The constructive/non-constructive duality and dual process theory

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What we will claim

- **The <u>purest</u> constructive thought is found in System 1.**
- **The <u>purest</u> non-constructive thought is found in System 2.**

The origin of the constructive / non-constructive distinction

- The origin was in mathematics, in the distinction between a constructive and a non-constructive proof.
- Philosophers, going back to Dummett, have extended this to justification.

Constructive justification

- We will use a disjunction, "p or q", as the relevant logical form.

- A <u>constructive</u> justification of "p or q" comes from "below", as a result of observing p, or alternatively q, and then inferring "p or q".

Constructive example

- **We observe a specific person, Smith, in our band taking more than his share of a benefit. He is a cheater.**

- **We infer <u>constructively</u> that Smith is a cheater <u>or</u> Jones is a cheater. This inference is from "below". We may not assert the disjunction, but we believe it.**

Non-constructive example

- **We notice that resources are missing, but we do not observe anyone taking them. Assuming hypothetically that someone has taken them is a better explanation of the fact they are missing than assuming no one has taken them. We infer <u>non-constructively</u>, from "above", that Smith is a cheater <u>or</u> Jones is a cheater, but we do not know which one is.**

Constructive thought and modules

- To identify a cheater constructively we need a face recognition module.
- But there is only weak evidence that we have an innate cheater detection module of the type Cosmides (1989) described.

The confound in Cosmides (1989)

- The following conditionals are <u>not</u> of the same logical form:

- If a card has a vowel on one side, then it has an even number on the other.

- If you take a benefit, then you must pay.

Cannot explain conditionals fully without System 2

- Deontic conditionals, some of which are about social contracts, are of great use.

- So are indicative conditionals inferred in non-constructive reasoning. Once we have inferred that Smith is the cheater or Jones is, we can infer that, if Smith is not the cheater, then Jones is.

The Ramsey test

- **How can we explain the use of ordinary conditionals?**

- **The Ramsey test: to make a judgement about "if p then q", people hypothetically suppose p and then make a judgment about q, "… fixing their degrees of belief in q given p."**

The implications

- The Ramsey test implies the conditional probability hypothesis:
- The subjective probability P(if p then q) is the conditional subjective probability of q given p, P(q/p).

- Evans, Handley, & Over (2003); Over, Hadjichristidis, Evans, Handley, & Sloman (in press).

Implementation

- The Ramsey test is implemented using heuristics, inductive reasoning, and causal models. Non-constructive thought can also implement the test, as when a conditional is inferred from a disjunction with a non-constructive justification.

The example of the inference

- We have inferred, “from above”, that Smith has taken the resource or Jones has taken it.
- We infer next that, if Smith has not taken it, then Jones has.

The logical form of the inference in question

- From “p or q”, infer “if not-p then q”.
- From “not-p or q”, infer “if p then q”.

More logical points

- **For all conditionals we must have that**
- **“if p then q”**
- **<u>logically implies</u>**
- **“not-p or q”**
- **But <u>only</u> for the material conditional, can the converse hold, as the material conditional just means “not-p or q”.**

Inferring a conditional from a disjunction is <u>not</u> logically valid

- Inferring "if p then q" from "not-p or q" can only be valid when the "if" is the material conditional.
- The natural language, ordinary "if" is <u>not</u> the material conditional.
- Evans, Handley, & Over (2003); Over, Hadjichristidis, Evans, Handley, & Sloman (in press).

Valid inferences for the material conditional - “the paradoxes”

- From “not-p”, we may validly infer: “not-p or q”
- From q, we may validly infer: “not-p or q”

Why called “the paradoxes”?

- Linda is not a feminist. Therefore, if she is feminist then she believes that women are inferior to men.
- Linda is a feminist. Therefore, if she believes that women are inferior to men, then she is a feminist.

A “paradox” with disjunction

- Linda is not a feminist. Therefore, she is not a feminist or she believes that women are inferior to men. Thus, if she is a feminist then she believes that women are inferior to men.

- The inference is not pragmatically justified in the above case. Why not?

The probability of a disjunction 1

- P(not-p or q) =
- P(not-p) + P(q) - P(not-p & q)
- P(not-p) + P(q/p) - P(not-p)P(q/p)

The probability of a disjunction 2

- P(not-p or q) =
- P(not-p) + P(q/p) - P(not-p)P(q/p)

Probability and validity

- An inference with a single premise - “p and q” - is valid if and only if this premise cannot be more probable than the conclusion - q.

The Linda example (Tversky and Kahneman, 1983)

- Linda is a bank teller and active in the feminist movement.

- Linda is a bank teller.

Evidence that the natural language conditional is not the material conditional

- People do not judge the probability of "if p then q", P(if p then q), to be the probability of the material conditional, P(not-p or q).
- People often implicitly judge P(not-p or q) to be higher than P(if p then q).
- People often implicitly judge P(p or q) to be higher than P(if not-p then q).

Over, Hadjichristidis, Evans, Handley, & Sloman (in press).

- People explicitly assess P(if p then q).

- They also explicitly judge:
- P(p & q).
- P(p & not-q).
- P(not-p & q).
- P(not-p & not-q).

The analysis

- **We performed multiple regression analyses on P(if p then q) using P(p) and P(q/p) as predictors**

- **If "If p then q" was the material conditional, P(p) should have a significant negative loading.**

The results for participants

- **Analyses across individual participants. Cells = beta weights**

	EXP1 (indicatives)		EXP2 (indicatives)
	True	False	
P(p)	.02	.02	.16*
P(q/p)	.42*	-.38*	.51*

The results for items

- **Analyses of item means on item means. Cells = beta weights**

	EXP1 (indicatives)		**EXP2 (indicatives)**
	True	False	
P(p)	.05	.00	.14*
P(q/p)	.90*	-.93*	.93*

The results on disjunction (not published so far)

- For all 81 participants in these experiments:

  mean P(not-p or q) > mean P(if p then q)

- The same was true in the analyses by items. For all 32 items:

  mean P(not-p or q) > mean P(if p then q)

Belief versus assertion

- In people's <u>beliefs</u>, P(not-p or q) is often greater than P(if p then q).
- People will often infer "if p then q" when "not-p or q" is <u>asserted</u>.
- How is this possible? People acquire extra, pragmatic information from <u>assertions</u>.

A pragmatic inference from an <u>assertion</u>

- Suppose you ask me where Linda is, and I reply, "She is in her office or the Library." You will think you are justified in inferring, "If Linda is not in her office, she is in the Library."

Why pragmatic?

- Suppose I know that Linda is in her office and nothing about why she is there. From this, I can infer that she is in her office or the Library. If I assert only this disjunction, however, I will violate Grice’s Maxim of Quantity, and you will be misled.

May sometimes "violate" Maxim of Quantity

- When helping a class prepare for an exam, we may say that topic p or topic q is on the exam, when we know that only p is on the exam.

Return to belief

- When can we infer "if p then q" from "not-p or q" in our beliefs?
- When can we infer "if not-p then q" from "p or q" in our beliefs?

Recall the probability of a disjunction

- P(not-p or q) =

- P(not-p) + P(q/p) - P(not-p)P(q/p)

Justifications of "p or q"

- **"p or q" could be justified from "below", <u>constructively</u>. Then we can<u>not</u> believe "if not-p then q".**

- **"p or q" could be justified from "above", <u>non-constructively</u>. Then we <u>can</u> believe "if not-p then q".**