

Faith in Measurement

I recently attended an extremely illuminating lecture by Denny Borsboom of the University of Amsterdam. I would like to share the gist of it, in the hope of prompting discussion and debate.

Borsboom showed that data conforming to one of our strongest psychometric models, the Rasch model, do not necessarily – as is commonly assumed – point to the existence of a single underlying process such as increasing levels of depression. They can in fact be produced by a network of mutually-triggering processes or symptoms. Thus, having difficulty sleeping might lead to inability to concentrate which might lead to dismissal from work which might lead to worrying which might exacerbate concentration problems and so on.

By extending this process of mapping the links between symptoms, Borsboom showed that DSM classification might not only be provided with some kind of theoretical basis, but also that the linkages between symptoms might be merged into clusters with more meaning than the collections of ‘diseases’ in the DSM framework. In this map symptoms may appear in more than one cluster and the symptoms may have proximate or distal connections with symptoms in other clusters. Borsboom also demonstrated that treatment of a single symptom in a network of mutually-triggering processes might, after all, make some kind of sense if blocking that process put paid to one component in a sequential network of triggering operations.

Borsboom claimed that this work illuminates findings from genetics. If genes affect the strength of causal connections between symptoms, then the aggregate score may prove highly heritable in a twin study; however, the effect of the genes themselves becomes untraceable due to the many interactions in the network. This explains the current state of affairs in behaviour genetics, where the inability to identify genes responsible for the high heritabilities reported in twin studies is known as the problem of ‘missing heritability’.

The most important implications of Borsboom’s work are for the very way we think about individual differences and the measurement of change. There are tens of thousands of peer-reviewed published studies of ‘What works’ in education and health care (including drugs and psychotherapy) reaching conclusions which the measurement tools that were used are incapable of supporting. The tests used offer only ‘arbitrary metrics’ such that the difference between two points on the scale – say among more and less able people – just do not mean the ‘same thing’, in any sense in which that term might be used. What Borsboom and co have shown is that, even when the measures conform to the most rigorous tests of non-arbitrariness we have available (which most do not), one cannot necessarily infer that they are, in reality, measuring differences on a single underlying trait or characteristic. ‘What works’ at one level may therefore not ‘work’ at another. The psychological nature of the changes induced, or not induced, may be quite different.

The practical implications which arise are of immense importance. The failure to mount sufficiently comprehensive evaluations of developmental and health care programmes - at both group and individual levels – is scientifically and ethically unjustifiable. People develop (and are damaged) in a whole variety of different ways and not just in terms of an increase or decrease in scores on a single ‘variable’ of concern to the sponsor or investigator. Meaningful evaluation instead requires us to map individual responses across a huge domain of idiosyncratically interlinked effects (for more detail, see Borsboom, 2008; Cramer et al., 2010). Study of these linkages enables us to group them into clusters while recognising that these clusters do not form the ‘dimensions’ of traditional psychometrics.

If Borsboom and co can crack the very basis of faith in ‘variables’ they will have done us a great service.

John Raven

Edinburgh

References

- Borsboom, D. (2008). Psychometric perspectives on diagnostic systems. *Journal of Clinical Psychology*, 64, 1089-1108.
- Cramer, A.O.J., Waldorp, L.J., Van der Maas, H.L.J. & Borsboom, D. (2010). Comorbidity: A network approach. *Behavioral and Brain Sciences*, 33, 137-193.