Tales of the Unexpected:

language and cognitive access in the psychology laboratory

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Background to this talk:

- my work is concerned with finding out how people reason

- in psychology of reasoning this has been tackled with prescribed experimental paradigms

- and a quantitative approach to data collection

- my tack: this is an inadequate approach to cognitive processing

- in particular, this is because we need to pay attention to the **construction of meaning** in the lab

Plan of the talk:

- discuss cases where meaning plays a role in experimental tasks

- discuss why and how to take meaning into account

Language matters in accessing cognition

Language-for-the-task:

- access ability *via* linguistic means **vs.** ability $=$ linguistic means
- e.g. false belief task - explaining the failure of young children and deaf adolescents.

Discourse genres:

- cross-cultural work indicates that participating in the discourse of psychological task requires prior inculturation in school environment - learning to be a 'universal' subject?
- social-psychological strangeness of some tasks - mix of co-operative and critical stance required

Language mismatches:

- natural language connectives $\neq$ those of the propositional calculus
- comes to the fore in logical reasoning tasks - syllogistic, selection task

False belief task

Method: Child sees familiar container - say a Smarties box. They are asked what they think is inside. Box is then opened to reveal unexpected contents, e.g. a plastic frog. Child is again asked what they thought was in the box (before they saw the frog). Also often asked what their friend in the next room will think is in the box.

Crucial 'false belief' question:

what did you think was in the box?

- normally developing children > 4 years old: 'Smarties'

- children < 4 years old: 'a plastic frog'

- autistic children (and adults): 'a plastic frog'

- deaf children $<$ adolescence: 'a plastic frog'

What comes first - language or thought?

- **Cognition scaffolds language**: standard account in terms of concept acquisition/cognitive capacity (Perner, Leslie). The correct response requires a report of previous false belief; subjects can only do this if they can and have acquired the concept of belief.

- **Cognition separate from language**: task is a test of linguistic competence, and there is evidence of working knowledge of false belief much earlier - in deception and pretend play (Chandler).

- **Language scaffolds cognition**: deaf children perform badly even on non-verbal versions of the test, and have delayed development in language but not socialisation. This suggests that specific syntactic structures are required, to make 'representational capacity' for propositional attitude reports available (de Villiers).

Discourse genres

- Studies with illiterate subjects (Luria, Scribner) suggest that reasoning on basis of given premises is not something done 'naturally' but must be learnt.

- Is education teaching us how to think? Does the charge of the 'pre-logicality' of traditional societies stick?

- No: work with preschool children (Harris & Leevers) , and examination of transcripts from illiterate subjects indicates this is not the case.

- What is learnt is not the skill (logical reasoning) but rather appropriate contexts of use of the skill; discourse contexts which cue roles.

- But they are not always mastered: 'belief bias' effects in syllogistic reasoning indicates subjects still take own beliefs into account.

- Even when the genre of the task and the role of participant are understood, more subtle problems can arise.

Language mismatches: … or the projection of theory onto nature

- natural language connectives $\neq$ those of the propositional calculus
- the success of classical logic has been counterproductive here, since it gives the idea that the conditional is understood, and that its essence is captured by the material implication.
- comes to the fore in logical reasoning tasks - syllogistic, selection task
- but surely *some* connectives - like the conjunction - are simple?

Classical logic has been immensely successful. But this very success has enshrined certain formats and procedures, that also have drawbacks. For instance, many themes suffer from what may be called 'system imprisonment'. We have to discuss the behaviour of [say] negation inside specific formal systems, such as propositional or predicate logic - even though these systems do not correspond to meaningful distinctions in the 'open space' of actual reasoning.

van Benthem (2000)

Conjunctive version of the Wason selection task

Conditionals are known to be complex. In contrast, the conjunction is much simpler. If we replace the conditional with a conjunction, does it reduce the task complexity and lead to more 'logical' answers?

There are As on one side of the cards and 4s on the other.

Formulate as conjunction $p \wedge q$, then results were as follows:

- **none**: 5 / 4(3)

- all: 0 / 2

- p, q: 3 / 1

- $p, \neg q$: 0 / 2

- p: 1 / 0

- $\neg p, \neg q$: 1 / 1(0)

The conjunction as existential
(or the universally quantified conjunction as a conjunction of existentials)

[subject 8 in the conjunctive condition; ticked no cards in the written]

S: *OK. Um I wasn't sure exactly what that was all about. ...* **I think that's already true, cause there's an A there (pointing at the A) and there's a 4 there** *(now at the 4), so I guess that's already proven, just by looking at it.*

E: *OK. So you don't need to turn any of the cards?*

S: *No, but I think I probably ticked that I did. Cause it's quite confusing.*

Notice that this subject makes the competent choice - for very different reasons than presumed. Clear evidence that ticking boxes is not enough!

The conjunction as disjunction
(or the free choice paradox in reverse)

[subject 7 in the conjunctive task; ticked A in written task; has just done original task correctly]

S: *OK. Well this is basically saying that … so this means that there's going to be at least an A or a 4 on each card.*

E: *What, this rule?*

S: **This rule says that there's going to be either an A or a 4.** *So which would mean there'd be a 4 here (pointing to the K) and a A (on the 7) here.*

The conjunction as conditional
(or the conditional is only easy when disguised)

[subject 1; chose A,4 in conditional condition; ticked no cards in the written; chooses A and 7]

E: *So that combination, the K and the 4, doesn't disprove the rule - is that what you are saying?*

S: *Yes, because it doesn't say, that, (pause) erm, any even number on one side has to have a vowel on the other. ...* **It just says if there's a vowel there's got to be an even number on the other side**.

[subject 5; ticked A,4 in the written]

S: *Exactly the same, I'd turn these two (the A and 4), 'cause there are As on one side and 4s on the other.* **It's the same statement, just written in a different way. Isn't it? Because they've missed out the 'if', that's all, that's all they've missed out.**

Thus far ...

- Subjects' grasp of language and discourse play a role in their responses on cognitive tasks - what that role is, differs from task to task

- Role is crucial in the case of logical reasoning tasks, but has largely been ignored in task set-up (e.g. response possibilities) and in theorising.

- Logical form is a function of semantic meaning, not just syntax

- ... and meaning is a function of discourses, not just sentences

in sum: **we need to take meaning into account**

... so why hasn't this happened yet?

Why have aspects of meaning been neglected?

- access is indirect at best, impossible at worst

- lack of cross-disciplinary research

- cognitive psychology wants to be an objective science

- 'lab situation' in the physical sciences: **control of stimuli**

  – what happens when subject of investigation is human and stimuli is linguistic? does it matter?

  – depends on nature of task: does subject have to operate on internal representation or just report it?

  – perception tasks vs higher-level cognitive tasks - cf 'illusions' in both cases

- slows research and changes its focus

Bruner's diagnosis: the computational metaphor

Very early on [in the cognitive revolution], ... emphasis began shifting from "meaning" to "information", from the *construction* of meaning to the *processing* of information. The key factor in the shift was the introduction of computation as the ruling metaphor and of computability as a necessary criterion of a good theoretical model. Information is indifferent with respect to meaning.

Bruner, *Acts of Meaning* (1990)

A revealing quote from Wason

One of the curious things about the earlier, introspective studies of thinking was that they demonstrated more than anything the inadequacies of their own methods. The course of thinking is affected by factors which are not available to introspection. Modern experimental work has avoided some of the issues by restricting itself to studying what people do when they solve problems.

Wason, *Reasoning* (1966)

Redressing neglect of meaning

- take a more exploratory approach

- get more information from each subject - within and across tasks

- look to other disciplines for help

but what does this buy you?

Wason's selection task

Below is depicted a set of four cards, of which you can see only the exposed face but not the hidden back. On each card, there is a number on one of its sides and a letter on the other.

Also below there is a rule which applies only to the four cards. Your task is to decide which if any of these four cards you *must* turn in order to decide if the rule is true. Don't turn unnecessary cards. Tick the cards you want to turn.

Rule: *If there is an A on one side, then there is a 4 on the other side.*

Cards:

A   K   4   7

Typical results

Formulate

If there is an A on one side, then there is a 4 on the other side.

as an implication $p \rightarrow q$, then the observed pattern of results is typically given as follows:

- 0–5% $p, \neg q$

- 45% p, q

- 35% p

- 7% $p, q, \neg q$

- rest miscellaneous

Logically correct answer in this case should be $p, \neg q$

An explanation of the modal choice 'A, 4'

- conditionals with true consequents are odd, maybe even ungrammatical e.g. *'If polar bears are difficult to hunt, then polar bears are white'*

- Fillenbaum (1978) observed subjects doing **pragmatic normalisation** - changing features of the original sentence to make more sense of it: *'Clean up or I won't report you'* becomes *'If you don't clean up, I'll report you*

- does normalisation occur in the Wason task?

- decompose conditional into
  If there's an A on the face, then there's a 4 on the back, **and**
  if there's a A on the back, there's an 4 on the face.

- and normalise to:
  If there's an A on the face, then there's a 4 on the back, **and**
  if there's a 4 on the face, there's an A on the back.

- A, 4 is the competent choice on this assumption

- explains judgement of K-4 as irrelevant, 4-K as falsifying

Interim conclusions

- Construction of meaning is integral to cognitive processing

- Reasoning processes operate on this constructed meaning

- Known aspects of conditional meaning can be recruited to explain data

- Discourse setting also needs to be taken into account

- Leading to better experimental set-ups

- Resulting in a richer and more plausible theory of human reasoning