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Letter to the Editor

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Do people recover from the impact of COVID-19 social isolation? Social connectivity and negative affective bias

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Social cognitive impairments refer to difficulties in the processes that are involved in understanding and interacting with other people in social situations (Frith, 2008). These impairments are commonly observed in various mental health disorders and can significantly impact an individual's ability to navigate social interactions and maintain healthy relationships (Cotter et al., 2018). Facial emotion recognition impairments refer to difficulties in accurately perceiving, interpreting, and responding to the facial expressions of emotions displayed by others. These impairments are thought to be robust features of several common mental health problems, in particular biases towards interpreting facial expressions as sad (Penton-Voak, Munafò, & Looi, 2017).

Social isolation can have a profound impact on social cognitive ability (Cacioppo & Hawkley, 2009) whereby a lack of exposure to diverse social situations can hinder the ability to accurately interpret social cues, such as facial expressions. Likewise, poor social cognitive abilities can contribute to social isolation, with individuals withdrawing from social interactions as a coping mechanism. However, to develop effective interventions for people exhibiting problems in social cognition, it is essential to understand whether this disruption is a *consequence* of prolonged periods of isolation and poor social connections, or instead an *intrinsic component* of mental health disorders. Social distancing measures implemented to combat the spread of the SARS-CoV2 infections in 2020 presented a unique opportunity to investigate whether individuals without any previous mental health problems exhibited disruption to social cognitive markers (Bland et al., 2022a).

In an article published in Psychological Medicine, we examined emotional facial recognition during the most stringent period of UK government-enforced 'lockdown' (21st April–10th May 2020) in 107 adults who reported no prior experience of mental health problems (Bland et al., 2022a). We demonstrated significantly reduced positive affective biases (*accuracy for happy faces minus accuracy for sad faces*) which were driven by increased accuracy in recognizing sad faces and reduced accuracy in recognizing happy faces, relative to normative data taken from an earlier validation study (Bland et al., 2016). During lockdown, we demonstrated that greater social connectivity was significantly associated with greater positive affective bias; specifically driven by less accuracy in the recognition of sad facial expressions (Bland et al., 2022b).

To determine whether the impact of social isolation on social cognitive skills is transient, whereby social cognitive deficits return to typical levels upon normal social connectivity resuming, or whether the impact continues longer-term, we invited all participants to repeat the measures. We were able to collect follow-up data from 45 individuals (19th October 2022–14th March 2023). Individuals that responded showed no statistically significant differences in demographics or variables relating to social connectivity and affective bias compared to those who did not respond. We found that 49% of participants reported that their social connectivity had not returned to typical pre-lockdown levels. Importantly, we found increases in social connectivity since lockdown were significantly associated with reductions in recognizing sad facial expressions (Fig. 1a; $r = -0.342$, $p = 0.025$). There was no significant relationship with the recognition of happy faces (Fig. 1b; $r = -0.02$, $p = 0.879$). However, caution should be taken in interpreting these results as Steiger's Z test did not reach statistical significance with a sample size of 45 ($p = 0.082$).

Comparing lockdown and follow-up data, we observed a significant reduction in sad accuracy (Means = 0.82 [S.D.0.12] to 0.76 [S.D.0.16]; $F_{(1,43)} = 5.11$, $p = 0.029$, $\eta_p^2 = 0.10$) but no significant changes in happy accuracy (Means = 0.83 [S.D.0.15] to 0.81 [S.D.0.13]; $F_{(1,43)} = 1.34$, $p = 0.253$, $\eta_p^2 = 0.03$). Furthermore, although we observed improvements in affective bias scores

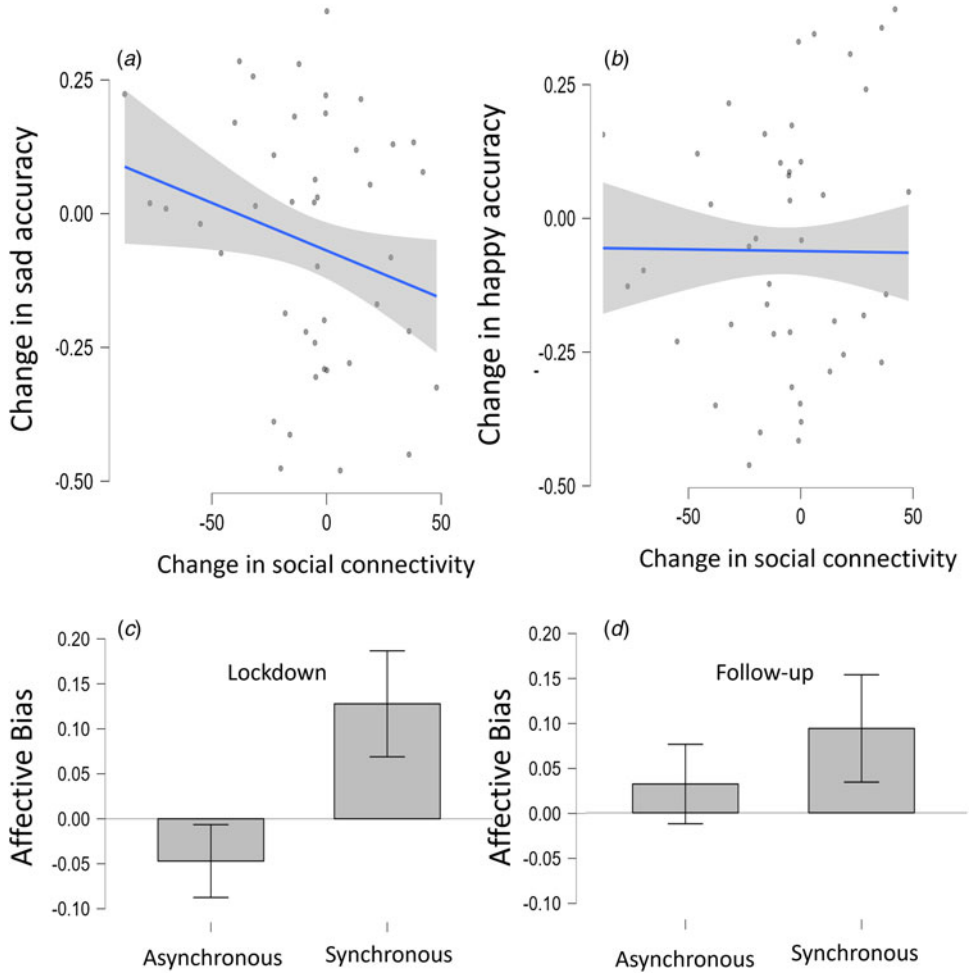

Figure 1. Scatter plots to show the relationship between changes in social connectivity and changes in the accuracy to sad (a) and happy (b) faces. Increase in accuracy in sad faces: higher score is equal to improved accuracy in recognizing sad faces whereas a lower score shows a worsening of sad accuracy. Increase in accuracy in happy faces: higher score is equal to improved accuracy in recognizing happy faces whereas a lower score shows a worsening of happy accuracy. Change in social connectivity: a score of 0 suggests that contact is similar to pre-lockdown levels. A higher score means that connectivity has improved whereas a lower score indicates that connectivity has not resumed to normal levels. Bar plots with standard error bars to show a negative affective bias for asynchronous text-based social communicators during lockdown (c) and a positive affective bias score at follow-up (d).

from 0.023 (*S.D.*0.24) during lockdown to 0.055 (*S.D.*0.23) at follow-up, this did not differ significantly ($F_{(1,43)} = 0.731$, $p = 0.397$, $\eta_p^2 = 0.02$) suggesting that overall affective bias, similarly to connectivity levels, have not returned to pre-pandemic levels. Specifically, these biases had not normalized to levels observed in our normative data in 200 participants where affective bias scores were 0.095 (*S.D.*0.19) (Bland et al., 2016). Using a univariate ANOVA, controlling for age (which differed in the present sample compared to our 2016 study), we found that that scores remained significantly lower in this follow up study ($F_{(1,242)} = 4.40$, $p = 0.037$, $\eta_p^2 = 0.02$).

In our lockdown study we found that people who used synchronous video and voice calling to keep in touch with family and friends showed more positive affective biases than people who preferred asynchronous text-based communication (Fig. 1c; Bland et al., 2022b). In our follow-up we observed that text-based communicators' affective bias has improved so that it was no longer significantly lower than audio/video communicators (Fig. 1d; $F_{(1,43)} = 0.72$, $p = 0.401$, $\eta_p^2 = 0.02$). Once again this was specifically driven by a significant decrease in the recognition of sad faces ($F_{(1,43)} = 4.76$, $p = 0.030$, $\eta_p^2 = 0.02$) but no change to happy faces ($F_{(1,43)} = 1.34$, $p = 0.249$, $\eta_p^2 = 0.00$).

Overall, the results point towards affective biases, and in particular the recognition of sad faces, as potential markers of social connectivity, which can be modified as social connectivity changes. This not only has important implications for understanding the effects of social isolation due to COVID-19 pandemic, but also has wider implications for understanding the interactions between social isolation, social cognition and mental health. Taken together, social cognitive disruption may not necessarily be an *intrinsic component* of mental health disorders but can also be induced by periods of social isolation, pointing towards social isolation as a key risk factor for developing social cognition problems. This supports the World Health Organization declaring that loneliness is a major health concern worldwide, with increasing evidence demonstrating that loneliness has profound implications for both physical and mental health. Indeed, loneliness is associated with abnormal brain structure (Lam et al., 2021), and depression and social isolation was found to increase the risk of dementia by 26% (Shen et al., 2022).

Whilst these data begin to shed light on the potential etiology of social cognition dysfunction, one limitation is that we were unable to recontact the entire sample of original participants,

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therefore this study may not be powered to detect more subtle effects. However, there were no demographic or other statistically significant differences relating to social connectivity and affective bias between those participants who were in the follow-up and those who were not. In conclusion, social connectivity is an important therapeutic target and may prevent the development of social cognitive deficits associated with mental health problems.

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Competing interests. BJS consults for Cambridge Cognition. Her research is conducted within the NIHR Brain Injury MedTech and *in vitro* diagnostics Cooperative (MIC, Cambridge) and the NIHR Cambridge Biomedical Research Centre (Mental Health and Neurodegeneration Themes). TWR provides consultancy for Cambridge Cognition and Supernus, and has a research grant with Shionogi. JPR has previously received funding from Cambridge Cognition towards a PhD studentship, and is a consultant for GH Research.

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