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Beyond the Brain: Behavioral Sociomics and the Future of Psychiatry

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Although psychiatric disorders are, at their core, social disorders, we—as biological psychiatric researchers—have spent much money and effort over the past two decades on characterizing psychiatric disorders primarily through genomics, proteomics, transcriptomics, metabolomics, toponomics, and neuroimaging techniques, while their social aspects have often been neglected. In the meantime, however, we are recognizing the limitations of purely biological approaches, as the standard treatment of psychiatric disorders has so far hardly changed. In recent years, experimental psychiatry has therefore returned to its social aspects. The significance of this development has been showcased by the fact that the recognized biopsychiatric journal *Biological Psychiatry: CNMI* published an innovative article by Simon Jangard and colleagues (1), which lacks the neuroscientific methods usually on display in this venue and, instead, presents a comprehensive characterization of social behavior in patients with alcohol use disorders (AUD) in comparison with healthy controls. Using a discovery-replication approach, the authors investigated altruism, fairness, trust, as well as third-party punishment and compensation employing established game-theoretical behavioral paradigms, which were first collected in a laboratory study in Sweden and subsequently in a confirmatory online study in America with a total of 500 participants. Psychiatric symptoms, cognitive and affective empathy, and moral attitudes were also assessed by questionnaires. In the laboratory study, visual attention was additionally examined using eye-tracking. In both samples, the authors found that altruism, fairness, and reciprocal trust decisions were reduced in AUD patients, while trust and third-party punishment/compensation were unaffected. Decreased prosocial behavior was associated with greater attention to the selfish choice, faster reaction times (indicative of increased impulsivity), and a rejection of moral impartiality. However, no correlations were found between social decision-making and AUD severity or other psychiatric symptom load, leading the authors to conclude that these social alterations may represent a stable trait and, thus, a risk factor for AUD. These findings are significant because such social changes may play a central role in both the development of addictive disorders and their treatment (2). Previous smaller studies with the Ultimatum Game had shown that individuals with AUD may have an elevated sensitivity to unfairness or that they have more difficulties in controlling their emotions in unfair situations, resulting in more aggressive or retributive responses to unfair offers (3-5). Though, this could not be confirmed in the present study. Disturbances of social decision-making behavior have similarly been studied in some other substance use disorders. In a preliminary study, Hou et al (6) showed that heroin users also displayed higher rejection rates of unfair offers in the Ultimatum Game. Chronic cocaine users preferred higher monetary payoffs for themselves and cared primarily about efficiency and less about fairness in a combined distribution and dictator game (7). A recently published study with methamphetamine users showed with the help of a modified dictator game and an interesting computational modelling approach that the users behaved less prosocially because they give lower

weight to the benefit of others and not because they give higher weight to their own benefits (8). In these stimulant user studies, no correlations could be found between consumption intensity and prosocial behavior too, again indicating a preexisting trait (7). However, only longitudinal studies can ultimately investigate to what extent such behavioral impairments are due to a predisposition, or if they are – at least partially – a consequence of consumption. The latter was suggested by a first longitudinal study with a small sample of chronic cocaine users showing that both fairness behavior and impulsive behavior could recover after longer period of abstinence (9,10).

The study by Jangard and colleagues (1) is not the first to use such neuroeconomic games in the field of addiction research, but it is one of the best done so far, as it uses a broad range of games, is well-powered, and contains a replication sample collected in a different cultural context.

While game-theoretic decision-making paradigms remain promising approaches to the experimental study of social behavior in psychiatric disorders, the challenges associated with their application should be kept in mind:

1) The classic games are psychometrically not ideal. For example, the test-retest reliability of many of games is low to moderate (11). Especially for the needed longitudinal studies, more reliable and stable behavioral paradigms are warranted. The same applies to their use in the context of experimental pharmaco-challenge studies (especially for within-subject designs) or as outcome measures in clinical intervention studies with patients (see below). Another problem with games is that they often have little interindividual variance (e.g., due to limited number of choices). This makes it difficult to find correlations with the severity of psychiatric symptoms but also with other everyday social functions. Paradigms that generate a broader variance would thus be advantageous.

2) The usual money distribution games have so far often observed behavior from a limited monetary-economic perspective and neglected other social values and motives beyond money-based rewards (e.g., social bonding, social attention and affection, social feedback, reputation, etc.). In the future, new paradigms should be developed that can reliably capture social behavior beyond monetary incentives in a way that is as ecologically valid as possible.

3) The instructions of many games commonly used in economic research may work well for students of economics, but for psychiatric patient populations they are often too long, too complex, and too abstract. Simple and, above all, short instructions that are also understandable for patients with slight cognitive impairments and, ideally, internationally standardized would be desirable.

4) While games in economic research are always played with real players and cover stories are taboo, psychiatric research often works with fictitious social situations for several reasons: i) The anonymity of the patients, which must be guaranteed for data security reasons, makes testing in groups

difficult. ii) It is often problematic to test larger groups of patients at the same time for availability reasons. iii) Finally, it also remains unclear how the influence of attitudes and stigmas affects decision-making behavior. For example, should only substance users and controls be tested among themselves (self-stigma could play a role here; see 12), or should cases and controls be tested together? These questions can only be answered empirically.

5) The influence of the size of financial gains on decision-making behavior is not well explored in many games. Some studies use only virtual amounts, others pay out small, rather symbolic amounts, still others operate with relatively substantial sums. An international standardization of the monetary gain, oriented for example to the purchasing power of a country, would increase comparability between the studies.

What are the relevant questions we should answer in future research?:

1) *Are social decision-making impairments predisposed or consequences of substance use?* The chicken-and-egg problem is highly relevant not least to the question of treatability. If we assume that disruptions of such social functions hinder the establishment of a functional therapist-client relationship, the reintegration into the family and into employment, and thus worsen the prognosis, then training of such social skills might significantly improve the treatment outcome (2). However, social functioning is likely to be better treated if it is a consequence of use. Promising preliminary data from our laboratory show that, for example, empathy skills, social behavior, and impulsivity can partially recover under abstinence in chronic cocaine users (9,10). Note that “consequence of use” does not necessarily mean “substance-induced”, but could also mean a process of self-stigmatization, as recent data from cocaine users suggest (12).

2) *Are impairments in social behavior that have been assessed under laboratory conditions relevant to everyday life?* Only little research exists on this, especially in the context of addiction. It is necessary not only to measure social behavior in the laboratory in an ecologically valid way, but also to define useful indicators that can reliably capture social behavior in everyday life (e.g., size of social network, popularity in the social environment, social conflicts and so on).

3) *Can social decision-making paradigms be used to identify patients who respond better or worse to psychotherapy or pharmacotherapy?* On the one hand, it is conceivable that intact prosocial behavior could predict a better response specifically to psychotherapy. On the other hand, patients with reduced prosocial behavior may also specifically benefit from prosocial training programs.

4) *Can social decision-making behavior be influenced pharmacologically?* Pharmaco-challenge studies would be a possible way to investigate the neuropharmacological basis of social decision-making and thus its pharmacological treatability in principle. The use of social behavioral paradigms in clinical

trials could also be interesting, at least as a secondary outcome, given that we know little about how our standard pharmacotherapies change patients' social behavior. However, to study the pharmacological controllability of social decision-making, paradigms with high test-retest reliability are essential.

The ecological valid measurement of the social core symptoms of people with substance use disorders is crucial for the further development of our field. Hence, the establishment of “behavioral sociomics” (i.e., the broad, reliable, and valid measurement of social functions) should move to the center of the discipline. The American and the European decades of the brain are over, let’s start a decade of biosocial psychiatry.

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