# Why do experts disagree?

This is a visual presentation of our taxonomy of disagreements as described in our published article; please use the following citation when using the figure:
Deroover K., Knight S., Burke P.F., Bucher T. (2022) Why do experts disagree? The development of a taxonomy. *Public Understanding of Science*. https://doi.org/10.1177/09636625221110029

## What

Conceptualising expert disagreement is a crucial step in supporting lay understanding of such disagreement to mitigate against rejection of expert information and reduce confusion. While many elements discussed here are individually recognised in both the literature, and the expert interviews, the purpose of the taxonomy is to bring these dimensions of disagreement together to provide a shared conceptualisation. This taxonomy aims to contribute to the conceptualisation of disagreement and to facilitate an awareness of the differences therein. Please note that we wish to acknowledge that a best, correct or finished taxonomy may be undefinable and should not be seen as the aim. Instead, this taxonomy aims to be extendible, and to provide a tool to raise awareness, spark discussion, and encourage further research.

## Why

The primary use of the present taxonomy is to provide a theoretical base for further research and communication around expert disagreement. Additionally, knowledge about the range of causes for discerning information may help with an effective evaluation of, e.g. health, information, and the developed taxonomy may inform and help both communicators and readers with the transfer of evidence-based information.

## How

This work aims to provide an overview of the possible causes for expert disagreement with the use of such overview as an educational tool in mind. It identifies ten types of disagreement classified under three dimensions; informant-, information-, and uncertainty-related causes for disagreement. We used a Frayer model-inspired structure to explain the different categories of the taxonomy (Frayer et al., 1969). As such, for every category, we provide a definition, characteristics, example(s) and non-example(s). This approach provides a flexible method to both define and illustrate items, while also supporting differentiation between the different categories.

to the taxonomy

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# Why do experts disagree?

## Informant

- Competence
- Motivation

## Information

- Evidence type
- Available evidence
- Input ambiguity
- Outcome ambiguity

## Uncertainty

- Expert pertinence
- Human judgement
- Inherent uncertainty
- Tentative knowledge

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## Definition

Different levels of competence based on educational/ professional background, experience and scientific expertise.

# Competence

## Characteristics

- One's competence may influence the methods or research process used to answer a research question.

Different methods may be able to avoid biases to a greater or lesser extent.

- An expert's level of competence may also be influenced by one's ability to invest time and effort .

## Example(s)

"*Besides the unreliability that may be intrinsic to a complex, ambiguous task such as forensic evaluation, research has identified multiple extrinsic sources of expert disagreement. One such source is limited training and certification for forensic evaluators. While specialised training programs and board certifcations have become far more commonplace than in the early days of the field in 70s and 80s, the training and certification of typical clinicians conducting forensic evaluations today remains variable and often poor (De Matteo et al., 2009).*" (Guarnera et al., 2017)

## Non-example(s)

Experts must make judgements all along the scientific process, which may be equally "correct". They decide on research design and methods (*Evidence Type)* and make judgements about the problem definition and integration of information (*Human judgement on problem structure*).

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## Definition

Material, financial or status-related interests may influence experts.

## Characteristics

-Personal interests may result in selective reporting of findings or may affect the expert's willingness to admit uncertainty about reported findings.

-Funding environments and political factors may influence research topics and outputs.


## Example(s)

Weaver and Miller (2017) described how scientists routinely have to navigate bias in clinical nutrition research, both that of others and their own; "*Important examples of the former include the biases of reviewers of grant applications and manuscripts, as well as public and professional perceptions. External assumptions of bias can be particularly acute when the research is funded by industry, which has become a growing issue as federal funding declines and industry funding is sought to fill the void and maintain research programs. Examples of individual bias include the desire for respect and recognition among peers, the academic imperative to "publish or perish", [...] and financial conflicts of interest.*"

## Non-example(s)

Experts (or the business/ organisation the experts are associated with) may be influenced by their perspectives, including their worldviews, values, and beliefs about social, ethical, cultural, religious or political aspects (*Perspective*). Such beliefs or preconceived ideas about the topic may, intentionally or unintentionally, cause a tendency to confirm one's prior beliefs or hypotheses.

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## Characteristics

Beliefs or preconceived ideas about the topic may, intentionally or unintentionally, cause a tendency to confirm one's prior beliefs or hypotheses.

# Perspective

## Example(s)

-In clinical nutrition research: "*[…] Scientists may be subject to bias based on a personal history of supporting a specific position, personal passions, ideologies or philosophies, religious or ethical orientations, nationality, ethnicity. […]*" (Weaver & Miller, 2017)

- "*Selective observation is a critical problem in social science research as often inquiry into an issue is driven by professional interest in a particular phenomenon. [...] Once you have concluded that a particular pattern exists and developed a general understanding of why, then you will be tempted to pay attention to future events and situations that correspond with the pattern. You will most likely ignore those that don't correspond* " (Robb, 2020)

## Non-example(s)

Perspective could be an informant-related cause or an uncertainty-related cause, depending on the informant's level of competence and the nature of their motivation. If competence and motivation are constant between scientists, they may still come to differing conclusions based on having made differing judgements along the scientific process. This category is further described in "*human judgement*".

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## Definition

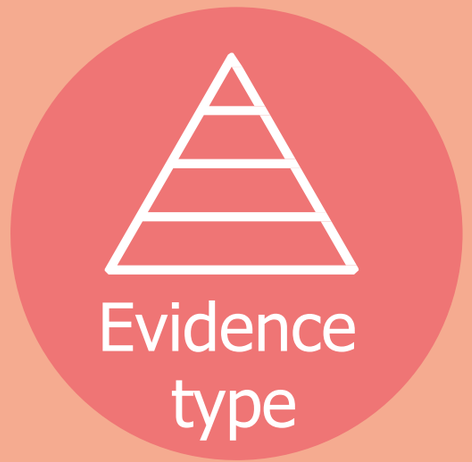
Different levels of strength, quality and rigour of scientific evidence.

## Characteristics

- Different weights should be given to evidence that is based on a study that describes a single case versus a study that combines the findings of multiple studies and includes an indication of the quality of those studies.

- Correlation does not necessarily imply causation.

- There is a need to evaluate evidence based on the knowledge of different research designs and their relative ability to answer the research questions.




## Example(s)

- *"[...] Nutritional epidemiology is plagued by measurement error, reverse causality, selection bias, weak effects, analytical flexibilty, and unmeasured or residual confounders. [...] Randomized diet intervention trials, on the other hand, often do not actually study the effects of different diets, but rather investigate the effects of differing diet advice.[...] Domiciled feeding studies can provide important mechanistic insights, however, their artificial environment may limit generalizability and application to free-living populations [...]*" (Hall, 2020)

## Non-example(s)

- Several types of study designs and evidence are required to come to new knowledge. As such, the choice for different types of studies can be correct, however, may come to different conclusions. This is, however, not about choosing a design that does not suit the research question (*competence*) or fake evidence (*interest*).

- With time, new better research designs may be discovered (*tentative knowledge*)

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# Definition

The unavailability or inaccessibility of information to the expert at a particular time.

# Characteristics

-Evidence includes both the theory and data.

-Academic papers are not always published in open- access databases.

-Accessibility may be temporarily enabled due to a delay in the dissemination of new data.

-In the case of business-generated data, there may even be interests or incentives to withhold information from others.

Available evidence

# Example(s)

"*Conventionally, public health professionals seek evidence from the published literature. However, in the case of tobacco, much research was done by the industry with the explicit intention that it not be published*."
(Rosen et al., 2010)

# Non-example(s)

There is a distinction between the availability of data and human judgement about the use of data. If judgement about the screening, selection, integration and interpretation of data is the cause for expert disagreement, this would be a matter of disagreement based on human judgement about the research process *(Human judgement* ).

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## Definition

Ambiguity about the relevance of the input variable

## Characteristics

we need to define clearly what 'x' is in claims like: 'x' causes 'y'

# Input ambiguity

## Example(s)

"*[…] Most studies show that a lack of vitamin D increases the risk of osteoporosis and the likelihood of hip and other non-spinal fractures. […] Some studies include only women, others both men and women; some include only frail, elderly, or institutionalized subjects, others physically active people; some use vitamin D alone, others a combination of D and varying doses of calcium; and some administer 400 international units (IU) of vitamin D a day, others up to 800 IU a day)[…]*" Vitamin D and your health: Breaking old rules, raising new hopes, May 17, 2019.

## Non-example(s)

-This is not about the probability of information being correct, instead here disagreement arises based on doubt about the relevance of the input variable

- When there is ambiguity about the relvance of the dependent variable, or outcome variable, that is an example of "*Outcome Ambiguity*"

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# Outcome ambiguity

## Definition

Ambiguity about the relevance of the outcome variable

## Characteristics

-there is a need to define clearly what 'y' is in claims like: 'x' causes 'y'

- Often concepts like health or wellbeing are ultimately the outcome variable of interest, however, such variables are hard to define and may depend on personal and contextual differences. As such, experts may define the same construct differently.

## Example(s)

*"[…] A professor of nutrition and epidemiology questions the conclusion that the cons of drinking always outweigh the pros. While there's "no question" that heavy drinking is harmful, he says that plenty of data supports links between moderate drinking and lower total mortality and a decreased risk of heart disease – which, he says, are far more relevant concerns for most Americans than something like tuberculosis, which the Lancet paper identifies as a leading alcohol-related disease worldwide. Tuberculosis is very rare in the U.S.[…]'* A new study says any amount of drinking is bad for you. Here's what experts say. August 24, 2018.

## Non-example(s)

-This is not about the probability of information being correct, instead here disagreement arises based on doubt about the relevance of the outcome variable.

- When there is ambiguity about the relvance of the independent variable, or input variable, that is an example of "*Input Ambiguity*".

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## Definition

Uncertainty about the relevance of that expert to answer a speci c question.

## Characteristics

Expert pertinence is particularly relevant for complex topics where several elds are involved, which may have different ways to look at a certain topic.

# Expert pertinence

## Example(s)

*"What dieticians think is important differs from what nutrition scientists think is important. Dieticians and nutrition scientists can vary a lot; a dietician will care a lot more about how you measured something and what the error is of your measurement methods or devices. I think nutrition scientists are happy for devices to have a bit more error."* (Deroover et al., 2022)

*"When I compare basic and applied research, I see that basic research wants to show an effect and it does not matter how big or small that effect is. In applied research, however, it is only interesting if it concerns a large effect that can make an impact in real life."* (Deroover et a'., 2022)

## Non-example(s)

When an expert is incompetent, or influenced by personal interests or perpectives, those causes are respectively "*Competence*", "*Motivation by Interest*" or "*Motivation by perspective*".

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# Human judgement

## Definition

Experts have to make judgements about the way a) the problem is de ned and b) the information is integrated

## Characteristics

-Differences in the way the problem is seen by different experts may lead to differing problem de nitions, research methodology, interpretation of the ndings and formulation of conclusions.

-Different ways in which an expert organises and integrates information can also be a cause for disagreement.

- Theory choice can be based on pursuit-worthiness (Lichtenstein, 2021)

## Example(s)

"*[…] Most studies show that a lack of vitamin D increases the risk of osteoporosis and the likelihood of hip and other non-spinal fractures. But there is considerable disagreement about how much supplements reduce the risk of fractures. […]*." Vitamin D and your health: Breaking old rules, raising new hopes, May 17, 2019.

## Non-example(s)

-Judgement may be influenced by *competence*, personal *interests* or *perpectives*.

-The experts' background, e.g. eld, may influence their judgements along the research process. One expert may be more or less pertinent to answer a question, which could result in disagreement caused by "*Expert Pertinence*".

However, when competence, bias and pertinence are constant, experts may still make different judgements on the problem structure.

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## Definition

Uncertainty due to the randomness of the world.

## Characteristics

the probability associated with future outcomes

?

# Inherent uncertainty

## Example(s)

-"*[…] Perhaps the reason so many studies come up with so many different conclusions is that every person is different to a degree, especially in the way they metabolize substances. […]*' ZME Science. (2019) Is coffee good or bad? A critical view on the science behind it.

-" *There is always another finding that could disapprove your findings, especially in human sciences, you're never 100% sure.*" (Deroover et al., 2022)

## Non-example(s)

-It distinguishes itself from epistemic uncertainty, which refers to the type of uncertainty that is about how much one actually knows about something. Where inherent uncertainty refers to the future, epistemic uncertainty is about the certainty we have about present issues and represents the recognition of the limitations of our knowledge. Epistemic uncertainty refers to knowledge about phenomena that is currently incomplete but theoretically attainable.

- Experts may differ in their willingness and ability to admit uncertainty. Differences in willingness to admit uncertainty are based on motivational aspects and therefore classify under that category in this taxonomy.

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# Definition

As experts a) work in dynamic situations with evolving conditions and constraints, and b) keep building upon existing knowledge, they keep revising and updating ideas, theories, and concepts.

# Characteristics

-the dynamic nature of knowledge

↳ the "facts" of today may tomorrow be obsolete and regarded as the flaws of yesterday

-Social (need for policies) and financial (lack of funding) factors may hasten the process to come to solutions quickly and pressure scientists not to engage in debates or express uncertainty.

Tentative knowledge

# Example(s)

-"[…] Conflicting information about the effects of coffee abound. Until not too long ago, the WHO classified coffee as "possibly" carcinogenic, but later reversed the statement stating that evidence for the association between coffee and cancer is inadequate. […]" ZME Science. (2019) Is coffee good or bad? A critical view on the science behind it. Available at: https://www.zmescience.com/science/coffee-good-or-bad-04232/.

-"The knowledge we have is created, constructed, and therefore always evolving." (Deroover et al., 2022)

# Non-example(s)

- This is not about being uncertain about an outcome (*inherent uncertainty*) but instead about acknowledging knowledge based on the evidence available at a certain point in time and at the same time being aware that this knowledge may be revised in the future.

-This is not disagreement due to experts' differing judgements on the problem definition and integration of information (*Human judgement*)

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