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Biases in Stakeholder Elicitation as a Precursor to the Architecting Process

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Background on Biases

- Thinking broken down into two processes (Kahneman, 2011)
  - System 1 thinking - Fast, automatic, unconscious, emotional responses
  - System 2 thinking - Slow, effortful, logical response when solving more complicated problems

- Heuristics often utilized due to accuracy-effort tradeoff wherein effort is saved via use of heuristic at the cost of accuracy (Payne, Bettman, & Johnson, 1993; Oppenheimer, 2003)
  - Use of heuristics leaves room for error in the form of biases

- Over 250 cognitive biases identified in research
  - Current list of biases in presentation not exhaustive, though important to take into consideration during architecture process

Stakeholder Description

- Levels of stakeholders
  - Primary stakeholders - essential to the survival and wellbeing of the organization
  - Secondary stakeholders - Organization interacts with these stakeholders but they are not essential to the organization's survival (Freeman, 1984; Clarkson, 1995)

- Relationships between stakeholders feature aspects of power, dependence, and reciprocity (Mitchell, Agle, & Wood, 1997)

- Types of stakeholder relationships
  - Stakeholder dominant
  - Firm dominant
  - Mutual power-dependence

Stakeholder Biases

- Stakeholders are a major source of both complexity and knowledge in a project (Caron, 2014)
- Stakeholders inherently biased given vested interest in a project
  - All may attempt to influence design decisions in various ways (Babar, Zhu, & Jeffery, 2004)
- Expert judgment can be incredibly useful, though experts make mistakes (Burgman, 2004; Hemming et al., 2018)

Amplification of Biases

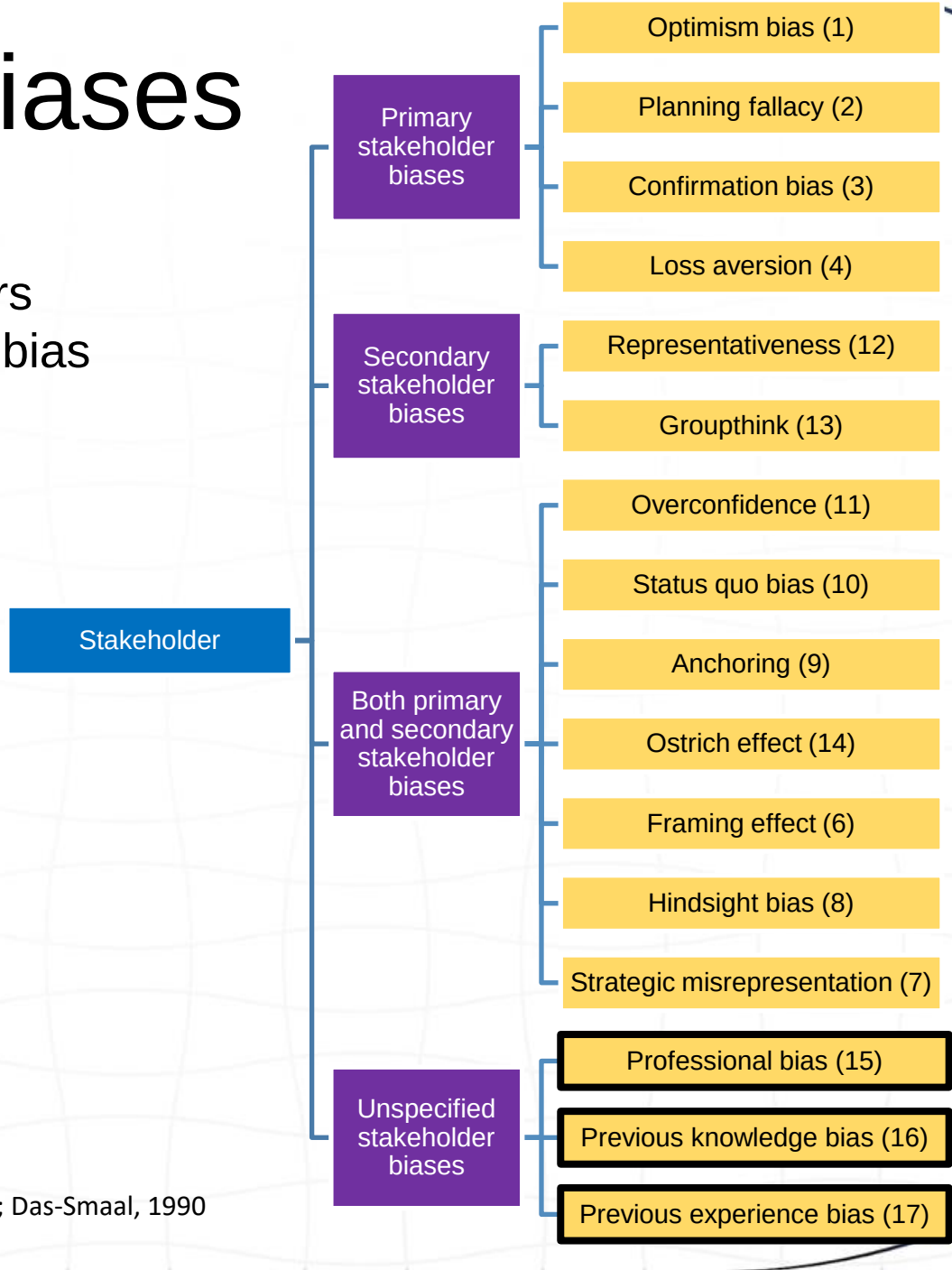
- Inappropriate & ill-informed elicitation methods can amplify biases (Hemming et al., 2018)
  - Relying on subjective and unreliable methods for selecting experts (Shantaeu, Weiss, Thomas & Pounds, 2002)
  - Asking poorly specified questions (Wallsten, Budescu, Rapoport, Zwick, & Forsyth, 1986)
  - Ignoring protocols to counteract negative group interactions (Janis, 1971)
  - Applying subjective or biasing aggregation methods (Aspinall & Cooke, 2013; Lorenze, Rauhut, Schwietzer, & Helbing, 2011)

Stakeholder Input

- Requirements development process takes inputs from relevant stakeholders and translates inputs into technical requirements (DoD RAM Guide, 2005)
- Presence of insufficient individuals in design review sessions one of the major issues with conventional design review approaches (Parnas & Weiss, 1985; Babar, Zhu, & Jeffery, 2004)
- If desired quality attributes include reliability and maintainability, presence of stakeholder with vested interest important
- Engaging stakeholders in beginning of planning process increases accuracy of initial and subsequent estimates as larger amounts of data are available earlier (Zuber, 2013)

Stakeholder Biases

Biases inherent to stakeholders grouped into four overarching bias types



Chatzipanos & Giotis, 2014; Enríquez-de-Salamanca, 2018; Das-Smaal, 1990

Stakeholder Needs & Requirements

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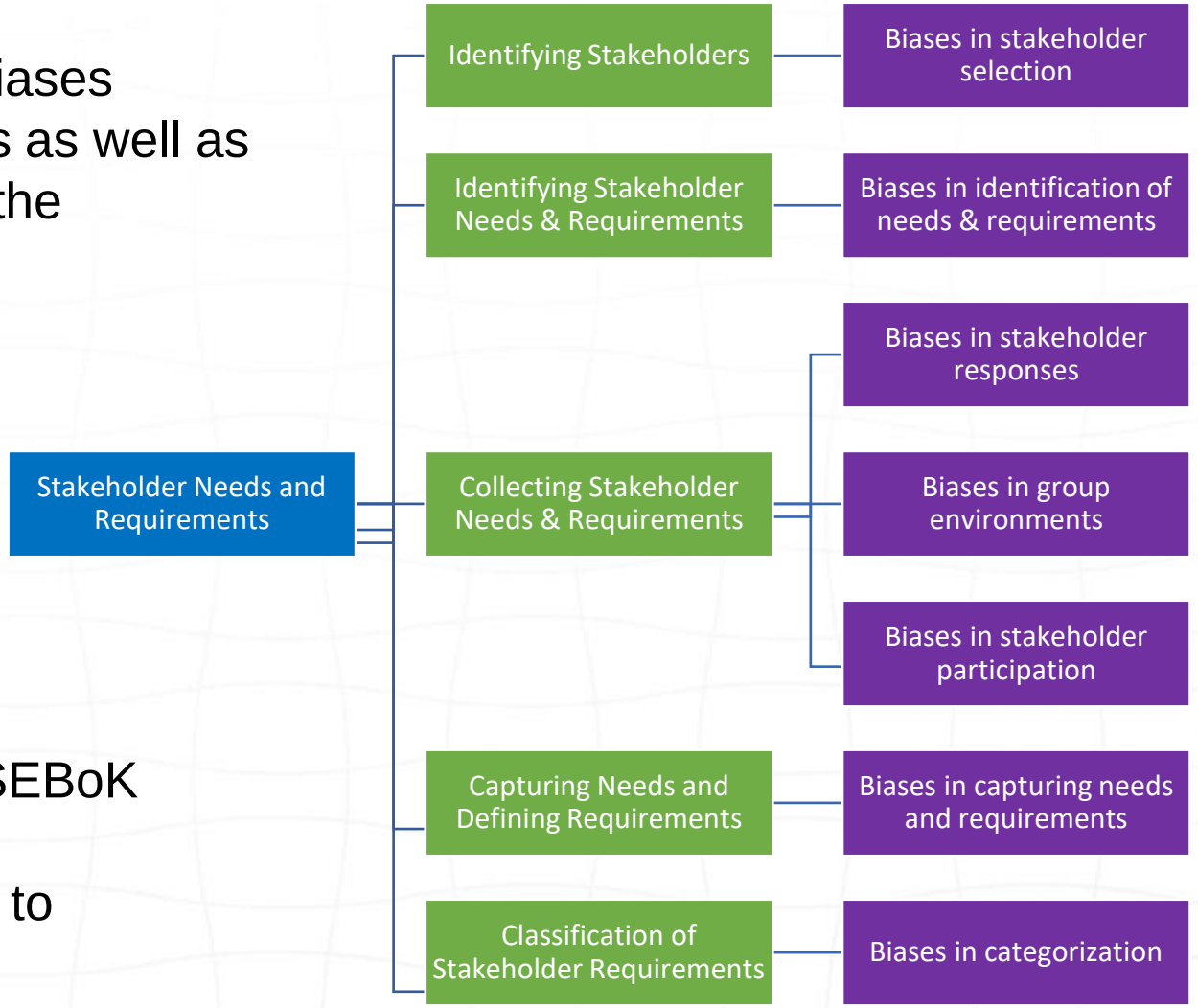
Goal is to understand biases inherent to stakeholders as well as biases that exist within the stakeholder needs and requirements process



Blue – SEBoK process
Green - Activity within SEBoK process
Purple - Biases related to activities within process

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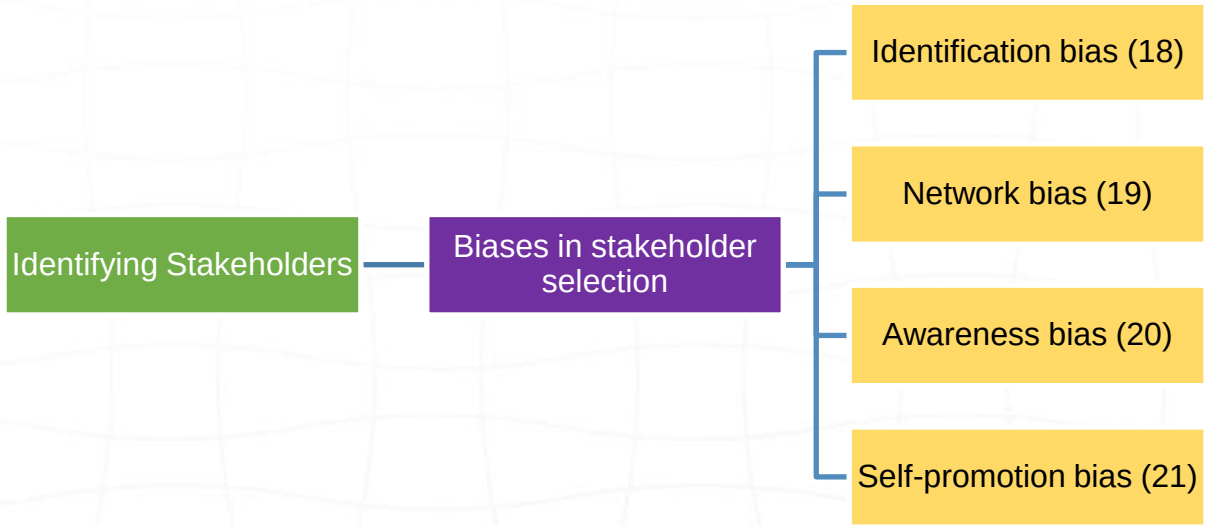
Identifying Stakeholders

- **Purposive selection** – potentially results in biased sample of stakeholders and risks (*identification bias*)
- **Snowballing** – can lead to repetition of biases across multiple stakeholders (*network bias*)
- **Open-call** – may miss those with no access to recruitment information (*awareness bias*)
- **Systematic selection** – large number of stakeholders may be identified (*self-promotion bias*)



Haddaway et al., 2017

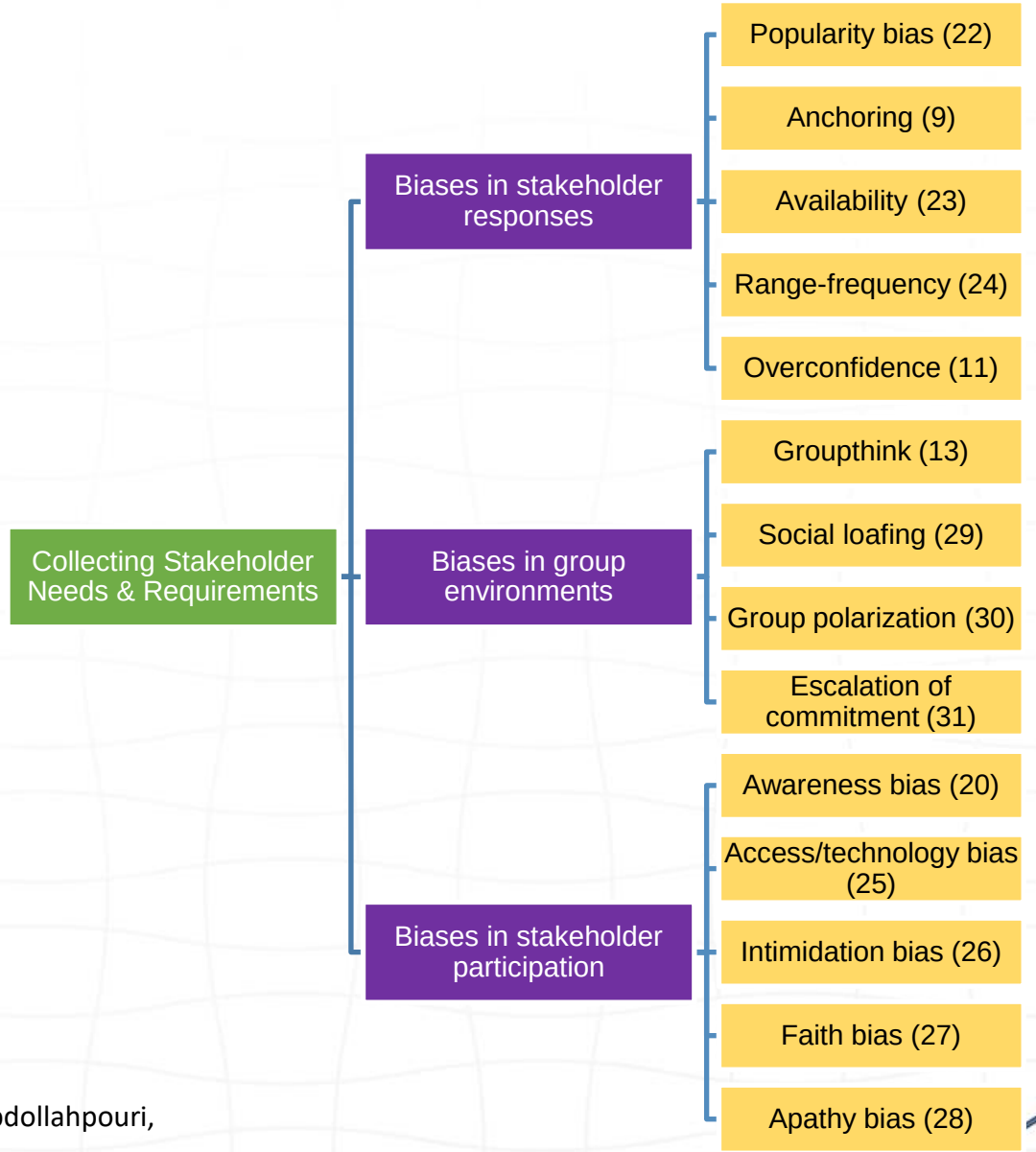
Identifying Stakeholder Needs & Requirements

- Requirements defined through process using ConOps or Strategic Business Plan
- Stakeholder requirements captured in output typically called Stakeholder Requirement Specification or Stakeholder Requirement Document

Das-Smaal, 1990; Yu & Shi, 2001

Collecting Stakeholder Needs & Requirements

- Collection of needs and requirements can be completed in various ways including:
  - Brainstorming workshops
  - Interviews & questionnaires
  - Simulations & visualization
  - Use case diagrams



Chatzipanos & Giotis, 2014; Mannion & Thompson, 2014; Abdollahpouri, 201; O'Hagan, 2019; Abdollahpouri, 2019; Flyvbjerg, 2021

Capturing Needs & Defining Requirements

- Cycle of Needs (Faisandier, 2012) involving various need types within requirements
- Process involves weighing, prioritizing, and selecting which can be highly subjective and impacted by individual differences

Das-Smaal, 1990

Classification of Stakeholder Requirements

- Examples of classification groups include:
  - Human factors
  - Reliability
  - Availability
  - Maintainability
  - Quality

Das-Smaal, 1990; Yu & Shi, 2001

Mitigation Techniques

- Selecting a diverse set of stakeholders is important (Hemming et al., 2018)
  - Diversity reflected by variation in age, gender, cultural background, life experience, education, and specialization

- Structured elicitation protocols can improve quality of expert judgments (Cooke, 1991; O'Hagan et al., 2006; Hemming et al, 2018)
  - Should treat elicitation of expert judgements/stakeholder input in the same regard as empirical data
  - Do so by using repeatable, transparent methods and addressing scientific questions rather than value judgments

IDEA Protocol

- IDEA protocol as an example of structure elicitation (Burgman, 2015; Hemming et al., 2018)

- During elicitation
  - **I**nvestigate: All experts individually answer questions and provide reasons for their judgments
  - **D**iscuss: Experts shown anonymous answers from each participant and visual summary of responses
  - **E**stimate: All experts make 2nd final and private estimate

- Post-elicitation
  - **A**ggregate: Mean of experts' 2nd round responses calculated
  - Experts may review and discuss individual and group outcomes, add commentary, correct residual misunderstandings

Even Swaps Process

- Even swaps process as an example of designing the elicitation process with biases in mind (Hammond, Keeney, & Raiffa, 1998; Lahtinen, Hämäläinen, & Jenytin, 2020)
- Alternative is replaced with a preferentially equivalent virtual alternative until only one alternative remains
- Effects of biases in different steps of process counteract each other
  - Does not force decision maker to change behavior or learn to avoid biases

Stakeholder Management

- Stakeholders may have multiple and conflicting expectations
  - Stakeholder prioritization may be helpful to decide which stakeholders to focus on and in what sequence (OpenStax, 2020)

- Can prioritize by weighing stakeholder responses
  - Not all people involved in a project should necessarily have the same influence (McGee, Eklund, & Lundin, 2010)
  - Influence weight may be determined taking into account power of stakeholder and stakeholder interest

Mitigating Biases in Group Environments

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- Collaboration often suggested to mitigate individual bias, though group settings have own set of biases
- As workshops a source of stakeholder needs and requirements, mitigation of group biases important
- Organizational strategies by Mannion & Thompson (2014)
  - Groupthink
  - Social loafing
  - Group polarization
  - Escalation of commitment

Groupthink Mitigation

- Organizational strategies to combat groupthink:
  - Create a conducive, open climate at all levels in which giving and accepting criticism is encouraged by leaders
  - Group leaders help foster open debate and inquiry by refraining from stating personal preferences at start of discussions
  - Establish multiple groups to work on decision-making in parallel; groups can be divided into subgroups

Social Loafing Mitigation

- Organizational strategies to combat social loafing:
  - Increasing identifiability so nobody can “hide in the crowd”; group decision making tasks can be divided
  - Limiting group size
  - Strengthening group cohesiveness by enhancing the sense of social solidarity and bonding among group members
  - Allowing task choice to increase autonomy among group members

Group Polarization Mitigation

- Organizational strategies to combat group polarization:
  - Encouraging group participants to take the perspective of other members
  - Forming work groups from a variety of professional specialisms or disciplines

Escalation of Commitment Mitigation

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- Organizational strategies to combat escalation of commitment:
  - Structuring incentives so group members are not penalized for inconsistency
  - Informing group members that adverse outcomes were beyond anybody's control to help reduce incentive among members to defend a previous faulty decision
  - Making group decision-makers aware of the costs of subsequent withdrawal before they decide to commit further resources

Conclusion

- The overall effect of biases depends on how preference elicitation is structured (Lahtinen, Hämäläinen, & Jenytin, 2020)
- Biases exist within stakeholders themselves, in how they're chosen, and in how the elicitation process occurs
- Diversification helpful in mitigating stakeholder biases (Hemming et al., 2018)
- Structured elicitation processes helpful in mitigating process biases (Hemming et al., 2018)
- Mitigation of group biases helpful when elicitation preferences in workshops

Questions?

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Biases and Definitions

Optimism bias (1)	The tendency to be overly optimistic about the outcome of planned actions, including overestimation of the frequency and size of positive events and underestimation of the frequency and size of negative ones (Flyvbjerg, 2021)
Planning fallacy (2)	The tendency to underestimate costs, schedule, and risk and overestimate benefits and opportunities (Flyvbjerg, 2021)
Confirmation bias (3)	The tendency to focus on information that affirms the individual's beliefs and assumptions (Chatzipanos & Giotis, 2014)
Loss aversion (4)	The tendency of individuals to prefer to avoid losses than acquire gains (Chatzipanos & Giotis, 2014)
Sunk cost fallacy (5)	The tendency to take some otherwise undesirable action simply because of a sunk cost (Friedman, 2007)
Framing effect (6)	Using an approach or description that is too narrow for the situation or issue (Chatzipanos & Giotis, 2014)
Strategic misrepresentation (7)	The tendency to deliberately and systematically distort or misstate information for strategic purposes (this can also be known as political bias, strategic bias, or power bias) (Flyvbjerg, 2021)

Biases and Definitions

Hindsight (8)	The tendency to see past events as being predictable at the time those events happened (Flyvbjerg, 2021)
Anchoring (9)	The tendency to rely too heavily, or “anchor,” on one trait or piece of information when making decisions, typically the first piece of information acquired of the relevant subject (Flyvbjerg, 2021)
Status quo (10)	The human preference for the current state of affairs; any change from the baseline is considered a loss (Chatzipanos & Giotis, 2014)
Overconfidence (11)	Making fast and intuitive decisions when slow and deliberate decisions are necessary; individuals are overly optimistic in their initial assessment of a situation and then are slow to incorporate addition information about the situation into later assessments because of their initial overconfidence (Chatzipanos & Giotis, 2014)
Representativeness (12)	The tendency to irrationally attribute one characteristic to imply another (Tversky & Kahneman, 1974; Irshad, Badshah, & Hakam, 2016)
Groupthink (13)	A mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members’ strivings for unanimity override their motivation to realistically appraise alternative courses of action (Janis, 1991)
Ostrich effect (14)	Avoiding risky or difficult situations or failed projects at the cost of learning (Chatzipanos & Giotis, 2014)

Biases and Definitions

Professional bias (15)	Practitioners' experience or expertise may impact judgments/predictions (Enríquez-de-Salamanca, 2018)
Previous knowledge bias (16)	Prior knowledge is used to make judgments (Das-Smaal, 1990)
Previous experience bias (17)	Prior experience can make a significant impact in judgments (Das-Smaal, 1990)
Identification bias (18)	Purposeful selection of stakeholders using personal/organizational knowledge or unsystematic searches may result in a biased and unbalanced group of stakeholders (Haddaway et al., 2017)
Network bias (19)	Asking others to suggest potential stakeholders may result in a biased and unbalanced group of stakeholders (Haddaway et al., 2017)
Awareness bias (20)	Announcing an open call for stakeholder engagement may target a biased and unbalanced group of stakeholders (Haddaway et al., 2017)
Self-promotion bias (21)	Systematically searching for potential stakeholders may select only those with an online presence, producing a biased or unbalanced group of stakeholders (Haddaway, et al., 2017)

Biases and Definitions

Popularity bias (22)	Certain stakeholders (popular ones) may achieve very high utility values while other stakeholders (less popular ones) are ignored (Abdollahpouri, 2017)
Availability bias (23)	The tendency to overestimate the likelihood of events with greater ease of retrieval (availability) in memory (Flybjerg, 2021)
Range-frequency bias (24)	The tendency to assign less probability to the categories judged most likely and more probability to the other categories (O'Hagan, 2019)
Access/technology bias (25)	Stakeholders may not have the ability to respond to invitations or on-going engagement, resulting in attrition and leaving a biased, unbalanced group of stakeholders (Haddaway et al., 2017)
Intimidation bias (26)	Stakeholders may be less like to respond if they feel their views are unlikely to be heard over the views of the majority (Haddaway et al., 2017)
Faith bias (27)	Stakeholders may not engage if they believe that their views will not be heard due to failures on the part of others (Haddaway et al., 2017)
Apathy bias (28)	Stakeholders may not respond if they feel others will perform their role for them (Haddaway et al., 2017)

Biases and Definitions

Social loafing (29)	Group situations may reduce the motivation, level of effort, and skills employed in problem-solving compared with those that an individual would deploy when working alone (Jones & Roelofsma, 2000; Mannion & Thompson, 2014)
Group polarization (30)	Groups sometimes make more extreme (compound) decisions than the initial position of its (individual) members (Mannion & Thomson, 2014)
Escalation of commitment (31)	The tendency to justify increased investment in a decision, based on the cumulative prior investment, despite new evidence suggesting the decision may be wrong (some may refer to a this as the sunk cost fallacy) (Flyvbjerg, 2021)