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Using 'hug drugs' to understand affiliative behavior: the value of the social neurochemistry perspective. *Commentary on:*

'Ecstasy'as a social drug: MDMA preferentially affects responses to emotional stimuli with social content by Wardle, Kirkpatrick, and de Wit (2014)

The desire to reach out and connect with other people is one of humankind's most fundamental desires (Baumeister and Leary, 1995). Identifying the psychological mechanisms underlying this affiliative desire was a major focus in the early days of social psychological research (Schachter, 1959) but has received less attention in the modern era (Leary, 2010). Yet, one of the critical questions for understanding human sociality is learning why we affiliate. Just what are the motivational and situational factors that influence our willingness to seek out and interact with others?

Early models postulated that we have a 'sociostat' (Latané and Werner, 1978) that functions in a homeostatic manner (O'Connor and Rosenblood, 1996) such that when we lack social contact, our desire for social interaction increases. Anecdotally, the so-called hug drug ecstasy (also known as 'E' or 'X'), 3,4-methylenedioxymethamphetamine (MDMA), has been known for years to increase gregariousness, friendliness and closeness to others (Sumnall *et al*, 2006; ter Bogt and Engels, 2009), which has been validated in controlled studies (Vollenweider *et al*, 2002; Kirkpatrick *et al*., 2014). Understanding how MDMA increases the motivation to engage with others may provide insight into the psychological mechanisms underlying affiliation. In other words, can we identify what puts the 'hug' in this hug drug?

This is the central question of the manuscript by Wardle, Kirkpatrick and de Wit (2014) in this issue of *Social Cognitive and Affective Neuroscience*. In their impressively large study, participants visited the laboratory on three occasions and received a different pharmacological treatment each time. On one visit, participants received placebo, but the other two times they received either 0.75 or 1.5 mg/kg of MDMA. They were then asked to rate the valence of positive, neutral and negative images from the International Affective Picture System database. Critically, half of the images at each valence level contained social content (i.e. images containing at least two people or parts of people), whereas the remaining images contained non-social content. Wardle, Kirkpatrick and de Wit (2014) found that MDMA increased how positively participants rated positive social images but decreased how positively they rated positive non-social images. There were no effects of MDMA on the ratings of negative or neutral images whether they were social or non-social. This pattern of results was interpreted as demonstrating a 'socially selective' effect of MDMA on how people process rewards. With these results in hand, it can be seen how this enhancement of the positivity of social rewards could lead an MDMA user to readily approach people at raves and parties.

We highlight here three additional points not mentioned in the article that are relevant for social psychological theory. In addition, we also highlight implications of these findings for the integration of social psychology and neurochemistry.

First, it would appear that MDMA does not lead people to affiliate indiscriminately. Indeed, if that were the case, then MDMA would have increased how positively participants rated all social stimuli, including the negative stimuli, rather than just the positive social stimuli. Thus, it appears that MDMA is increasing social approach more than it is reducing social avoidance.

Second, closer examination of the stimuli used by Wardle, Kirkpatrick and de Wit (2014) may point to an even greater selectivity of MDMA's effects on social approach. The social images used by Wardle, Kirkpatrick and de Wit (2014) in this study featured more than one person. Yet, in a separate study with a subset of these subjects, MDMA failed to increase how friendly, attractive or trustworthy participants rated images of individual faces (Kirkpatrick *et al*., forthcoming). Thus, MDMA's 'socially selective' effect may be restricted to the positive displays of affection between multiple individuals that were used as social stimuli in this study. Perhaps MDMA elicits a stronger push toward social groups than individuals, suggesting the neurochemical systems MDMA acts on may play a more prominent role in bonding to a group than bonding to another individual (Anstey *et al*., 2009).

Alternatively, the enhanced response to these social stimuli could also be due to a mood-congruent phenomenon. As mentioned, the positive social stimuli used in the study predominantly featured displays of loving affection and play between people. One of the subjective effects of MDMA reported by participants in the study was an increase in loving and playful feelings. Thus, the increase in positive ratings may have been due to congruence between the participants' feelings and the behaviors being displayed in the images. Future work could examine the extent of MDMA's 'social selectivity' to determine whether particular types of social rewards are enhanced (e.g. love, helping, sex) as well as whether particular social targets are favored.

Third, it remains unclear whether MDMA directly enhances the processing of social rewards or if this effect is a downstream consequence. For example, by viewing affiliative motivation through the lens of a self-regulatory framework (e.g. Carver and Scheier, 1982), MDMA could increase motivation for affiliative behaviors by either increasing the target level of social engagement or by reducing perceptions of current social engagement. That is, MDMA could increase the level

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of social interaction and integration that people aim to achieve (the ideal state) or it could decrease the level of social integration that they perceive themselves to currently possess (the actual state). An important area for future research will be delineating the relative contribution of these mechanisms. Both may be involved. MDMA can increase feelings of loneliness (Kirkpatrick *et al.*, forthcoming), which suggests that participants who took MDMA perceived lower levels of current social integration and were thus more motivated to seek social connection. MDMA also increases ratings of sociability and friendliness (Kirkpatrick *et al.*, forthcoming). This drug-induced increase in openness to affiliation could be a result of the feelings of loneliness. Or, alternatively, the increased ratings of sociability could be the result of an increase in the desired level of social interaction independent from the feelings of loneliness. Perhaps the reason MDMA is such a strong driver of affiliation is that it does both: it pushes individuals out of a state of loneliness as well as pulls them toward a higher desired level of social interaction.

In terms of broader implications for future social psychological work in neuropharmacology, the results of Wardle, Kirkpatrick and de Wit (2014) suggest the critical involvement of a neurochemical system in social affiliation that has been, thus far, understudied in social psychology. MDMA primarily triggers transporter-mediated release (Rudnick and Wall, 1992) of serotonin (Battaglia *et al.*, 1988) leading to robust increases in levels of serotonin in the synapse (Mechan *et al.*, 2002). Intriguingly, MDMA also increases levels of oxytocin in the blood (Thompson *et al*, 2007; Dumont *et al.*, 2009), which has given rise to the question of whether oxytocin might be the mediator of the affiliative and social effects of MDMA. However, recent work indicates that there is not a correlation between the changes in oxytocin in the plasma and the changes in social behavior (Hysek *et al.*, forthcoming), which suggests that either oxytocin released into the brain is responsible for the social effects or other neurochemical systems are involved (Kirkpatrick *et al.*, forthcoming). Because of the robust effects of MDMA on the serotonin system, it would seem that serotonin is a good candidate for being a key regulator of the desire to affiliate and bond with others (Way and Taylor, 2010).

Furthermore, serotonin is known to have an important role in reward processing (Liu *et al.*, 2014; Macoveanu, 2014). The differential response to positive stimuli depending on their social content elicited by MDMA indicates that serotonin may be particularly important for the modulation of social rewards as opposed to other rewards. The particular rewards amplified by serotonin may be context dependent such that serotoninergic manipulations interact with the situational context in determining which rewards are enhanced and/or dampened.

The fact that MDMA elicited such differential responses to stimuli depending on their social content and valence indicates that subtle differences in the social context can have robust effects on drug responses. Because of the rich history exploring how the social situation can influence information processing (Lewin, 1936), social psychologists can make a highly valuable contribution to neuropharmacological research. Thus, rather than looking for the effect that a given drug has on how an organism responds to various stimuli, a question might be, '"How does a drug influence how an organism responds to a stimulus in this context?' Just as the effects of non-pharmacological manipulations of psychological processes can be shaped by the surrounding situation, pharmacological manipulations of psychological processes may also be shaped by the situation in which they occur (Badiani and Robinson, 2004; Robinson *et al*, 2010). An improved understanding of drug effects may be obtained by integrating a social-psychological perspective on the context of neurochemical research. Wardle and de Wit's (2014) variation of the social contexts being depicted represents a valuable step in this direction and an important contribution to the growing field of social neurochemistry.

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