

## CREL Seminar

**What the linguistics of “if” could teach social psychology, health psychology, and the study of rationality.**

**Dr Peter Collins**



Please mute your microphone to prevent feedback.



Turn on live captions to follow along as the presenter speaks if you like.



To ask a question please use the chat box or the raise your hand function.



This talk will be recorded. Please comment in the chat box if you do not consent to being recorded.

# FRAMING, LANGUAGE, AND “IF”

Dr Peter Collins

School of Human Sciences, University of Greenwich

9/12/20

- A yoghurt can be described as 95% fat-free or 5% fat – the first tends to lead to more positive evaluation
- An intervention is described in terms of lives saved or people dying – the latter tends to lead to “riskier” decisions
- Smoking cessation could be advocated by stressing potential gains (“If you give up smoking, you’ll reduce your risk of lung cancer”) or losses (“If you don’t...you won’t) – it’s claimed there are systematic differences

## FRAMING EFFECTS

- Different, but *equivalent*, descriptions lead us to different judgements & choices
- Violates rules of rationality: *principle of description invariance*  
(Tversky & Kahneman, 1981)
- Mainstay of *Nudge* campaigns, marketing & mass persuasion

BUT...

- Frames are not arbitrary descriptions but (parts of) deliberate speech acts
- What did the speaker/author *mean*?
- Such accounts are arguably rare
  - (c.f. Mandel, 2014; Sher & McKenzie, 2006)
- For one type – goal framing – minimal attention has been given to language

## MY AIMS - I

- To argue that, to understand and predict framing effects, we need to consider language
  - *Independently motivated linguistic accounts*
- To highlight that linguistic accounts raise a different set of questions for research

## MY AIMS - 2

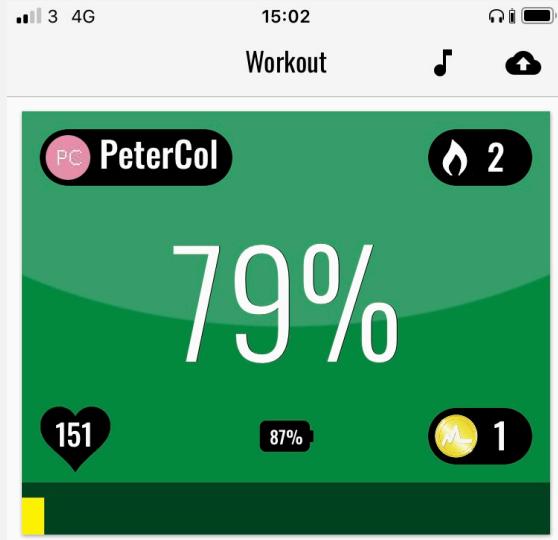
- To present some largely theoretical work
- To tempt linguists (and others) among you into considering (potentially) new areas

# PLAN

1. A case study: attribute framing
2. Goal framing: the standard view
3. Goal framing and *if*: towards a linguistic account
4. Conclusions

# PART I:ATTRIBUTE FRAMING

A case study



Or “21% more to give”?

Or “5% fat”?



## Prevention



Cancer cases are  
preventable, UK, 2015

Or “62% not preventable”?

# ATTRIBUTE FRAMING

- Different but *logically equivalent* descriptions
  - 79% effort → 21% left to give
- Descriptions are *valued*
  - Effort committed, fat-free, & preventable are good
  - Effort uncommitted, fat, & non-preventable are bad
- Positive frame leads to more positive evaluations
  - Robust effect for evaluation, estimation, & behaviour (Freling et al., 2014)

## WHY ATTRIBUTE FRAMING?

- Associative: valence of the frame leads to valenced associations
  - Positive frames → positive associations → positive evaluations
  - Negative frames → negative associations → negative evaluations
  - Spillover from fat > quality > taste
- Biases attention to positive/negative aspects

(Levin, Schneider & Gaeth, 1998)

BUT ARE THE FRAMES EQUIVALENT?

The water level has changed.

The glass is half-empty.

What was the water level  
before?



The water level has changed.

The glass is half-empty.

What was the water level  
before?

Most say full



The water level has changed.

The glass is half-full.

What was the water level  
before?



The water level has changed.

The glass is half-full.

What was the water level  
before?

Many say empty



# NON-EQUIVALENCE

- Descriptions like “half-full” and “half-empty” may be *logically* equivalent but intuition suggests different patterns of use
- Experimental data across a range of contexts, with & without affect
- Producing & interpreting descriptions

## FINDINGS – I

- Speakers use frames systematically in different contexts
  - Use frames to imply increase over reference point
    - “...initial, expected, or standard level of a variable”  
(Sher & McKenzie, 2006)
      - 90% survival → higher than expected
      - 10% mortality → higher than expected
- (Leong et al., 2017; McKenzie & Nelson, 2003; Sher & McKenzie, 2006)

## FINDINGS - 2

- A positive frame indicates recommendation, a negative frame non-recommendation
- Hearers systematically infer a reference point from the description
- Use these reference points in making their judgements & decisions

(Leong et al., 2017; McKenzie & Nelson, 2003; Sher & McKenzie, 2006)

## IMPLICATIONS

- An initial untested assumption leads to one set of accounts
- But considering language reveals sophisticated reasoning about implicit meanings
- Suggests a different process

## MEANING V. ACCEPTANCE

- Step 1: identify the intended (and perhaps implicit) meaning of the frame
- Step 2: decide whether to accept that meaning
- Step 3: judge the framed object accordingly
- *A difference between meaning & acceptance (do I believe the speaker)*

## WORK IN PROGRESS

- Does attribute framing depend on knowledgeable speakers?
  - *Speakers who could know important reference points*
- Does attribute framing depend on trustworthy/well-intentioned speakers?
  - *Speakers who can be taken at their word*

## SUMMARY

- A language-based account can clearly account for the dominant behaviour pattern
- Resolves apparent irrationality
- Raises new, unanswered questions: dependence on expert, benevolent speakers

## PART 2: GOAL FRAMING

The Standard Account

“Research shows that women who do breast self-examination have an increased chance of finding a tumor in the early, more treatable phases”

“Research shows that women who do not do breast self-examination have a decreased chance of finding a tumor in the early, more treatable phases.”

## GAINS & LOSSES

- Gain/Positive frame: stresses the advantages of compliance
- Loss/Negative frame: stresses the disadvantages of non-compliance
- Assumed to be equivalent, but loss frames predicted to be more effective

(Meyerowitz & Chaiken, 1987)

# WHY?

- Loss aversion: losses loom larger than gain; have roughly twice the effect on our happiness

(Meyerowitz & Chaiken, 1987)

- Across many studies, loss frames are *not* more persuasive than gains

(O'Keefe & Jensen, 2006)

## AN ALTERNATIVE

- We know that people have different risk preferences for gains and losses
- Suggested that goal framing may depend on the riskiness of the advocated behaviour  
  
(Meyerowitz & Chaiken, 1987; Rothman & Salovey, 1997)

## RISK & GAINS

1. A sure gain of £800.
2. An 85% chance to gain £1,000 and a 15% chance to gain £0.

- Most people choose option 1, even though on average 2 would lead to a bigger gain (£850)
- Averse to the risk (probabilistic nature) of 2.

(Kahneman & Tversky, 1984)

## RISK & LOSSES

1. A sure loss of £800.
2. An 85% chance of losing £1,000 and a 15% chance of losing £0.

- Most people choose option 2 even though on average it would lead to a bigger loss (£850)
- Attracted to the risk (probabilistic nature) of 2

(Kahneman & Tversky, 1984)

## ROTHMAN & SALOVEY (1997)

- Short-term risk of behaviours - used in 95% of studies (Nan et al., 2018)
- Prevention behaviours – exercise, flossing, healthy diet
  - Low risk
  - Pair with *gain* frames, which prompt risk aversion
- Detection behaviours – HIV testing, cancer screening
  - High risk
  - Pair with loss frames, which prompt risk seeking

## SOME PROBLEMS - I

- Findings are unimpressive: a small advantage for gain framing for prevention behaviours, but only on some measures & not consistent across behaviours

(Gallagher & Updegraff, 2012; O'Keefe & Jensen, 2009)

- The theoretical predictions are arguably *misapplications* of Prospect Theory  
- a different sense of risk

(van't Riet et al., 2016)

## SOME PROBLEMS - 2

- When Prospect Theory is properly tested, the predictions are not clearly supported

(van't Riet et al., 2016)

- Even the most optimistic researchers acknowledge a theoretical vacuum

(Rothman et al., 2020)

## SOME QUESTIONS

- Can we take a similar approach to attribute framing?
- Is there any evidence to support the assumption that goal frames are equivalent?
- What does a linguistic analysis suggest about the meaning & response to frames?

## PART 3: GOAL FRAMING & “IF”

## AN ON-GOING PROJECT

- Building a corpus of frames: analyzing their content
- Drawing on collaborative experimental work on conditionals
  - Profs. Ulrike Hahn, Stephan Hartmann, Gregory Wheeler
  - Drs Karolina Kryżanowska & Niels Skovgaard-Olsen
- Theoretical & pilot work with Prof. Ulrike Hahn

- “Research shows that women who do (do not do) breast self-examination have an increased chance (decreased chance) of finding a tumor in the early, more treatable phases” (Meyerowitz & Chaiken, 1987)
- “If you use (don’t use) sunscreen with SPF 15 or higher, you decrease (increase) your chances of damaging your skin and of bringing on an early death”  

(Detweiler et al., 1999)
- “By regularly exercising (not regularly exercising) you will gain (not gain) important benefits and reduce the risk [of common illnesses]”  

(Arora et al., 2006)

# CONDITIONALS

## Example conditionals

If you have regular HIV testing, you'll detect any infection early.

Have regular HIV testing and you'll detect any infection early.

Have regular HIV testing or you won't detect any infection early.

By having regular HIV testing you'll detect any infection early

(Declerck & Reed, 2001)

- Express a condition under which the outcome occurs
- Different flavours: X or not Y sounds like a threat
- Connect with rich – but untapped - literatures in linguistics, philosophy of language, & psychology of reasoning

(Fraser, 1998)

# EQUIVALENCE

- With attribute framing, it seemed plausible that frames were logically equivalent
- Assuming the numbers are exact,  $100\%-95\% = 5\%$
- Two sentences are equivalent if each follows from the other
- To understand this, we need a theory of what the conditional *is*

## EXAMPLE I: LOGIC

- Traditionally, conditionals were seen as the material conditional of classical logic
- Inferring one frame from the other is to commit a formal fallacy: *denial of the antecedent*

If Peter is Prime Minister, he lives in Downing Street.

Peter isn't Prime Minister.

So he doesn't live in Downing Street?

*But could he be Boris Johnson's latest paramour?*

## EXAMPLE 2: PROBABILITY

- Roughly speaking, a conditional "If P, Q" is closely tied to the conditional probability  $P(Q|P)$
- Denial of the antecedent is not fallacious, but relevant conditional probabilities don't constrain each other

”If you eat less red meat (P), you’ll reduce your risk of bowel cancer (Q)”

$$P(Q|P) = 1$$

But risk factors include: fiber, obesity, smoking, physical activity

$$P(\text{Not } Q|\text{Not } P) < 1$$

## AN EXCEPTION

- Speakers sometimes use “if” to mean “if and only if” : *conditional perfection*
- “If you mow the lawn, I’ll give you £5”
  - → If you don’t mow the lawn, I won’t give you £5
- Not a default interpretation (Evans & Over, 2004)

## AN UNJUSTIFIED ASSUMPTION

- On two possible models of the conditional, the frames are not generally equivalent
- A claim: researchers have tended to ignore the linguistic form of the frames, perhaps because they have assumed they're equal

SO WHAT DO FRAMES MEAN?

# AN INVITATION

- To predict responses to frames, we must first build a model of their content
- That model should be based in linguistic theories of the conditional
  - Numerous theories are available
- Rich potential for input from linguists, philosophers, & psychologists of reasoning

ONE OPTION

# THE PROBABILISTIC CONDITIONAL

- Close connection between conditional "If P, Q" and conditional probability  $P(Q | P)$
- When speakers assert a conditional, they mean that  $P(Q|P)$  is high

## EVIDENCE BASE

- Conditional closely related to conditional probability in various judgement tasks

(Evans et al., 2007; Over & Cruz, 2018)

- When we learn a conditional, we learn (among other things) that  $P(Q|P)$  is high

(Collins et al., 2020)

- $P(Q|P)$  predicts reading times

(Haigh, Stewart, & Connell, 2013)

## PROBABILISTIC FRAMES

- “If you have regular HIV testing, you’ll detect any infection early”
  - Means that  $P(\text{Early Detection} \mid \text{Regular Testing}) = \text{High}$
- “If you don’t have regular testing, you won’t detect any infection early”
  - Means that  $P(\text{Not Early Detection} \mid \text{Not Regular Testing}) = \text{High}$
- It is not clear that hearing (reading) one frame gives you information about the other

## SUBJECTIVE VALUE

- But both frames are about actions and outcomes with subjective value (utility) for the hearer
- Goal frames express an argument for carrying out the action
  - *Argument from consequences*
  - Do this because the consequences are good
  - Don't do this because the consequences are bad
- Argument can be judged on its own merits

# PROBABILITY & UTILITY

- Conditional reasoning better captured by probabilities than logic  
(Oaksford & Chater, 2007, 2013)
- Combining utilities & probabilities allows to predict
  - Persuasiveness of other types of arguments from consequences  
(Hahn & Oaksford, 2007)
  - Persuasiveness of promises, tips, threats, warnings
    - (Evans et al., 2008)

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you **have regular HIV tests**, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will **detect any infection early**.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you **don't have regular HIV tests**, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you **won't detect any infection early.**
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$

# CONTENT

- If you have regular HIV tests, you will detect any infection early.
  - $P(\text{Detect} \mid \text{Testing})$
  - $U(\text{Action}) + [U(\text{Outcome}) * P(\text{Outcome}|\text{Action})]$
- If you don't have regular HIV tests, you won't detect any infection early.
  - $P(\text{Not Detect} \mid \text{Not Testing})$
  - $U(\text{Not Action}) + [U(\text{Not Outcome}) * P(\text{Not Outcome}|\text{Not action})]$  : THE WORSE THE BETTER

## PILOT DATA - I

- So far only investigating the effect of utilities with prevention behaviour
  - Arguments in favour of painful surgery or unpleasant medication
  - Citing risk reduction of major or minor illness
- E.g.
  - "If you take this mildly unpleasant medicine, you'll reduce your risk of a minor infection"
  - "If you don't.....you won't...."
- Rating convincingness of argument & utility of the actions and outcomes

## PILOT DATA - 2

- 2 web-based experiments (within participants; N = 92, 91)
- Strong evidence for effect on the convincingness of arguments ( $b = .87$ ,  $b = .19$ ,  $BFs > 100$ ):
  - Both U(Action) and U(Outcome) are important ( $BFs > 100$ )
- Weak/anecdotal for an advantage for positive frames ( $BFs \approx 2.6$ )
- Suggestive, but more work needed, especially on probabilities

# IMPLICATIONS

- A reminder: the conditional probabilities of the positive and negative frames can be very different
  - Legitimate to respond very differently
- Much will depend on the context: participants' knowledge & beliefs about the issue at hand
- Not only *probabilities* that differ
  - What happens to the subjective value?

## UTILITY OF ACTING & NOT ACTING

- Frames are generally about actions that are unpleasant but have happy consequences
- What happens to these utilities under negation?
- E.g. How do we treat *not* having painful surgery?
  - As inaction: neutral (Bonnefon, *personal communication*)
  - As avoiding an expected loss (Abeler et al., 2011)

$U(\text{Surgery})$

Mean

mean = -3.32

100% < 0 < 0%

95% HDI  
-3.77      -2.86

-4            -3            -2            -1            0

$\mu$

$U(\text{Not Surgery})$

Mean

mean = 2.07

0% < 0 < 100%

95% HDI  
1.44      2.71

0            1            2            3            4

$\mu$

## IMPLICATIONS

- Negation flips utilities: not acting is good
  - An escape from expected unpleasantness (see Abeler et al., 2011)
- Weakens negative frames, which are persuasive in virtue of their negativity

# CONNECTIONS

- A new framework:
  - Based on psycholinguistics & psychology of reasoning
  - Initial evidence
  - Parameters haven't been *programmatically* explored
- Feature occasionally in literature
  - (e.g. Block & Keller, 1995; Orbell & Hagger, 2006; O'Keefe, 2013)

# THE COMPLEXITY OF FRAMING

# THE COMPLEXITY OF ARGUMENTS - I

- “Research shows that women who do breast self-examination have an increased chance of finding a tumor in the early, more treatable phases”
- Research shows
  - That if women do breast self-examination
    - Then If they develop a cancerous tumour
      - They are more likely to detect it in the early, more treatable phases
- A nested conditional – pushing at the boundaries of psychological research
- Are they clearly understood?

## THE COMPLEXITY OF ARGUMENTS - 2

- “If you use sunscreen with SPF 15 or higher, you decrease your chances of damaging your skin and of bringing on an early death”
- $P(\text{Decrease Risk} \mid \text{Sunscreen})$
- A probability of a risk reduction?
  - Second-order probabilities?
- Is that meaningful?

## THE COMPLEXITY OF ARGUMENTS - 3

- In some contexts, the audience will know there are multiple actions available
  - One treatment option out of several
- Do they spontaneously compare with relevant alternatives?
  - Affects the relationship between frames
- Arguably a rational audience should

(Oaksford & Hahn, 2007; Reed et al., 2008)

# SPEAKER INTENTIONS

- Conditional probabilities are high
- But in what contexts do speakers naturally use these frames?
  - Leak information about intentions? (Hilton et al., 2005)
  - Impression management (Rothman et al., 2020)
- How might *these* influence persuasion?

# SUMMARY

- Once we interrogate equivalence, it seems unjustified
- Parallels with attribute framing:
  - Not equivalent
  - What did the speaker (author) intend?
  - Should we believe them?
- Difference from attribute framing:
  - Goal frames express an argument, which can be judged in its own terms

## IMPLICATIONS & OPEN QUESTIONS

## MULTIPLE LAYERS OF FRAMING

- The intended meaning of the utterance
- The persuasiveness of the utterance
  - Assertion: *does the speaker's view matter?*
  - The content of the argument

# GOAL FRAMES

- Gain and loss frames can mean very different things & elicit very different responses
- Offered one account based on probabilistic theory, but others are plausible
- Language-based accounts need urgently developing and testing
- Independently motivated: strong linguistic theories

## RELATIONSHIP BETWEEN + & -

- Once we see that frames don't have to be equivalent, this question becomes less central
- Perhaps no general rule about which type of frame is more persuasive
- Focus instead on making the clearest & best arguments
- Monitor the complexity of the arguments being developed

## LIMITATIONS

- Attribute framing & goal framing seem promising
- Framing can happen with minimal language  
(Tversky & Kahneman, 1981)
- Language-based accounts don't always work  
(Mandel, 2014 v. Chick et al., 2016)
- Language is an important check *before* diagnosing irrationality

# AN INVITATION TO LINGUISTS

- The best theories will come from interdisciplinary collaborations
- A way to use linguistic theories for impact/enterprise
- Not just framing, but a wide range of language-based tasks in judgement and decision making/social psychology
  - E.g. one-shot demonstrations of irrationality

THANK YOU

- Abeler, J., Falk, A., Goette, L., & Huffman, D. (2011). Reference points and effort provision. *American Economic Review*, 101(2), 470-92.
- Arora, R., Stoner, C., & Arora, A. (2006). Using framing and credibility to incorporate exercise and fitness in individuals' lifestyle. *Journal of Consumer Marketing*.
- Block, L. G., & Keller, P.A. (1995). When to accentuate the negative: The effects of perceived efficacy and message framing on intentions to perform a health-related behavior. *Journal of marketing research*, 32(2), 192-203.
- Chick, C. F., Reyna, V. F., & Corbin, J. C. (2016). Framing effects are robust to linguistic disambiguation: A critical test of contemporary theory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 42(2), 238.
- Collins, P. J., Krzyżanowska, K., Hartmann, S., Wheeler, G., & Hahn, U. (2020). Conditionals and testimony. *Cognitive Psychology*, 122, 101329.
- Declerck, R., & Reed, S. (2001). Conditionals. A comprehensive empirical analysis. De Gruyter Mouton.
- Detweiler, J. B., Bedell, B. T., Salovey, P., Pronin, E., & Rothman, A. J. (1999). Message framing and sunscreen use: gain-framed messages motivate beach-goers. *Health Psychology*, 18(2), 189.
- Evans, J. St. B., & Over, D. E. (2004). *If*. Oxford University Press.
- Evans, J. S. B., Neilens, H., Handley, S. J., & Over, D. E. (2008). When can we say 'if'? *Cognition*, 108(1), 100-116.
- Fraser, B. (1998). Threatening revisited. *Forensic Linguistics*, 5, 159-173.
- Freling, T. H., Vincent, L. H., & Henard, D. H. (2014). When not to accentuate the positive: Re-examining valence effects in attribute framing. *Organizational Behavior and Human Decision Processes*, 124(2), 95-109.
- Gallagher, K. M., & Updegraff, J. A. (2012). Health message framing effects on attitudes, intentions, and behavior: a meta-analytic review. *Annals of behavioral medicine*, 43(1), 101-116.
- Hahn, U., & Oaksford, M. (2007). The rationality of informal argumentation: a Bayesian approach to reasoning fallacies. *Psychological review*, 114(3), 704.
- Haigh, M., Stewart, A. J., & Connell, L. (2013). Reasoning as we read: Establishing the probability of causal conditionals. *Memory & cognition*, 41(1), 152-158.
- Hilton, D. J., Kemmelmeier, M., & Bonnefon, J. F. (2005). Putting ifs to work: goal-based relevance in conditional directives. *Journal of Experimental Psychology: General*, 134(3), 388.
- Kaheman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist*, 39, 341-350.
- Leong, L. M., McKenzie, C. R., Sher, S., & Müller-Trede, J. (2017). The role of inference in attribute framing effects. *Journal of Behavioral Decision Making*, 30(5), 1147-1156.

- Levin, I. P., Schneider, S. L., & Gaeth, G. J. (1998). All frames are not created equal: A typology and critical analysis of framing effects. *Organizational behavior and human decision processes*, 76(2), 149-188.
- Mandel, D. R. (2014). Do framing effects reveal irrational choice?. *Journal of Experimental Psychology: General*, 143(3), 1185.
- McKenzie, C. R., & Nelson, J. D. (2003). What a speaker's choice of frame reveals: Reference points, frame selection, and framing effects. *Psychonomic bulletin & review*, 10(3), 596-602.
- Meyerowitz, B. E., & Chaiken, S. (1987). The effect of message framing on breast self-examination attitudes, intentions, and behavior. *Journal of personality and social psychology*, 52(3), 500.
- Nan, X., Daily, K., & Qin, Y. (2018). Relative persuasiveness of gain- vs. loss-framed messages: A review of theoretical perspectives and developing an integrative framework. *Review of Communication*, 18(4), 370–390.
- Oaksford, M., & Chater, N. (2007). *Bayesian Rationality*. Oxford University Press.
- Oaksford, M., & Chater, N. (2013). Dynamic inference and everyday conditional reasoning in the new paradigm. *Thinking & Reasoning*, 19(3-4), 346-379.
- O'Keefe, D. J. (2013). The relative persuasiveness of different forms of arguments-from-consequences: A review and integration. *Annals of the International Communication Association*, 36(1), 109-135.
- O'Keefe, D. J., & Jensen, J. D. (2006). The advantages of compliance or the disadvantages of noncompliance? A meta-analytic review of the relative persuasive effectiveness of gain-framed and loss-framed messages. *Annals of the International Communication Association*, 30(1), 1-43.
- O'Keefe, D. J., & Jensen, J. D. (2009). The relative persuasiveness of gain-framed and loss-framed messages for encouraging disease detection behaviors: A meta-analytic review. *Journal of Communication*, 59(2), 296-316.
- Orbell, S., & Hagger, M. (2006). Temporal framing and the decision to take part in type 2 diabetes screening: Effects of individual differences in consideration of future consequences on persuasion. *Health Psychology*, 25(4), 537.
- Over, D. E., Hadjichristidis, C., Evans, J. S. B., Handley, S. J., & Sloman, S. A. (2007). The probability of causal conditionals. *Cognitive psychology*, 54(1), 62-97.
- Over, D. E., & Cruz, N. (2018). Probabilistic accounts of conditional reasoning. In L. J. Ball & V.A. Thompson (Eds.), *International handbook of thinking and reasoning* (p. 434-450). Hove, UK: Psychology Press..
- Reed, C., Walton, D.N., Macagno, F. (2008). *Argumentation Schemes*. Cambridge University Press.
- Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: the role of message framing. *Psychological bulletin*, 121(1), 3.
- Rothman, A. J., Desmarais, K. J., & Lenne, R. L. (2020). Moving from research on message framing to principles of message matching: The use of gain-and loss-framed messages to promote healthy behavior. In *Advances in Motivation Science* (Vol. 7, pp. 43-73). Elsevier.
- Sher, S., & McKenzie, C. R. (2006). Information leakage from logically equivalent frames. *Cognition*, 101(3), 467-494.
- Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *science*, 211(481), 453-458.
- Van't Riet, J., Cox, A. D., Cox, D., Zimet, G. D., De Brujin, G. J., Van den Putte, B., ... & Ruiter, R. A. (2016). Does perceived risk influence the effects of message framing? Revisiting the link between prospect theory and message framing. *Health Psychology Review*, 10(4), 447-459.