Observational Research

http://philosophy.ucsd.edu/faculty/wuthrich/

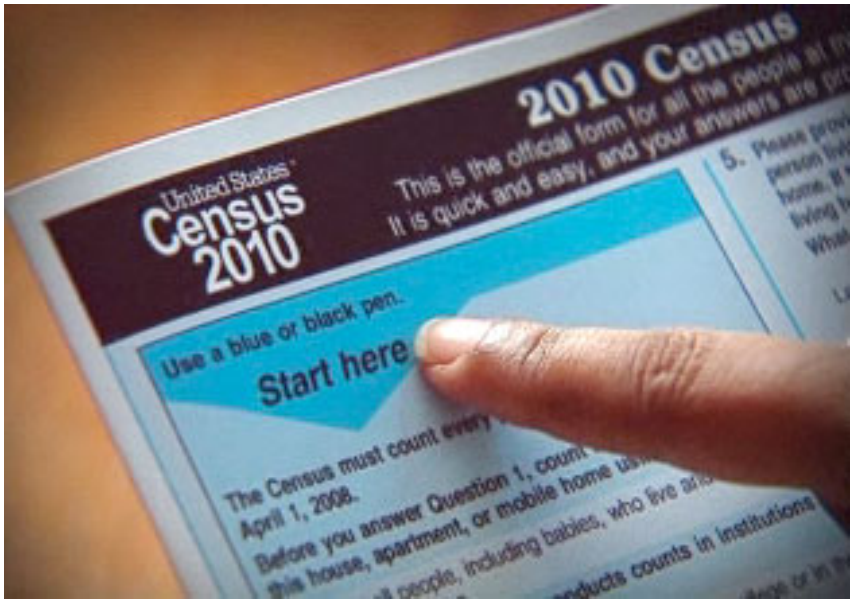
12 Scientific Reasoning

Acknowledgements: Bill Bechtel

Review

- What we observe depends not just on what is before us, but how our visual system works, what we attend to, what we already know and expect to see, etc.
- What we observe with instruments likewise depends on how the instruments work, the conditions under which they are used, and what we know and expect to observe.
- Importance of multiple observers and multiple instruments to corroborate observations
- Importance of assessing plausibility of observations
- The categories we use play a major role in determining what we see:
  - Different categories provide different accounts of what we are seeing
  - Must choose categories appropriate to the knowledge we want to obtain

Review



- Developing a category system before collecting observational information is critical.
- Only what can be captured in the chosen categories is available for later analysis.
- Consider the controversies over developing census forms.

Systematic observation

- Careful recording of what is observed and analysis (qualitative, quantitative, statistical) of the results
  - ⇒ If the process of recording information is contaminated, any knowledge claims (theories) built upon it are suspect.
- Recording may take the form of written notes, audio or videotaping, etc.
- No attempt to manipulate what happens
  - ⇒ If the researcher manipulates features of the situation and then observes what results, the researcher is conducting an experiment (but not an observation).

Why conduct observational research?

Although much scientific research involves manipulating variables (experiments), there is an important role for careful observation with little or no intervention on the part of the observer:

- gain a good description
  - ⇒ Make sure that any subsequent experimentation is ecologically valid.
- explore: search for a hypothesis
- confirm or falsify a hypothesis
  - ⇒ determine whether a predicted relation between variables occurs
  - ⇒ not alone sufficient when dealing with causal hypotheses

Observation as source of hypotheses

Nikolaas Tinbergen (1907-1988), Dutch ethologist and Nobel Laureate for his discoveries concerning organization and elicitation of individual and social behavior patterns, in 1965:

> *I find that during the long hours of observation in the field, I not only learn about behavior patterns, but I get ideas, 'hunches,' for theories, which I later test by experiments whenever possible.*

Tinbergen's theories went well beyond observation to the evolution and development of behavior, but good field observations of animals (esp. sea gulls) under natural conditions was his reference point.

Tension

- What we humans are able to observe is influenced by what we already know (including the categories we have), what our attention is drawn to, etc.
- Yet, we hope that observation can suggest new hypotheses.

$\Rightarrow$ How can observation suggest something we don't already expect to find?

  - Value of keeping multiple ideas/hypotheses in play and trying out possibilities (what if we grouped these items together?)
  - Value of involving multiple observers, each with different prior expectations

Naturalistic vs. participant observer

Definition

In a naturalistic observation, the researcher tries to remain unobtrusive, engaging in passive observation.

Definition

In a participant observation, the researcher becomes a part of the population being studied.

⇒ If studying how a business works, work in the business.

⇒ If studying how a scientific laboratory works, work in the laboratory.

Participant observer with other species

Dian Fossey (1932-1985), American zoologist, in order to study gorillas in Rwanda, Africa, found she had to learn to behave like a gorilla—eating, grooming, and vocalizing. Why?

> *One feels like a fool thumping one's chest rhymatically or sitting about pretending to munch on a stalk of celery as though it were the most delectable morsel in the world. But the gorillas have responded favorably. (Fossey, 1972, p. 211)*

Risks in observational research

1. Observer bias: seeing what one expects to see
2. Reactivity: the mere presence of an observer can alter the situation and make people behave differently
3. Anthopomorphizing: attributing one's own mental states to those studied—including non-human organisms and artefacts

(1) Observer bias

- Perception is affected by expectations—one is more likely to see what one expects to see
  - Sometimes one even sees what one expects when it is not there
- Sometimes the evidence a scientist reports is too perfect, suggesting either cheating or observer bias
  - Mendel's results too close to 3:1 ratio, suggesting observer bias
- Sometimes observations are just not credible
  - Franz Anton Mesmer (1733 - 1815), a Viennese physician, treated people with magnets and proclaimed what he called animal magnetism

Mesmer and Mesmerism

A French engraving of 1784 that shows Franz Anton Mesmer overseeing a demonstration of 'animal magnetism'. Mesmer's wild theories and his use of magico-theatrical settings alienated the medical profession.

- In the center of a large hall with darkened windows, Mesmer placed a large oaken tub filled with water and iron shavings.
- Iron rods protruded through the cover of the tub, which patients would hold and apply to their body.
- Mesmer himself would enter in brilliant silk robes, pass among the patients, touching them with a long iron wand.
- Many would claim they were healed after two or three treatments.

Mesmer's cures

According to Mesmer, a patient's health depended upon the distribution of animal magnetism in his body.

- Ill health was do to an excess or a deficiency of animal magnetism in the patient's entire body, or in specific parts of his body.
- Cure involved giving, removing or redistributing the animal magnetism within the patient.

Why did patients believe Mesmer?

- In some cases, hypnotism and hypnotic suggestion seems to have been at work (resulting in real cures).
- People interpreted small changes as cures due to Mesmer's treatments.

A royal inquiry

- Louis XVI appointed a commission of inquiry as to the efficacy of Mesmerism (headed by Benjamin Franklin; Members included Antoine Lavoisier, Jean-Sylvain Bailly and Joseph-Ignace Guillotin)
- Were the purported effects of Mesmerism due to any real force, or due to the ‘illusions of the mind’?

A royal inquiry: blindfolding people

- Blindfolded people were told that they were receiving or not receiving magnetism when in fact, at times, the reverse was happening.
- The people being studied felt the effects of mesmerism only when they were ‘told’ and felt no effects when they were not told, whether or not they were receiving the treatment.
- Introduction of blind treatment
- In a double blind study, both the subject and the investigator are kept blind)

(2) Reactivity bias

When being watched, people sometimes behave differently than they would otherwise.

- That is often the point of surveillance cameras—to deter unwanted behavior.
- But when conducting research that can destroy the phenomenon.

Strategies:

- Try to observe without being detected
- Allow time for subjects to habituate—People tend to forget about the observer and return to normal behavior

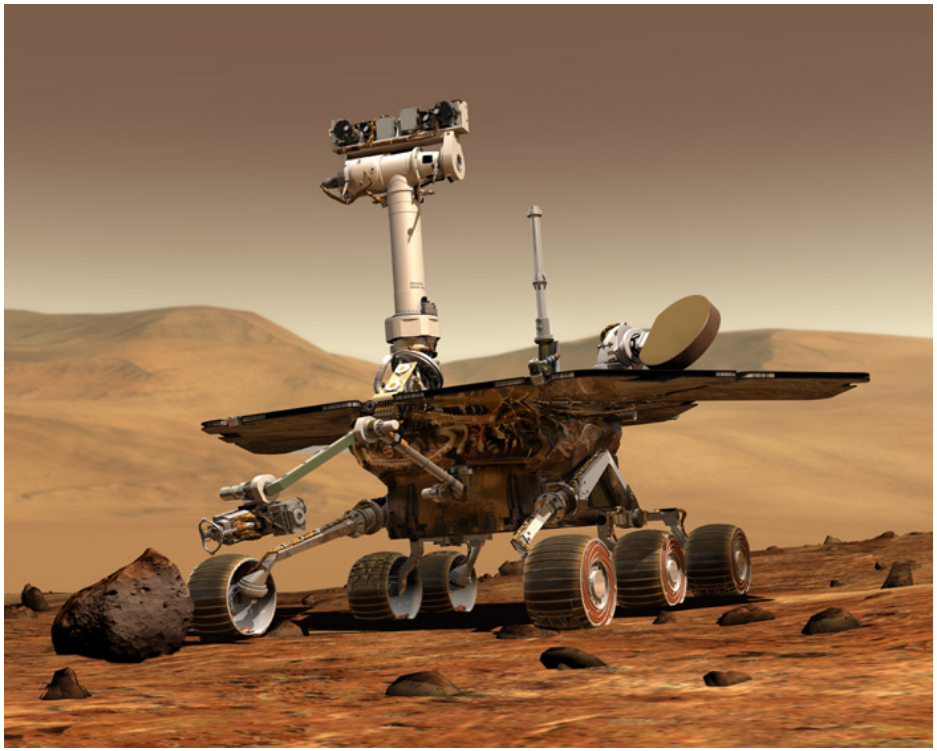
Observing without detection

Irenäus Eibl-Eibesfeldt (b. 1928), Austrian ethologist, created a camera with a fake lens, with the real lens rotated 90%, allowing him to photograph subjects without point the lens at them.

Eibl-Eibesfeldt's eyebrow flash

- Do humans have fixed action patterns (FAPs), i.e. indivisible instinctive behavioral sequences—human 'universals'?
- Eibl-Eibesfeldt et al. filmed people across wide range of cultures and found several human FAPs, such as smiling and the 'eyebrow flash':
- Most people in most cultures give a brief eyebrow flash, a brief raising of the eyebrows, together with a slight smile and a quick node of the head, such as this Himba woman from Namibia (SW-Africa) filmed in 1990.
- Link to the video sequence is here (go to 'Fixed Action Patterns').

(3) Anthropomorphizing



From http://www.planetary.org/news/ (link derelict)

After returning its first assault of shock and awe in pictures, Spirit went to sleep, but was slated to wake up Sunday morning,January 4, when Mars Global Surveyor (MGS) flies over Gusev Crater at 7:25 a.m. PST...

Spirit briefly awoke from a martian slumber on Sunday to beam more photos of the red planet back to Earth as scientists prepared the rover to search for ancient signs of life-sustaining water... Spirit did not go to sleep despite two commands from controllers to do so... Rover's condition upgraded from critical to serious...

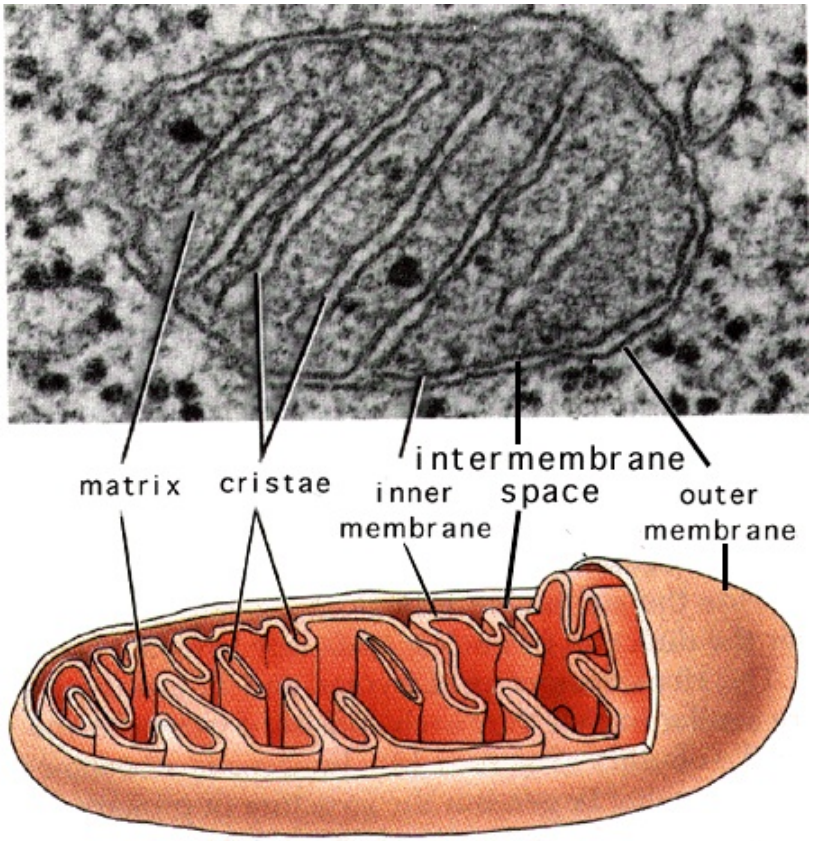
Anthropomorphizing risky, but not always fatal

- In describing animal behaviour it is nearly impossible not to attribute intentions, desires, beliefs, etc.
- We know what it is to choose a course of action—to have a goal, consider different options, make a decision.
- Nonhuman animals also perform actions, but it is doubtful that they represent goals to themselves, consider options, and select between them.
- As long as we are aware of the differences, there is no problem is describing animals as choosing actions, etc.

Recording observations

- Before photography, biological researchers often had to draw what they saw.
- With photographic images, more of what was to be seen can be preserved.
- Even so, drawing are useful in extracting the relevant information.

Recording observations



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- With photographic images, more of what was to be seen can be preserved.
- Even so, drawing are useful in extracting the relevant information. (Ex: mitochondria)

Narratives without inference

Narrative of Marian (7), David, teacher, and Elaine:

> *Marian... is complaining to all that David had squirted her on the pants she has to wear tonight. She says, "I'm gonna do it to him to see how it likes it." She fills a can with water and David runs to the teacher and tells of her threat. The teacher takes the can from Marian. Marian attacks David and pulls his hair very hard. He cries and swings at Marian as the teacher tries to restrain him; then she takes him upstairs... Later, Marian and Elaine go upstairs and into the room where David is seated with a teacher. He throws a book at Marian. The teacher says Marian to leave. Marian kicks David, then leaves. David cries and screams, "Get out of here; they're just gonna tease me."*

Hartup, W. W. (1974) Aggression in childhood: Developmental perspectives. *American Psychologist* **29**: 336-341.

A man whose recall mesmerized a nation

A naturalistic study of memory:
Watergate Testimony of John Dean

On September 15 the Justice Department announced the handing down of the seven indictments by the Federal Grand Jury investigating the Watergate. Late that afternoon I received a call requesting me to come to the President's Oval Office. When I arrived at the Oval Office I found Haldeman and the President. The President asked me to sit down. Both men appeared to be in very good spirits and my reception was very warm and cordial. The President then told me that Bob-referring to Haldeman-had kept him posted on my handling of the Watergate case. The President told me I had done a good job and he appreciated how difficult a task it had been and the President was pleased that the case had stopped with Liddy. I responded that I could not take credit because others had done much more difficult things than I had done. As the President discussed the present status of the situation I told him that all I had been able to do was to contain the case and assist in keeping it out of the White House. I also told him there was a long way to go before this matter would end and that I certainly could make no assurances that the day would not come when this matter would start to unravel. (Hearings, p. 957)

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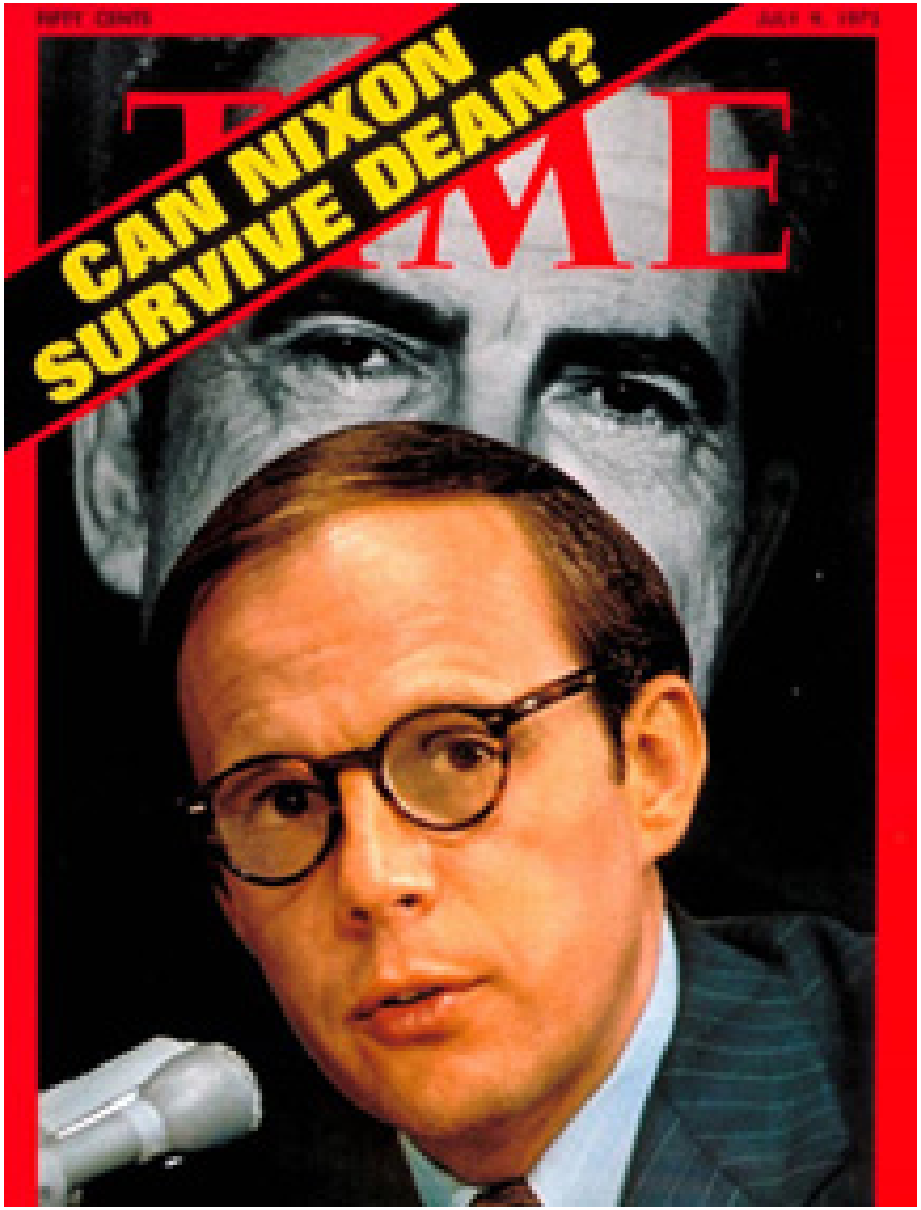
Accuracy check

- Dean's memory was riveting. He seemed to have a photographic memory (the events had transpired several months earlier).
- Then a new source of information was discovered...

Comparison with Watergate tapes

(*Presidential Transcripts*, p. 32; P: Nixon, D: Dean, H: Haldeman)

P: Hi, how are you? You had quite a day today, didn't you? You got Watergate on the way, didn't you?
D: We tried.
H: How did it all end up?
D: Ah, I think we can say well, at this point. The press is playing it just as we expected.
H: Whitewash?
D: No, not yet-the story right now-
P: It is a big story.
H: Five indicted plus the WH former guy and all that.
D: Plus two White House fellows.
H: That is good; that takes the edge off whitewash, really. That was the thing Mitchell kept saying, that to people in the country Liddy and Hunt were big men. Maybe that is good.
P: How did MacGregor handle himself-
D: I think very well. He had a good statement, which said that the Grand Jury had met and that it was now time to realize that some apologies may be due.
H: Fat chance.
D: Get the damn (inaudible)
H: We can't do that-
P: Just remember, all the trouble we're taking, well have a chance to get back one day. How are you doing on your other investigation?


CAN NIXON
SURVIVE DEAN?
TIME

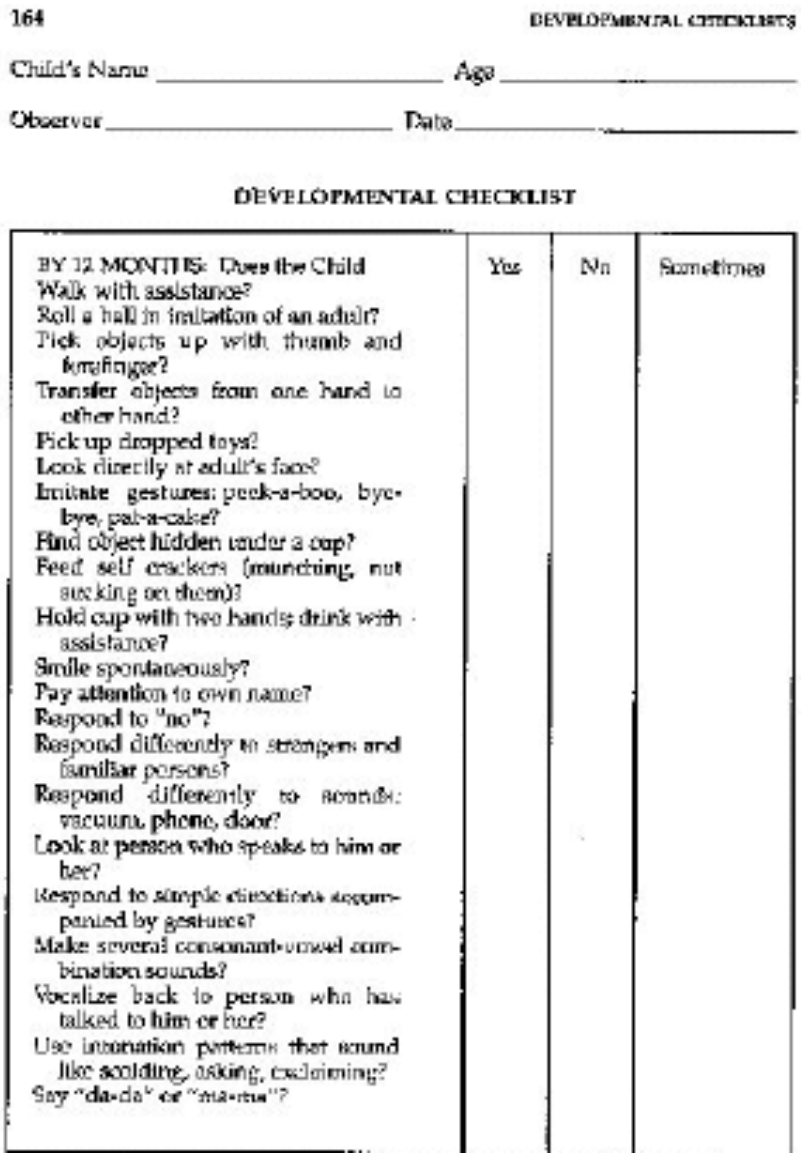
Ulric Neisser

John Dean's Memory: A Case Study

Abstract: *John Dean, the former counsel to President Richard Nixon, testified to the Senate Watergate Investigating Committee about conversations that later turned out to have been tape recorded. Comparison of his testimony with the actual transcripts shows systematic distortion at one level of analysis combined with basic accuracy at another. Many of the distortions reflected Dean's own self-image; he tended to recall his role as more central than it really was. Moreover, his memory for even the "gist" of conversations was quite poor except where that gist had been rehearsed in advance or frequently repeated. But while his testimony was often wrong in terms of the particular conversations he tried to describe, Dean was fundamentally right about what had been happening: the existence of a "cover-up" and the participation of various individuals in it. His testimony was accurate at a level that is neither "semantic" (since he was ostensibly describing particular episodes) nor "episodic" (since his accounts of the episodes were often wrong). The term "repisodic" is coined here to describe such memories: what seems to be a remembered episode actually represents a repeated series of events, and thus reflects a genuinely existing state of affairs.*

"Have you always had a facility for recalling the details of conversations which took place many months ago?" Senator Inouye of Hawaii asked this question of John Dean with more than a trace of disbelief. Dean, the former counsel to President Richard M. Nixon, was testifying before the "Watergate" Committee of the United States Senate in June, 1973. His testimony had opened with a 245-page statement, in which he described literally dozens of meetings that he had attended over a period of several years. The meetings were with John Mitchell, Robert Haldeman, Charles Colson, Gordon Liddy, and others whose names became American household words as the Watergate scandal brought down the Nixon administration. Some were with Nixon

Data extraction



164 DEVELOPMENTAL CHECKLISTS

Child's Name _____ Age _____

Observer _____ Date _____

DEVELOPMENTAL CHECKLIST

BY 12 MONTHS: Does the Child	Yes	No	Sometimes
Walk with assistance?			
Roll a ball in imitation of an adult?			
Pick objects up with thumb and forefinger?			
Transfer objects from one hand to other hand?			
Pick up dropped toys?			
Look directly at adult's face?			
Imitate gestures: peek-a-boo, bye-bye, pat-a-cake?			
Find object hidden under a cup?			
Feed self crackers (munching, not sucking on them)?			
Hold cup with two hands; drink with assistance?			
Smile spontaneously?			
Pay attention to own name?			
Respond to "no"?			
Respond differently to strangers and familiar persons?			
Respond differently to sounds: vacuum, phone, door?			
Look at person who speaks to him or her?			
Respond to simple directions accompanied by gestures?			
Make several consonant-vowel combination sounds?			
Vocalize back to person who has talked to him or her?			
Use intonation patterns that sound like scolding, asking, exclaiming?			
Say "da-da" or "ma-ma"?			

- Videos and even narratives typically contain too much information to recognize patterns in what is happening.
- Need to extract from the data—categorize events and record instances of events satisfying the category.
- Develop coding systems—the coding system will determine what you can and what you cannot learn from the observations.

$\Rightarrow$ Must be constructed carefully.

Continuous observing vs. sampling

Definition

A continuous observation takes a record of what is happening at every moment of time.

Definition

Time sampling is when recording what is happing occurs at predetermined intervals.

Definition

Event sampling is when recording is done whenever an event of a specified kind occurs.

Definition

Situation sampling occurs when recording what happens occurs in a variety of different situations (locations).

How do animals spend their days?

Develop a coding system for animal behaviour (an ethogram):

f = head down foraging
r = rearing up on two legs while foraging
l = standing quadrupedally and looking
c = standing quadrupedally and looking while chewing
u = standing bipedally and looking while chewing
w = walking or other locomotion
x = other behavior
o = out of sight

Coding system for children's reading

You are observing young children reading with the goal of understanding the types of errors they make. What categories should they use?

- Attempt
- Omission
- Substitution
- Appeal for help
- Repetition
- Insertion
- Self-correction

Coding and recording daily life activities

- On the job (work for pay)
- In transit*
- Get exercise*
- In class
- Off-line study/class assignments
- On-line study/class assignments
- On-line (personal)
- Tasks of daily living*
- Eat
- On the telephone/cellphone
- Relax/socialize/Facebook*
- Sleep Start... Finish...
- Other* (optional to specify)

Variables

Definition

A variable is a characteristic of feature of an event that varies, i.e. which takes on different values.

Examples:

- variables of a thrown ball: velocity, momentum, direction, spin,...
- variables of a World Series: winner, number of games, fights, strikeouts,...
- variables of human hair: colour, length, texture,...
- variables of human cognition: memory span, speed of reasoning, emotional state,...

Types of variables: categorical/nominal

- Variables differ in the type of measurement of the values of the variable that is possible. Sometimes one refers to types of scales rather than types of variable.

Definition

A categorical or nominal variable arises when items can be assigned to a category (whose members can then be counted, or compared on another variable).

Examples:

- Gender: male/female
- Major: psychology, political science, economics,...
- Stellar spectra: O, B, A, F, G, K, and M
- Organisms: Plant, Animal, Bacteria, Virus,...

Types of variables: ordinal/rank

Definition

An ordinal or rank variable is present when there is a rank-order (but in general no metric difference) to the values the variable may take.

Note

Numbers may be assigned to the items, but since there is no metric, one cannot compare how much higher or lower one item on the scale is than another.

Examples:

- Movies: *, **, ***, ****
- Class rank: top 10, next 10, etc.
- Patient condition: resting and comfortable, stable, guarded, and critical
- Socio-economic class: low, middle, high

Types of variables: interval

Definition

We speak of an interval variable if equal differences between numbers assigned to items reflect equal difference between the values being measured.

Note

Interval variables allow additive comparison ('x is three more than y'), but lacking a natural 0, do not permit multiplicative comparison ('x is three times y').

Examples:

- Intelligence: IQ score
- Temperature: in degrees Celsius or Farenheit
- Personality: degree of extroversion

Types of variables: ratio, score

Definition

We refer to a variable as a ratio variable if the items are rated on a scale with equal intervals and a natural 0-point.

Note

Ratio variables allow for both additive and multiplicative comparison.

Examples:

- Age: in years, months, days,...
- Temperature: in degrees Kelvin
- Time: in milliseconds, seconds, years,...
- Velocity, acceleration, etc.

Definition

Interval and ratio data often treated similarly and counted as score data.