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<http://www.unige.ch/fapse/SSE/teachers/hessels/ECIDD/ECIDD-program-Geneva.pdf>



Social and cognitive development in children with Down syndrome: trying to build wider developmental models?

Derek Moore
Institute for Research in Child Development

Keynote Talk to 8th ECIDD
19th June 2010

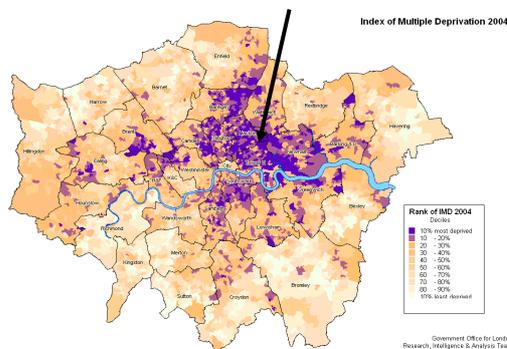
Support from ESRC, Baily Thomas Trust, NIH, Wellcome Trust, Eranda foundation



IRCD



- Based in School of Psychology at Stratford
- Purpose built Neuro-behavioural & baby labs
- Attention- eye tracking equipment ASL & Tobii
- EEG/ ERP 128-channel





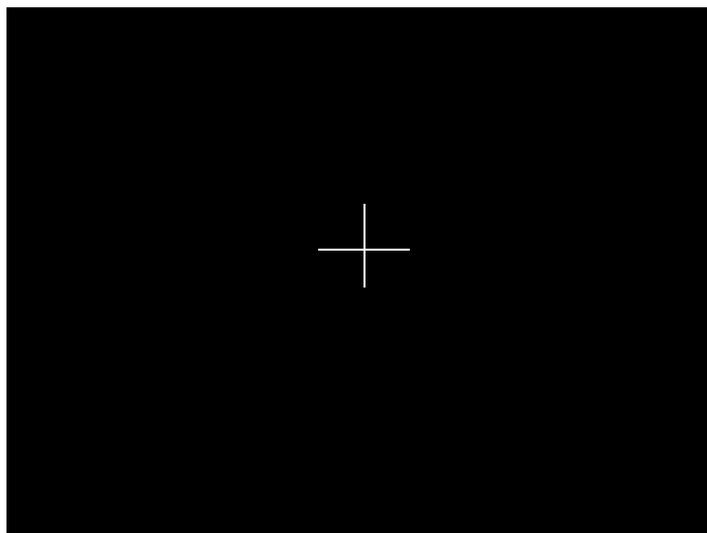
Three parts to talk



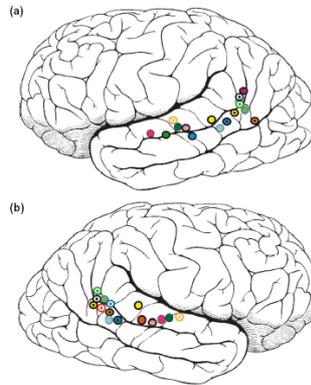
- Why we need to understand the relationship between social and cognitive development in infants with DS
 - Why we need to develop theories
 - How to notate and portray development
-



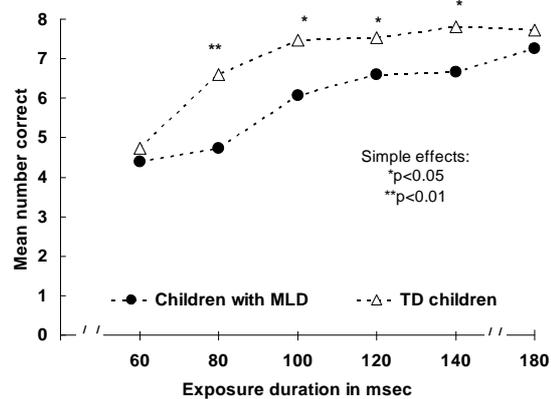
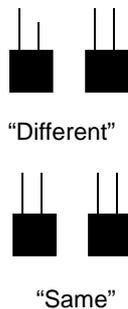
What is this?



- Are there aspects of social perception that operate independently of processes that determine IQ?
- Is there evidence that these are relatively spared in children with MLDs?
- How do the social and cognitive domains relate to each other?



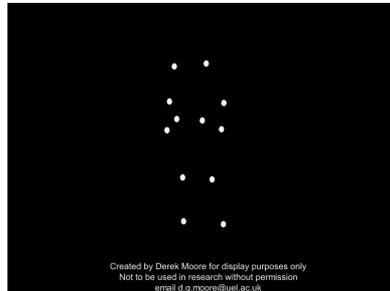
From Allison et al (2000) TICS



Moore, D.G., Hobson, R.P., & Anderson, M. (1995). Person perception: Does it involve IQ-independent perceptual processing? *Intelligence*, vol 20, p65-86.



Social perception

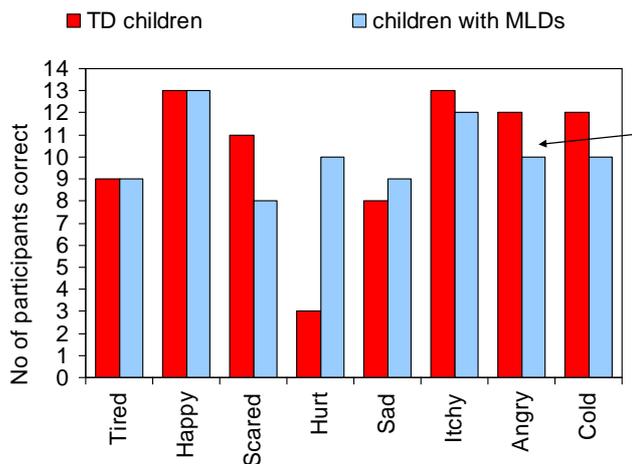


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- Moore, D.G., Hobson, R.P., & Anderson, M. (1995). Person perception: Does it involve IQ-independent perceptual processing? *Intelligence*, vol 20, p65-86.
- Moore, D.G., Hobson, R.P., & Lee, A. (1997). Components of person-perception: An investigation with autistic, non-autistic retarded and typically developing children and adolescents. *British Journal of Developmental Psychology*, vol 15, 401-423.
- Parron, C., Da Fonseca, D., Santos, A., Moore, D.G., Monfardini, E., & Deruelle, C. (2008) Recognition of biological motion in high functioning children with Autistic Spectrum Disorders. *Autism* 12, 261-274
- Hubert, B., Wicker, B., Moore, D.G., Monfardini, E., & Deruelle, C. (2007) Recognition of emotional and non-emotional biological motion in adults with autistic spectrum disorders. *Journal of Autism and Developmental Disorders* 37:1386-1392
- Moore, D.G., Goodwin, J.E., George, R., Axelsson, E., & Braddick, F. (2007). Infants perceive human point-light displays as solid forms. *Cognition* 104, 163-436.



Spared abilities in children with MID?



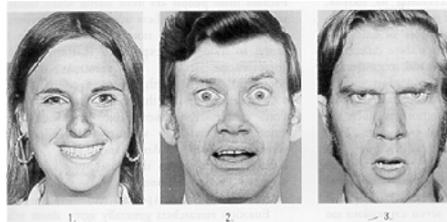
Moore, D.G., Hobson, R.P., & Lee, A. (1997). Components of person-perception: An investigation with autistic, non-autistic retarded and typically developing children and adolescents. *British Journal of Developmental Psychology*, vol 15, 401-423.



What of other developmental difficulties



- Do people with general IDs have emotion recognition difficulties with other emotional stimuli?
- Are these over and above developmental level (MA)?



Review of 21 studies



- most employed static stimuli
- only 12 used mental-age matched controls
- of these only 5 had a control task
- only one of these found evidence for a specific emotion recognition problem
- this involved complex cross-modal matching

Moore, D.G. (2001) Reassessing emotion recognition performance in people with mental retardation: a review. *American Journal on Mental Retardation*. Vol 106, 481-502.



Demands of different types of facial emotion recognition tasks



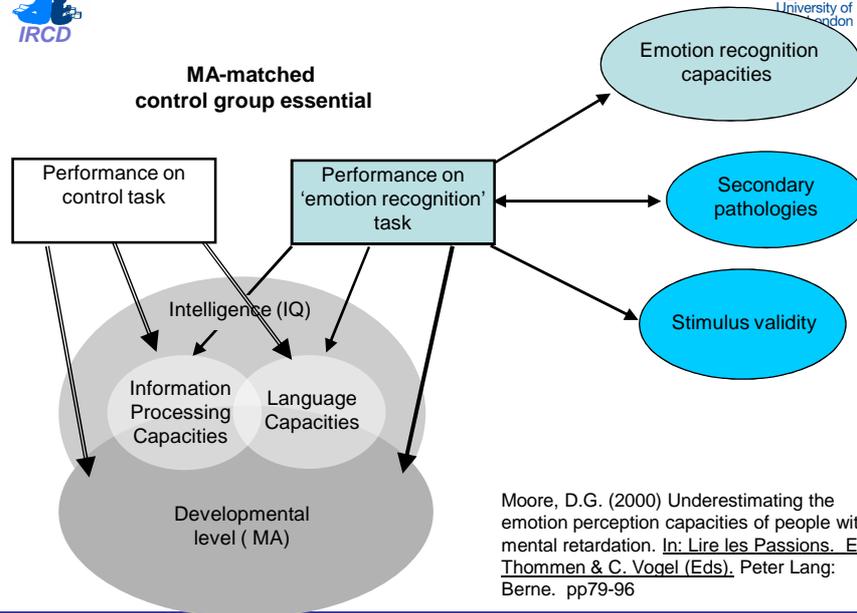
	Labeling	Identification/ Discrimination	Within-mode matching	Cross-modal matching	Rating
Hold in mind goal	ü	ü	ü	ü	ü
identify emotion in more than one stimulus	ü	ü	ü	ü	ü
identify emotion in more than one modality	ü	ü	ü	ü	ü
employ verbal response	ü	ü	ü	ü	ü
make non-categorical judgement	ü	ü	ü	ü	ü

Moore, D.G. (2000) Underestimating the emotion perception capacities of people with mental retardation. In: *Lire les Passions*. E. Thommen & C. Vogel (Eds), Peter Lang: Berne. pp79-96
Moore, D.G. (2001) Reassessing emotion recognition performance in people with mental retardation: a review. *American Journal on Mental Retardation*. Vol 106, 481-502.



“...there is a danger of creating a setting in which one participant’s intuitive emotional sensitivity might confer little advantage over another participant’s [...] cognitively effective classification abilities”
(Hobson,1991).

A model of performance



Important trends in the data

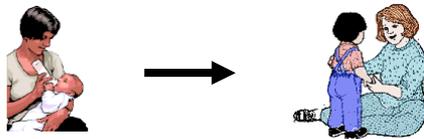
- Performance worsens with number of stimuli
- Performance worsens when doing labelling tasks or cross-model matching
- Performance very poor when rating ambiguous and neutral stimuli
- Performance worsens with age



Moore, D.G. (2001) Reassessing emotion recognition performance in people with mental retardation: a review. *American Journal on Mental Retardation*. Vol 106, 481-502.

- “to trace back the ontogenesis of complex social behaviour requires a focus on developmental mechanisms, not static lesions or deficits”

Pollock (2006)



What do these trends suggest?

- Is there a developmental element to this that is missing?
- We need to begin to follow processes from early in development
- We need to consider the relationship between social and cognitive processes as part of an explanation of developmental difficulties
- Need begin to study this in children with IDs as early as possible
- Very few IDs identified in first year but...

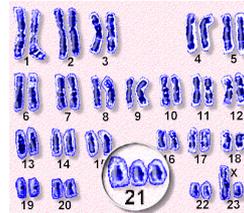


Children with DS (Trisomy 21) Behavioural phenotype



Key cognitive outcomes

- General intellectual delays
- Different attentional profiles
- Delays in motor development
- Selective deficits in short term memory
- Relatively slower onset of speech
- Selective problems in expressive language and syntax



But also specific problems with aspects of social communication

See Chapman & Heskith 2000; Fidler, 2005



Neuro-pathology



- Reduced neural proliferation
- Lower density in all cortical layers and reduced inter-neurons
- Variable myelination
- Reduced dendritic arbors and postsynaptic spines
- Spines abnormal
- Reduced synaptic density
- Reduction of brain volume

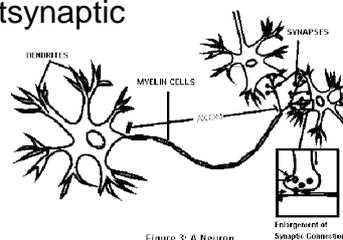


Figure 3: A Neuron

Enlargement of Synaptic Connection

- See Capone 2001 for gene-brain relationship in DS



Social phenotype



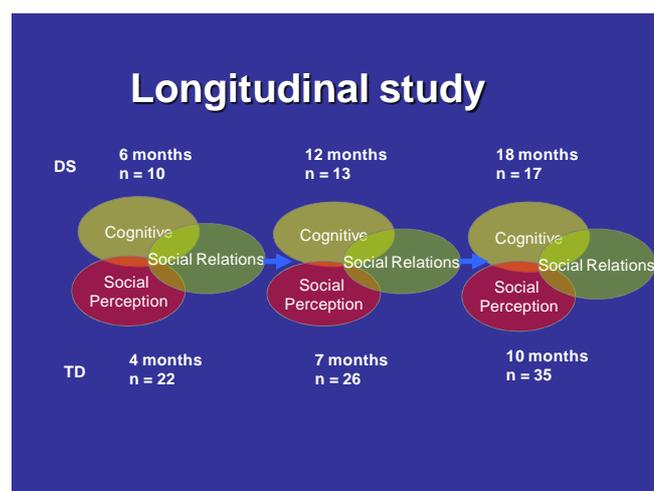
- Stereotyped as sociable and warm
- Good quality of relationships

But...

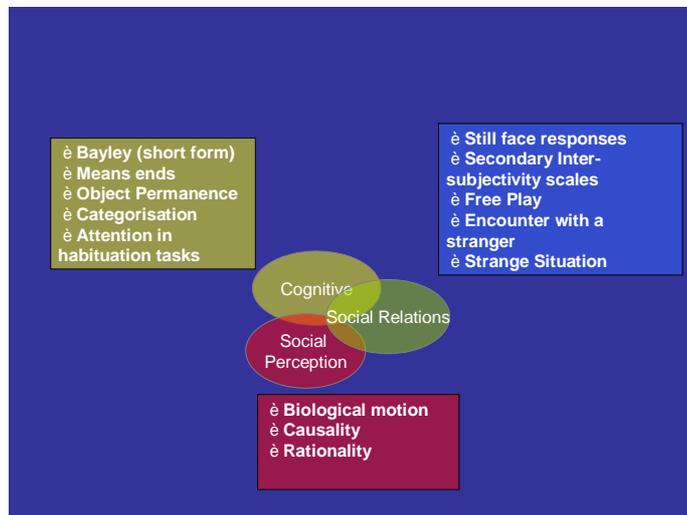
- There are subtle differences...



DS longitudinal study



ESRC grant R000236722



Problems with using Bayley scales for matching

- performance not independent of motor abilities
- requires a level of social engagement

We excluded items if...

- The motor demands were likely to compromise performance.
- The item was on the social facet.
- The item was on the language facet.
- items had previously been found to be unreliable in children with Down's syndrome (based on Wright 1998)

Moore, D.G., Goodwin, J.E., & Oates, J.M. (2008) A modified version of the BSID-II scales for cognitive matching of infants with and without Down syndrome. *Journal of Intellectual Disability Research* 52(6), 554-561.



The still-face paradigm

Tronick, Als, Adamson, Wise & Brazelton (1978)

phase 1: 180 secs of face-to-face mother-infant interaction

phase 2: 90 secs (max) where mother holds a 'still-face'

phase 3: 180 secs of face-to-face mother-infant interaction

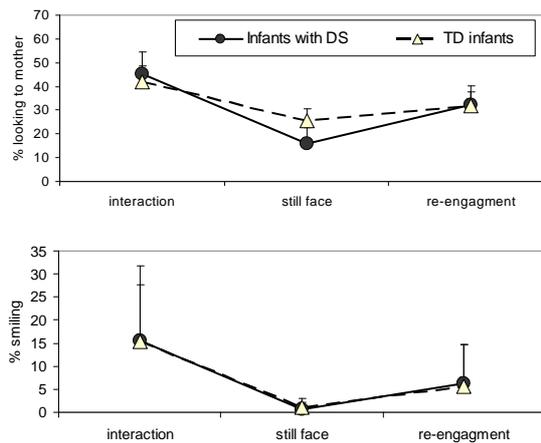
Video



Moore, D.G., Oates J.M., Goodwin, J.E., & Hobson, R.P. (2008). Behaviour of infants with Down syndrome and their mothers in the still-face paradigm. *Infancy* 13(1), 75-89.



Still face responses appear typical...



Moore, D.G., Oates J.M., Goodwin, J.E., & Hobson, R.P. (2008). Behaviour of infants with Down syndrome and their mothers in the still-face paradigm. *Infancy* 13(1), 75-89.

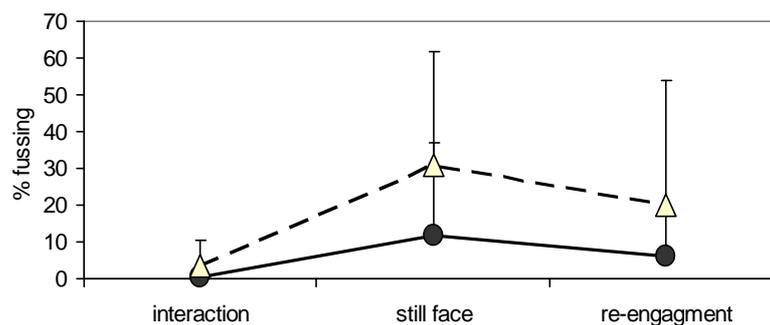
- It seems that infants with DS have a similar propensity to engage with others and have intact 'primary intersubjectivity'

But...

- is their social behaviour and environment typical?



There are subtle differences in emotional responding



Moore, D.G., Oates J.M., Goodwin, J.E., & Hobson, R.P. (2008). Behaviour of infants with Down syndrome and their mothers in the still-face paradigm. *Infancy* 13(1), 75-89.



Differential environment?



- Mother–infant interaction may have a different quality.

See also

Adamson et al 2009; Buckhalt, Rutherford, & Goldberg, 1978; Cielinski, Vaughn, Seifer, & Contreras, 1995; Legerstee, Varghese, & van Beek, 2002



Warmth and directiveness



		Phase	
		Interaction	Re-engage
Maternal ratings†		Mean (SD)	Mean (SD)
Warmth	DS	4.1 (1.0)	4.0 (1.1)
	TD	3.8 (1.2)	3.6 (1.1)
Directiveness	DS	4.3 (.8)	4.5 (.7)
	TD	3.6 (1.2)	3.5 (1.1)

†Group main effect $F(1,27) = 5.31, p = .03$, partial Eta-squared = .16
* $p < .05$; ** $p < .01$, 1-tailed

Moore, D.G., Oates J.M., Goodwin, J.E., & Hobson, R.P. (2008). Behaviour of infants with Down syndrome and their mothers in the still-face paradigm. *Infancy* 13(1), 75-89.



Different relationship to infant behaviours



Phase

Maternal ratings†		Phase		Correlations with infant behaviour in initial interaction (Spearman's <i>rho</i>)		
		Interaction	Re-engage	% looking	% smiling	% fussing
Warmth	DS	4.1 (1.0)	4.0 (1.1)	.46	.57*	.22
	TD	3.8 (1.2)	3.6 (1.1)	.46*	.66**	-.41*
Directiveness	DS	4.3 (.8)	4.5 (.7)	-.55*	-.19	-.54*
	TD	3.6 (1.2)	3.5 (1.1)	-.07	.03	-.04

Moore, D.G., Oates J.M., Goodwin, J.E., & Hobson, R.P. (2008). Behaviour of infants with Down syndrome and their mothers in the still-face paradigm. *Infancy* 13(1), 75-89.



- Mothers seem to be working harder to maintain attention
- This is not necessarily negative at this age but may have later effects
- What do we really know about the transaction between cognitive capacities and the social environments of people with DS





Cebula, Moore & Wishart (2010)



- There are relatively few studies of DS that attempt to relate social abilities and core cognitive difficulties in a developmental framework.
- Reviewed literature on social cognition in people with DS
- While there are some excellent studies of social abilities in DS there are large gaps in knowledge
- Tend to focus on specific aspects of social or cognitive but not theory driven
- Is DS poorly served by theoreticians?

Cebula, K, Moore, D.G. & Wishart, J. (2010) Social Cognition in Children with Down's Syndrome: Challenges to Research and Theory Building. Invited Review. *Journal of Intellectual Disability Research*, 54, 113-114



Is there enough research?



Google Scholar search term	Articles found for period of search	
	2010	2001-2010
"Autism"	5,900	82,700
"Down('s) syndrome"	3,432	55,300
"Trisomy 21"	771	15,700

Is there enough theory?

"Theory of autism"	75	1,470
"Theory of Down('s) syndrome"	0	0



- With ASD there is a clear attempt to link cognitive phenotype to social outcomes; social difficulties central to definition of ASD
 - It appears there is less interest in explaining the subtleties of social difficulties in people with DS.
-



Social phenotype: sparing?

- Stereotyped as sociable and warm
- Possible relative sparing in neonatal imitative abilities (Heimann et al. 1998)
- empathetic

But...



Cebula, K, Moore, D.G. & Wishart, J. (2010) Social Cognition in Children with Down's Syndrome: Challenges to Research and Theory Building. Invited Review. Journal of Intellectual Disability Research, 54, 113-114



Social phenotype: early differences



- Differences in temperament – reduced distress (Cicchetti etc)
- More attention towards people than objects (Legerstee etc)
- Different style of early interactions (Moore et al 2008; Buckhalt et al 1978; Roach et al 1998 etc.)
- Possible over application of imitative strategies (Wright, 1998)
- Possible differences in emotion recognition (Williams et al, 2005; Wishart et al 2007)
- Fewer social referencing looks (Knieps et al 1994; Kasari et al 1995)
- Reduced frequency of requesting behaviours (Mundy et al.)



Social phenotype: later differences



- Continued differences in interaction styles and fewer emotional and mental state terms in conversation (Kasari et al, 2001; Tingley et al, 1994)
- Very little known about interactions with fathers (see de Falco, 2008, 2009)
- Show reduced motivation to complete tasks and greater inconsistency (Wishart; Cuskelly)
- Still much unknown

Cebula, K, Moore, D.G. & Wishart, J. (2010) Social Cognition in Children with Down's Syndrome: Challenges to Research and Theory Building. Invited Review. *Journal of Intellectual Disability Research*, 54, 113-114



“Joint attention in infancy forms a bedrock for shared social realities, a precondition for the acquisition and use of language, and, in the deepest sense, for the formation and maintenance of culture: it depends on sharing the focus, context, and presuppositions about objects that guide attention.” Bruner (1995)



Static directional models are not sufficient

“Understanding development itself is the key to understanding developmental disorders”

(Karmiloff-Smith, 1998)

- To understand development we need dynamic developmental models and theories.
-



Lets get rid of delays versus differences



“Despite a large number of studies there is no consensus about whether or not the development of children with DS is delayed or different...Some researchers have argued that focussing on the question of delay versus difference may not be particularly helpful. What is more relevant is to examine how different areas of development are related” Lewis (2003)

Delays can lead to differences
Differences to delays

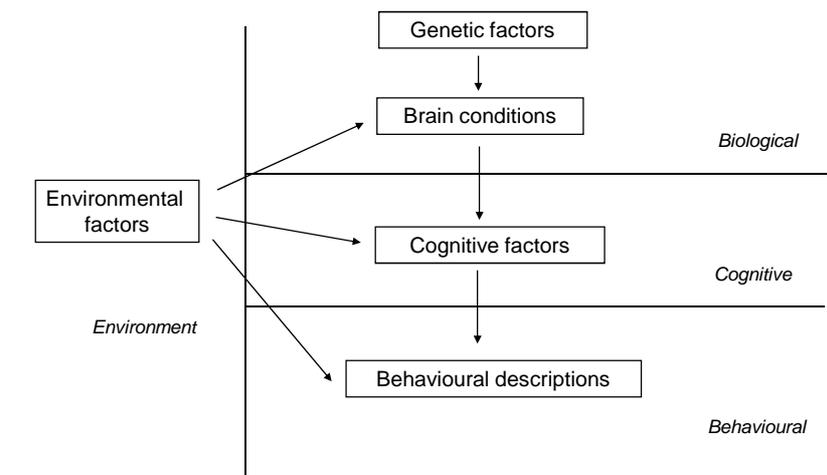
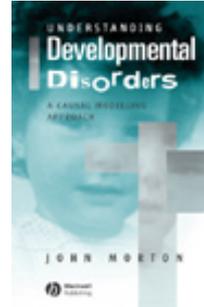


But how?



- We need a way of notating development so that people working in different fields are able to share in debates about theoretical causal pathways.
 - We need to link the important work in genetics to the subtle social outcomes
 - We need to make models that incorporate a developmental perspective
-

- The differences between theoretical positions can be difficult to understand clearly
- Very few theories are made fully explicit in text form
- We need conceptual tools to help us make these comparisons.
- These tools are useful for clinicians and researchers

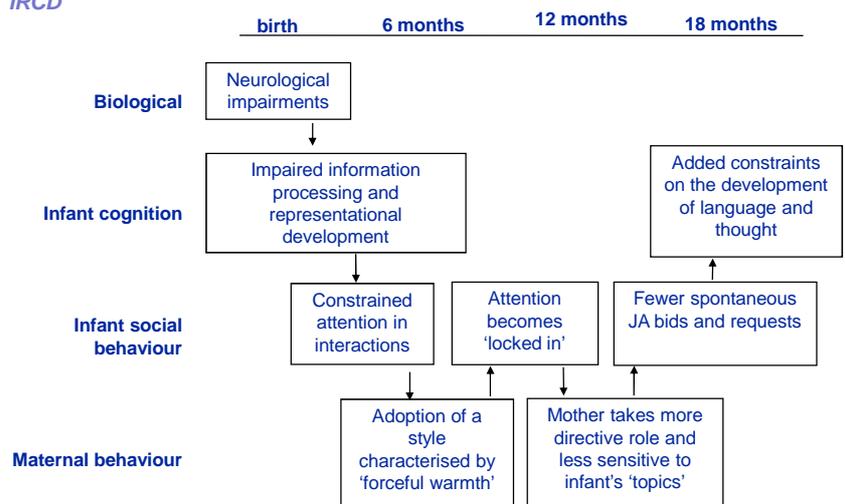
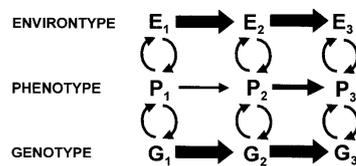




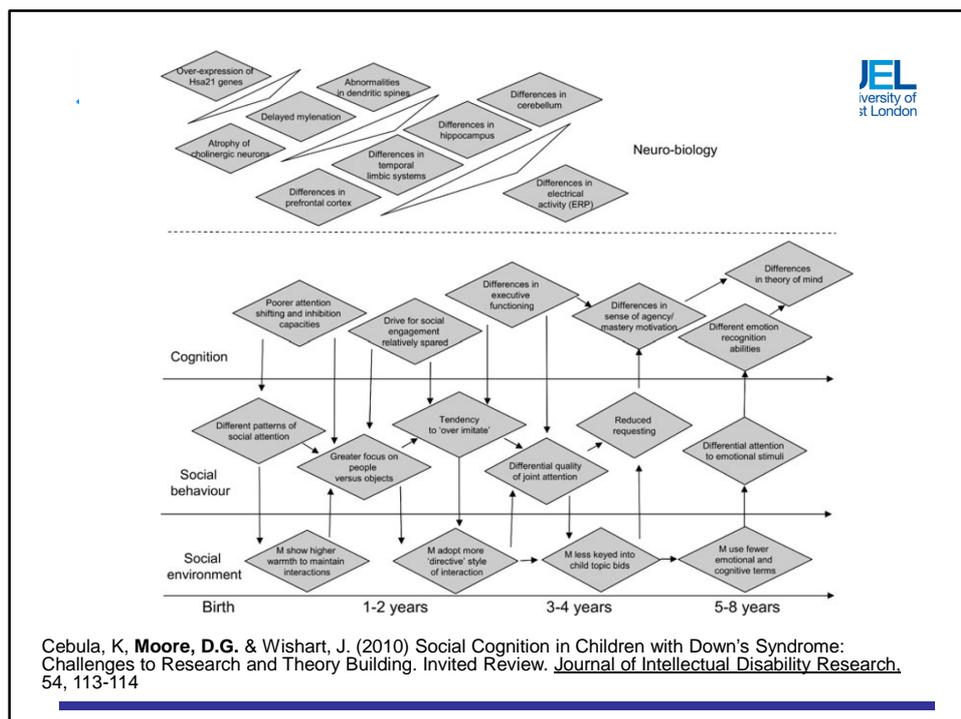
Improving this framework



- Do not restrict to uni-directional causes
- Make more allowance for changing influences over time
- Adapt the diagrammatic form to allow the description of transactional processes.



Moore, D.G., Oates, J.M., Hobson, R.P. and Goodwin, J.E. (2002) Cognitive and social factors in the development of infants with Down syndrome. *Down Syndrome Research and Practice*. vol 8, p43-52.





Why psychological theory is needed for DS



Over-simplified explanations may hinder understanding in all levels of explanation. Psychological theories can make the link from neuroscience to social behaviour

- Genetic and Neurosciences need to attend better to subtle phenotypic behavioural descriptions to understand gene expression.
- Cognitive science needs to better consider epi-genetic gene-environment effects to account for individual differences
- Clinicians and social workers need to better understand the neuro-cognitive underpinnings of behaviour



Developing a unified notation for development



- If we are to develop a better interdisciplinary understanding we need to come up with better ways of communicating across different fields.
- A unified notation for modelling causal developmental processes and pathways is required

Moore, D.G. and George, R. (in prep) Modelling cognitive and social development of infants with Down syndrome.



It is only a theory but...



- A theoretical model can not be completed by one person from any one field!
 - While any model and its components will be wrong this approach may allow people to articulate and demonstrate how they think a theory is wrong and why.
 - This approach starts to portray development as transactional and dynamic
 - This also allows us to portray both group and individual pathways
- but...
- We need to have a way of showing these processes and pathways in more dynamic ways ... This is to follow
-



Conclusions

- We must consider multiple levels of description to understand developmental disorders and in DS in particular.
- We need to be careful about attributing simple causal models that are based on 'static' adult neuropsychology
- Much more data on early behaviours is needed if we are to unpick the developmental processes involved and establish the transactions between biological, psychological and environmental factors
- We need to start developing explicit causal models a-priori and test them!
- You must use a big piece of paper.



People with DS deserve more

- There is considerable within-group variability in people with DS that could be explained
- Taking a developmental perspective across levels of explanation may help to resolve some of the difficulties in each of these areas.
- With more complete theories we can target valuable resources to focus on critical issues
- Clear theoretical models provide more powerful rationales for intervention strategies



With Katie Cebula, Jennifer Wishart, Peter Hobson, John Oates, Julia Goodwin, Mike Anderson, Christine Deruelle and others
