SARIC at the University of Sussex, says: "These findings challenge the classic view that all drugs produce identical changes in the reward regions of the brain and that they are addictive because of their ability to induce an extremely pleasurable state.

"This study shows that the provision of methadone alone is not sufficient for treating heroin addiction. Treatments should also tackle important social and environmental factors. For example, evidence-based intervention such as cognitive behavioural therapy and 'ecological momentary interventions' (such as smart phone applications that people can access anywhere at any time in their real life when they feel an urge to abuse drugs) should be a critical part of the treatment process."

More information: The affective and neural correlates of heroin vs. cocaine use in addiction are influenced by environmental setting but in opposite directions, *JNeurosci* (2018). [DOI: 10.1523/JNEUROSCI.0019-18.2018](https://doi.org/10.1523/JNEUROSCI.0019-18.2018)

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