

# Understanding Developmental Disorders

A Causal Modelling Approach

John Morton



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For G and Pooch, with love

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## PREFACE AND ACKNOWLEDGEMENTS

Human development can be seen as the unfolding of a particular pattern. Genes are responsible for producing proteins that lead to structures of various kinds – legs and hands and hearts and tongues and, the bit that concerns us, brains. Within the brain there is structure, and this is formed under the influence of the genes in complex ways, together with the influence of the environment, both internal and external. There is a lot of variation in the genes, and a lot of variation in the environment, but the result is a human being. The variations in the genes and the variations in the environment give rise to individual differences – in eye colour, height, temperament and intelligence – within the range of what is often termed normality. This is a difficult term, however, since what is normal is often confused with what is acceptable. A man who is seven foot tall is acceptable in the context of a professional basketball team, but not in the context of an airline seat, particularly next to me!

Things can go wrong with early brain development: there might an unfortunate combination of allelic variants of genes; one of the critical genes might be damaged; the environment might be unsuitable – for example, the intra-uterine environment provided by a drug-taking mother. As result of one of these misfortunes, the child develops outside the normal range – the problem may be a general one or may be specific, but in either case some health or education professional is going to want to describe the condition and relate that child to other children who are similar. The reason for doing this may be to help with prognosis – to predict what the future may be like for that child. The description will be of use in helping to understand the nature of the condition, predicting other kinds of problems, and giving a hint as to

what might happen in various situations or in the future. It will also be help to guide any treatment plan.

Later on, the interaction of the child with his or her environment may make things better or worse. In some cases, the environment may be so aversive that children with physically normal brains may develop in a way that leads them to be termed abnormal in some way. Such children will also attract labels.

Sometimes, the labels that are used relate only to the child's behaviour – conduct disorder is a good example. Sometimes the labels refer to a specifiable genetic problem – William's syndrome is an example here. In other cases the labels have deeper significance, with the defining features being more complex – autism is a good example here. One of the problems with the labels is that different people mean different things by the same label. Take 'dyslexia', for example. For some people, this is simply a term applied to children whose reading age is significantly below their mental age (usually by two years). For others, it means people with a deficiency in their magnocellular cortex. For yet others, it means people with a particular deficiency in phonological processing (and who, curiously, may have no observable problem in reading!). How can we discuss such different types of theories in the same breath?

I have felt for many years that understanding developmental disorders requires us to think about biological, cognitive, behavioural and environmental factors, and to discover the causal relationships among these elements. This is a way of thinking about developmental disorders which grew from my time at the Medical Research Council's Cognitive Development Unit (CDU) in London. My colleague Uta Frith and I felt the need for clarity in theorizing about this process and developed a methodology for enabling that clarity. We called the method 'causal modelling', and wrote a very long chapter about it (Morton & Frith 1995). This book is an extension of that work. This book is about the nature of causal theories.

The actual theories that I use are partially chosen for illustrative reasons, as I will repeatedly remind you. What I cannot do here is to list all the most up-to-date theories of each of the developmental disorders. To give a complete up-to-date account of any one of autism, dyslexia, conduct disorder or ADHD would take a book of the length of this one. So I have taken the theories I am most familiar with, and those that illustrate the range of theories that exist. I don't think that use of the causal modelling method makes any of these theories more correct.

Instead, it helps to identify weak spots in the theories, and also helps us to see the relationships between different theories. This makes it easier to set up ways of testing the theories against each other. This is what the book is about. At the CDU, we did develop our own beliefs about autism and dyslexia, for example, and, although I have tried to be dispassionate I may seem to favour those beliefs here. However, these beliefs are not fixed, and it is important for the reader to realize that what I want to communicate in this book is a way of thinking about different theories of developmental disorder. I am proposing a tool. This tool has been found useful by students and by practitioners, as well as by fellow scientists. It is offered as a way to help you formulate your own theory of any developmental disorder as well as a way of understanding other people's theories.

Of course, you cannot just pick up a complex tool and use it; you need to think about the problem appropriately. Using causal modelling encourages you to think about development in a particular way. Specifically, you have to learn to work productively with cognitive concepts, and clarify in your own mind the distinction between cognition and behaviour. It was the application of these principles to the problems of developmental disorders that I learned from Uta Frith. In a sense, causal modelling was my attempt to formalize the way in which Uta thought about autism and dyslexia. Her voice will be heard often through the book, and the only reason she is not co-authoring it is that she is too busy moving on our understanding of these disorders. I hope that she endorses much of what I have written, but I excuse her from endorsing it all.

The book has chapters of two kinds, those concerned with setting up and explaining what causal modelling is and how to do it, and those chapters illustrating how causal modelling can help us to understand and compare different theories of particular developmental disorders. Since this is a book on causal modelling, I will rarely refer to any theory that does not make causal claims about the syndrome. The major exception is in the chapter on conduct disorder (chapter 9), where, following Krol et al. (2004), I look at the structure of the main theories of conduct disorder, which are not causal in nature.

It is worth noting briefly the contrast between causal modelling as I have been describing it here and structural equation modelling, which is also sometimes called causal modelling (for an overview, see Fife-Shaw 2000). Structural equation modelling is an analytical technique that is applied to data. Roughly speaking, you look for *latent variables*

that mediate between measured variables. There may be an *a priori* theory connecting the variables, but the techniques do not depend on this. All you need know is that this is not what I am going to talk about.

In chapter 1, I introduce the notion of cause, comparing the everyday use of the term with a more scientific use. This discussion leads us to appreciate that when we are trying to account for a developmental disorder we have to distinguish between internal and external factors and, within the internal factors, we have to distinguish between biology, cognition and behaviour. I then discuss the need for a scientific tool, a tool to aid thinking, a tool which uses diagrams instead of words. Here I point out for the first time, as I will point out repeatedly, that use of the tool does not commit one to any particular theoretical position.

In chapter 2, I spend some time explaining why the study of developmental disorders requires us to consider cognition. This is the only theoretical point that I argue for in the whole book. If you don't believe that cognition has any role to play in the study of developmental disorders, and if I fail to convince you in this chapter, then you had better stop reading and I will give you your money back. But your reasoning had better be good!

The elements of causal modelling are introduced in chapter 3. The fundamental principle is that the verbal expression of your theory gets converted into a diagram. The notation is very simple, and I work through three examples of different types to give you a feel for what I am trying to do.

Chapter 4 is of the second kind. In it I take you through some of the history of the development of causal modelling – the evolution of the 'mentalizing deficit' account of autism.

In chapter 4, a number of issues raise themselves about the causal modelling technique. In chapter 5 I bring these issues together in the form of a number of maxims. These maxims go towards helping to establish good practice in formulating theories of developmental disorder and representing them in a causal model.

In chapter 6, I go through most of the current alternative theories of the origin of autism and frame them using the principles of causal modelling. This exercise helps us to see the relationships among the various theories, and pinpoints which theories are insufficiently explicit or are ambiguous in expression.

One of the major issues which becomes evident in chapter 4 is that of diagnosis. Thus, if we do not know what autism is we cannot have any theory about its development, nor can we properly diagnose it.

In chapter 6, we face these issues and show how causal modelling can help us to reconcile different approaches to diagnosis.

Chapter 7 takes up some of the general points raised in the previous chapter, concerning the notation of causal modelling and the ways that are available for elaborating our causal theories.

In chapter 8, I apply the lessons we have just learned to a discussion of the various current theories of dyslexia. In particular, the causal modelling method enables us to show clearly how some theories can be embedded in other theories, rather than being directly opposed. In this way, the debate about dyslexia can be focused on specific questions rather than involving major confrontations.

In chapter 9, I look at theories of ADHD. More properly, this is a set of disorders that are usually defined in terms of behaviour, without regard to the origins of the behaviour. This has led to much confusion over the years and it is only recently that decent cognitive theories have emerged.

Chapter 10 is devoted to a detailed analysis of conduct disorder. This work, based on a collaboration with Nicole Krol and Eric de Bruyn of Nijmegen, focuses on a disorder to which there is thought to be a major contribution of environmental and developmental factors. In this respect, the disorder is different from autism and dyslexia, for which there is a dominant well established biological/cognitive base. In this chapter I also compare causal modelling with other ways of talking about developmental disorders, particularly psychosocial pathways.

In chapter 11, I look at some of the more general issues of the relationships among the three levels of description; in particular, the relation between brain and cognition. The use of causal modelling has sharpened my own view of this relation.

Now let me say two words concerning what this book is not about. To start with, it is not about the nature of cognitive mechanisms. I do not address the question: How does cognition cause behaviour? This is not my concern here. I will say more about this in chapter 2. Nor will I say much on the topic of the relationship between a developmental disorder and an acquired disorder, although I will touch on that topic in chapter 8.

Developmental psychology is difficult, more difficult, I think, than constructing theories of adult cognitive function. I never managed to become a competent developmentalist, but managed in the CDU environment by being able to bring theoretical methods from the world of cognitive psychology, and by having support and continual interaction

from a number of outstanding developmental scientists. Their influence pervades this book. I have already mentioned Uta Frith, and I should add Annette Karmiloff-Smith, the late Rick Cromer, Alan Leslie, Mike Anderson and Mark Johnson. Of the many friends, visitors and short-term staff that we had at the CDU, Sue Carey, Anne Christophe, Mike Cole, Francesca Happé, Lila Gleitman, Mani das Gupta, Geoff Hall, Kang Lee, Jean Mandler, David Olson, P. Prakash and Prentice Starkey all played a role in my education.

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The figures were drawn using CHARTIST™.

John Morton