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Letter to the Editor

A reply to Dr Corcoran

We are grateful for this opportunity to comment on Dr Corcoran's critical commentary (Corcoran, 2008), published alongside our original study, 'Humour experience in schizophrenia: relationship with executive dysfunction and psychosocial impairment' (Tsoi *et al*. 2008*a*). Whilst her critique is no doubt a useful general contribution, some concerns she expressed about our study may be misleading if taken without qualification. We would like to emphasize the importance of research on humour in patients with schizophrenia and to address the issues raised, and to comment on the ideas and future directions proposed by Dr Corcoran.

Poor social functioning is one of the most disabling clinical features of schizophrenia (APA, 1994). Social cognition dysfunction may directly contribute to poor social functioning in patients with schizophrenia (Roncone *et al*. 2002; Lee *et al*. 2006). Understanding and experiencing humour requires social cognition skills, and as we expected, lower humour recognition sensitivity in patients was significantly associated with poor social functioning in our study. Hence we considered the journalistic 'double-entendre' title of the commentary, 'Why research with clinical groups should give us a good laugh', in bad taste and undermining of the importance of the subject.

Humour recognition and experience, like many other social cognition tasks, require coordination of multiple processes including emotion recognition, vicarious arousal, and cognitive understanding of what other people think (Strayer, 1987). Investigating a mixture of these complex processes such as humour in schizophrenia has inevitably many limitations. The most important one, among others, is that when patients show a deficit in such a task, researchers are uncertain of the locus of abnormality, i.e. whether or not a problem in one particular component causes the observed deficit (Lee, 2007). Nonetheless, we believe it is important to identify component processes that lead to disordered social ability in patients with schizophrenia in order to alleviate, in due course, their impact on patients' social functioning. This line of research would be central in understating the mechanisms of anhedonia that may contribute to core symptoms of schizophrenia (Meehl, 1989).

Choice of humour stimuli

Familiarity as a confounder

We agree with Dr Corcoran that it is desirable to use novel clips. However, researchers embarking on this work should be warned that producing such 'funny' clips with high quality is technically highly demanding. Hence, as our study was the first of its kind, we decided to use a mixture of novel and familiar clips and examine statistically whether or not controlling for the number of clips that subjects had previously seen changed our results. It did not. However, we accept that the ideal is to include all novel clips. And this method is one we have adopted in a follow-up study utilizing functional MRI to examine the neural basis of humour experience dysfunction in patients with schizophrenia.

Relevance of humorous stimuli to day-to-day life

Dr Corcoran advocated the use of language-based humour stimuli, as language provides a strong context in which intentions are easily delivered to subjects. However, researchers in this field should consider the close relationship between linguistic ability and humour recognition. For example, Johnson found an association between higher linguistic ability (measured with a word recognition task) and better humour appreciation using language-based-humour stimuli selected from books and magazines (Johnson, 1992). Patients with schizophrenia have been shown to have diminished ability to understand language (Stephane *et al*. 2007), in particular understanding metaphors and irony which are commonly used in language-based humour (de Bonis *et al*. 1997). Of course, studies that specifically focus on the link between social cognition and language impairments are of interest (Langdon *et al*. 2002). However, in our study, we were interested in whether patients with schizophrenia would show a deficit in recognizing humour whilst purposefully minimizing any contribution from linguistic components. We therefore consider it important to have a fine balance between experimental control of potential confounders and the ecological validity of stimuli when investigating humour.

Funniness ratings

The funniness rating results seem to have been missed by Dr Corcoran who wrote 'While Tsoi *et al*. report that they collected funniness ratings, they do not report findings on this. This is a pity.' On the contrary,

the results can be found in page 805, where neither main effect of group, the clip, nor group-by-clip interaction on the funniness ratings was significant. It is worth noting, however, that Dr Corcoran's own study in 1997 also found an absence of group difference in funniness ratings on visual joke stimuli between patients and controls. In the commentary, Dr Corcoran presented two possible explanations as to why patients might report the same level of funniness of scenarios as did controls (whilst at the same time being impaired in recognizing and interpreting visual stimuli joke stimuli). First, she suggested, patients may find different aspects of our stimuli funny. We agree with the possibility of this interpretation, because, as reported in our main results, although the patients identified a similar number of funny events as did controls, they identified more of these outside the predefined window of 'standard humorous periods'. We did not understand the second possibility raised by Dr Corcoran that 'patients were able to report their humour level in an acceptable way even though they may not have understood the jokes'.

Interpretation of findings and suggestions for future studies

The Wisconsin Card Sorting Test (WCST) is a well-established test of general executive function, but, as Dr Corcoran noted, successful WCST performance may rely on a number of different cognitive processes. Accordingly, factor analytical studies have consistently reported three cognitive processes underlying WCST performance, namely, set-shifting, hypothesis testing and response maintenance (Greve *et al*. 2005). Among WCST performance variables, the number of perseverative errors, which was used in our study, may particularly be relevant to set-shifting ability. This is because a perseverative error occurs when a subject uses the same card-sorting rule which is no longer valid. The number of perseverative errors distinguishes patients with frontal lobe damage, particularly those with dorsolateral prefrontal damage, very well from non-frontal-lobe damage patients (Demakis, 2003).

Impaired set-shifting ability in patients with schizophrenia (measured by the number of perseverative errors they made), was significantly negatively correlated with humour detection sensitivity in our study. We interpreted this finding as supporting a cognitive theory of humour, proposed by Suls (1972) and further elaborated by Martin (2006). This cognitive theory emphasizes the importance of schema. Suls (1972) considered humour appreciation as a two-step task: the detection of incongruence in a humorous event and then reinterpretation of the event (i.e. resolution of incongruence) based on alternative meanings or possibilities. For the first step, initial humour setting and its context will ensure that a subject generates a schema in order to predict a likely forthcoming event from the situation. The first condition for an event to be perceived as humourous is that the event should be incongruent with the perceiver's schema. Then, the perceiver enters into a problem-solving stage to reinterpret the event to 'get the joke'. That is, to perceive the event as funny, incongruence produced by the event should not remain incongruous. At this second stage, set-shifting ability to find alternative meaning is important. We therefore interpreted the correlation between impaired set-shifting ability and humour detection in patients with schizophrenia as denoting a meaningful relationship between them. Accordingly, the significant between-group difference in humour detection sensitivity disappeared when the WCST perseverative error score was controlled for in our study. Our data and interpretation would therefore be consistent with Brune *et al*. (2007) who suggested that difficulties in holding two schemata together may contribute to the impairment in mental state attribution in patients with schizophrenia.

Now let us consider Dr Corcoran's model of two stages in humour recognition, a general understanding of intention to be funny and 'specific intentional inference'. Dr Corcoran indicated that the intention to be funny was not a necessary condition, because, understandably we often find some events funny without knowing they are supposed to be funny. The second stage, so called 'specific intentional inference', related to an appraisal of incongruity by actively considering its context. We think therefore that this second stage corresponds to both stages in the cognitive theory of humour by Suls and Martin. We could then generate specific hypotheses about whether patients with schizophrenia are impaired in the detection of incongruity stage, or, alternatively, the appreciation of humour stage (during which a set-shifting ability is required to explore different meanings and resolve the incongruity). One way of testing these distinct possibilities would be asking patients to report whenever unexpected (or incongruent) events happened and comparing those incongruent responses with those to another condition where they find some events funny.

It is possible that a patient may not detect the funniness of comedy clips because they are depressed or unmotivated. In our study, this possibility was examined by analysing the relationship between humour detection sensitivity and depression scores in patients. As expected, we found that a higher level of depression was associated with reduced humour detection sensitivity. This is an important point because

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depression might be an intrinsic part of the symptomatology of schizophrenia (Lee *et al*. 2003). However, despite controlling for depression scores, we found a persistent between-group difference in humour detection sensitivity. This observation adds weight to our conclusion that humour detection sensitivity is specific to schizophrenia.

Humour recognition and experience may require a coordination of processing components including emotion recognition, vicarious arousal, and cognitive understanding of others. One potentially fruitful strategy to understanding a complex process such as humour would be investigating these various components in the same group of patients (Lee, 2007). For example, in our ongoing fMRI study, emotion recognition test (Tsoi *et al*. 2008*b*) is used in addition to executive function and theory-of-mind (ToM) tasks to investigate the locus of abnormality in humour recognition in schizophrenia.

Conclusion

In studying humour in patients with schizophrenia, there is a delicate balance to strike between selecting optimal stimuli whilst minimizing confounding factors in order to understand sub-processes underlying humour. We chose non-verbal humour stimuli to disentangle humour detection from language difficulty. In addition, we employed WCST perseverative errors (as a proxy measure of set-shifting ability) and ToM task (as a measure of ability to understand what other people think) as a way of further exploring links between humour appreciation and cognitive ability. Our key finding of the association between impaired humour detection and poor social functioning in patients indicates that there is a pressing need for more studies. Future studies might want to use different types of humour stimuli to examine whether patients show a deficit in the understanding of particular type of humour. An important advance is also likely to be made if one uses a comprehensive battery of cognitive and emotional tasks, informed by humour theory.

We hope that researchers in this area will take heart from the fact that this addresses an important and serious aspect of schizophrenia research, and which, although complex, is able to be done. We believe that a substantial amount of further research will be required to understand humour recognition and experience in patients with schizophrenia. Investigating this complex process experimentally is difficult and has many limitations. However, we believe that this area of research will be important for understanding mechanisms underlying social dysfunction in schizophrenia.

Declaration of Interest

None.

References

APA (1994). *Diagnostic and Statistical Manual of Mental Disorders*. American Psychiatric Association Press: Washington DC.

Brune M, Abdel-Hamid M, Lehmkamper C, Sonntag C (2007). Mental state attribution, neurocognitive functioning, and psychopathology: what predicts poor social competence in schizophrenia best? *Schizophrenia Research* **92**, 151–159.

Corcoran R (2008). Why research with clinical groups should give us a 'good laugh'. *Psychological Medicine* **38**, 787–789.

de Bonis M, Epelbaum C, Deffez V, Feline A (1997). The comprehension of metaphors in schizophrenia. *Psychopathology* **30**, 149–154.

Demakis GJ (2003). A meta-analytic review of the sensitivity of the Wisconsin Card Sorting Test to frontal and lateralized frontal brain damage. *Neuropsychology* **17**, 255–264.

Greve KW, Stickle TR, Love JM, Bianchini KJ, Stanford MS (2005). Latent structure of the Wisconsin Card Sorting Test: a confirmatory factor analytic study. *Archives of Clinical Neuropsychology* **20**, 355–364.

Johnson AM (1992). Language ability and sex affect humor appreciation. *Perceptual and Motor Skills* **75**, 571–581.

Langdon R, Coltheart M, Ward PB, Catts SV (2002). Disturbed communication in schizophrenia: the role of poor pragmatics and poor mind-reading. *Psychological Medicine* **32**, 1273–1284.

Lee K-H (2007). Empathy deficit in schizophrenia. In *Empathy in Mental Illness and Health* (ed. T. Farrow and P. Woodruff), pp. 76–112. Cambridge University Press: Cambridge.

Lee K-H, Brown W, Egleston P, Green R, Farrow T, Hunter M, Parks R, Wilkinson I, Spence S, Woodruff P (2006). A functional magnetic resonance imaging study of social cognition in schizophrenia during an acute episode and after recovery. *American Journal of Psychiatry* **163**, 1926–1933.

Lee K-H, Harris AW, Loughland CM, Williams LM (2003). The five symptom dimensions and depression in schizophrenia. *Psychopathology* **36**, 226–233.

Martin RA (2006). *The Psychology of Humor: An Integrative Approach*. Elsevier Academic Press: Burlington.

Meehl PE (1989). Schizotaxia revisited. *Archives of General Psychiatry* **46**, 935–944.

Roncone R, Falloon IR, Mazza M, De Risio A, Pollice R, Necozione S, Morosini P, Casacchia M (2002). Is theory of mind in schizophrenia more strongly associated with clinical and social functioning than with neurocognitive deficits? *Psychopathology* **35**, 280–288.

Stephane M, Pellizzer G, Fletcher CR, McClannahan K (2007). Empirical evaluation of language disorder in schizophrenia. *Journal of Psychiatry and Neuroscience* **32**, 250–258.

Strayer J (1987). Affective and cognitive perspectives on empathy. In *Empathy and its Development* (ed. N. Eisenberg

and J. Strayer), pp. 218–244. Cambridge University Press: New York, NY.

Suls JM (1972). A two-stage model for the appreciation of jokes and cartoons. In *The Psychology of Humor: Theoretical Perspectives and Empirical Issues* (ed. J. H. Goldstein and P. E. McGhee), pp. 81–100. Academic Press: New York.

Tsoi DT, Lee K-H, Gee KA, Holden KL, Parks RW, Woodruff PW (2008*a*). Humour experience in schizophrenia: relationship with executive dysfunction and psychosocial impairment. *Psychological Medicine* **38**, 801–810.

Tsoi DT, Lee K-H, Khokhar WA, Mir NU, Swalli JS, Gee KA, Pluck G, Woodruff PW (2008*b*). Is facial emotion recognition impairment in schizophrenia identical for different emotions? A signal detection analysis. *Schizophrenia Research* **99**, 263–269.

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A rejoinder to Lee *et al.*

I am grateful for the opportunity to continue the discussion about the use of humorous material in psychological studies of people with mental health difficulties. As stated in my original commentary on Tsoi *et al*. (2008), my intention is to encourage high-quality research exploring humour appreciation difficulties in chronic mental health conditions. It is for this reason that I accepted the invitation both to comment on the original article (Tsoi *et al*. 2008) and to present a rejoinder to Lee *et al*.'s above Letter. As I am not interested in academic sparring I will not dwell long on the points raised by Lee *et al*. Instead I will limit this rejoinder to two main themes that may be most fruitfully considered by would-be researchers in this field. I would first though like to point out that it was never my intention to make light of humour deficits and I am sorry that Lee *et al*. found my title in poor taste. I was clearly correct in my assumption that researchers are a little sensitive when it comes to conducting this kind of research (Corcoran, 2008).

The value of all scientific study is determined by the questions we choose to address, the methods we choose to address those questions and the manner in which we interpret the data and the statistical findings. Tsoi *et al*. (2008) asked good questions, the answers to which will improve our understanding of the clinical picture of psychosis. One of the foci in my commentary was on the methods chosen by Tsoi *et al*. in particular their choice of stimuli. It is unfortunate that methodological choices are so often driven pragmatically so that we find that we must compromise best design with what is achievable within a certain time scale and budget. I am very glad to hear that this group have developed novel clips for use in their ambitious fMRI study.

Some psychological studies of clinical groups address questions to do with aetiology or clinical profiles while others focus more on questions that have the potential to provide opportunities for psychological intervention or that provide direct patient benefit. Thus some have a more direct translational or applied element than others. In the translational research context in particular, it is sensible to select experimental stimuli that most closely reflect events or contexts in the day-to-day social world of patients to maximize the ecological validity of the research. Most everyday humour situations require the active processing of both verbal and non-verbal information. In their desire for experimental control of the effects of language processing on humour, Tsoi *et al*. compromised ecological validity, as Lee *et al*. acknowledge. Given that Tsoi *et al*.'s broad question was to do with improving our precise understanding of the clinical picture this was a rational choice. The debate about experimental control *versus* ecological validity is an old one but the choice we make in this regard when working with clinical groups needs to be determined by the nature of the broad questions we are examining, the aims of the research and the philosophy of the research group. Researchers who are planning studies in the area should be mindful in their choice of experimental stimuli so that their findings best reflect their broad goals. However, even given the role that our broad aims should play in determining our methodological choices, future studies could feasibly include three sets of humorous stimuli – entirely non-verbal, entirely verbal and a combination of both. In this way we maximize ecological validity and also take account of the language (and non-verbal) processing difficulties associated with psychosis.

The other area I want to address concerns the effective use of findings from different measures to drive the interpretation of results and to take knowledge forward. Here I must begin with an apology to Tsoi *et al*. who did (as Lee *et al*.'s Letter points out) report an analysis of funniness ratings. I was mistaken in saying they did not report these findings. In fact they found no group differences in funniness ratings for the clips. Thus patients reported experiencing the same level of humour despite the fact that they had poorer recognition of standard humour moments. Apparently therefore the groups found different elements within

the clips funny but reported finding the clips overall equally funny. Lee *et al*. did not understand the second possibility I suggested to account for an intriguing result like this (indeed similar to Corcoran *et al*.'s 1997 finding) and I would like to take this opportunity to clarify the point I was trying to make as it speaks to the symbiosis between study design and the interpretations we are justified to offer. In proposing that 'patients were able to report their humour level in an acceptable way even though they may not have understood the jokes', I simply meant that it was possible that the patients retained the knowledge that the clips were intended to be funny and it was this intact knowledge that enabled them to report seemingly appropriate funniness ratings even though the precise inferences they made about the meaning of the clips differed from those made by the control group. This suggestion is compatible with previous arguments that the socio-cognitive difficulties seen in schizophrenia can be understood as a compromised online ability to infer meaning from social material but an intact store of social semantic information (e.g. Corcoran & Frith, 1996). In cognitive psychology when different measures are gathered on the same data the purpose is most often to probe different sub-processes or aspects within an overall skill or capacity, often with a view to test aspects of a cognitive model or models. In other words, different measures have the capacity to challenge different aspects of an overall process. Thus the funniness ratings and the specific responses to standard humorous moments that Tsoi *et al*. collected tell us different things about what is going on in humour processing. Specifically, using the Corcoran *et al*. (1997) model, they probe the general intentional inference (reflecting the social semantic store) and the specific intentional inference (reflecting online social inference) stages respectively. The point here is that we should endeavour to collect (and report summary statistics of) data that has the capacity to inform about different aspects of complex processes, such as those which fall under the umbrella term of social cognition. We should then consider this information in concert and in relation to the cognitive models available. Doing so adds a level of sophistication to the arguments that we are justified in taking forward into future research. It is pleasing to see that Lee *et al*. have presented a more sophisticated interrogation of their preferred cognitive model than was offered in the original paper. This has been achieved through better use of the findings gathered from distinct measures.

I am very much looking forward to reading the future work of this group and I hope that others derive some benefit from the points raised within this debate.

Declaration of Interest

None.

References

Corcoran R (2008). Why research with clinical groups should give us a 'good laugh'. *Psychological Medicine* **38**, 787–789.

Corcoran R, Cahill C, Frith CD (1997). The appreciation of visual jokes in people with schizophrenia: a study of 'mentalizing' ability. *Schizophrenia Research* **24**, 319–327.

Corcoran R, Frith CD (1996). Conversational conduct and the symptoms of schizophrenia. *Cognitive Neuropsychiatry* **1**, 305–318.

Tsoi DT, Lee K-H, Gee KA, Holden KL, Parks RW, Woodruff PW (2008). Humour experience in schizophrenia: relationship with executive dysfunction and psychosocial impairment. *Psychological Medicine* **38**, 801–810.

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