

1-2010

Sensor Data and Perception: Can Sensors Play 20 Questions

Cory Andrew Henson
Wright State University - Main Campus

Follow this and additional works at: <https://corescholar.libraries.wright.edu/knoesis>



Part of the [Bioinformatics Commons](#), [Communication Technology and New Media Commons](#), [Databases and Information Systems Commons](#), [OS and Networks Commons](#), and the [Science and Technology Studies Commons](#)

Repository Citation

Henson, C. A. (2010). Sensor Data and Perception: Can Sensors Play 20 Questions. .
<https://corescholar.libraries.wright.edu/knoesis/978>

This Presentation is brought to you for free and open access by the The Ohio Center of Excellence in Knowledge-Enabled Computing (Kno.e.sis) at CORE Scholar. It has been accepted for inclusion in Kno.e.sis Publications by an authorized administrator of CORE Scholar. For more information, please contact library-corescholar@wright.edu.

Plant, Animal, or Mineral



Rules of 20 Questions

- questioner thinks of a word
- questioner may ask 20 yes/no questions
- questioner wins if they are able to guess the word



20 Questions demonstrates effective problem solving strategies applicable in many domains, such as cognitive psychology, artificial intelligence



20 Questions as a metaphor to talk about the domain of sensors and strategies for enabling situation awareness



Can sensors play 20 questions



Cory Henson

Semantic Sensor Web
Kno.e.sis Center
Wright State University



What are the semantics of sensor data?

- modeling, annotating, and querying sensor descriptions and observations
- interpreting sensor observations to make sense of the world and derive situation awareness



People are very good at perceiving the world and deriving situation awareness from sensor data

Thus, we should look towards cognitive models of perception to guide our way



So, how do we play 20 Questions?

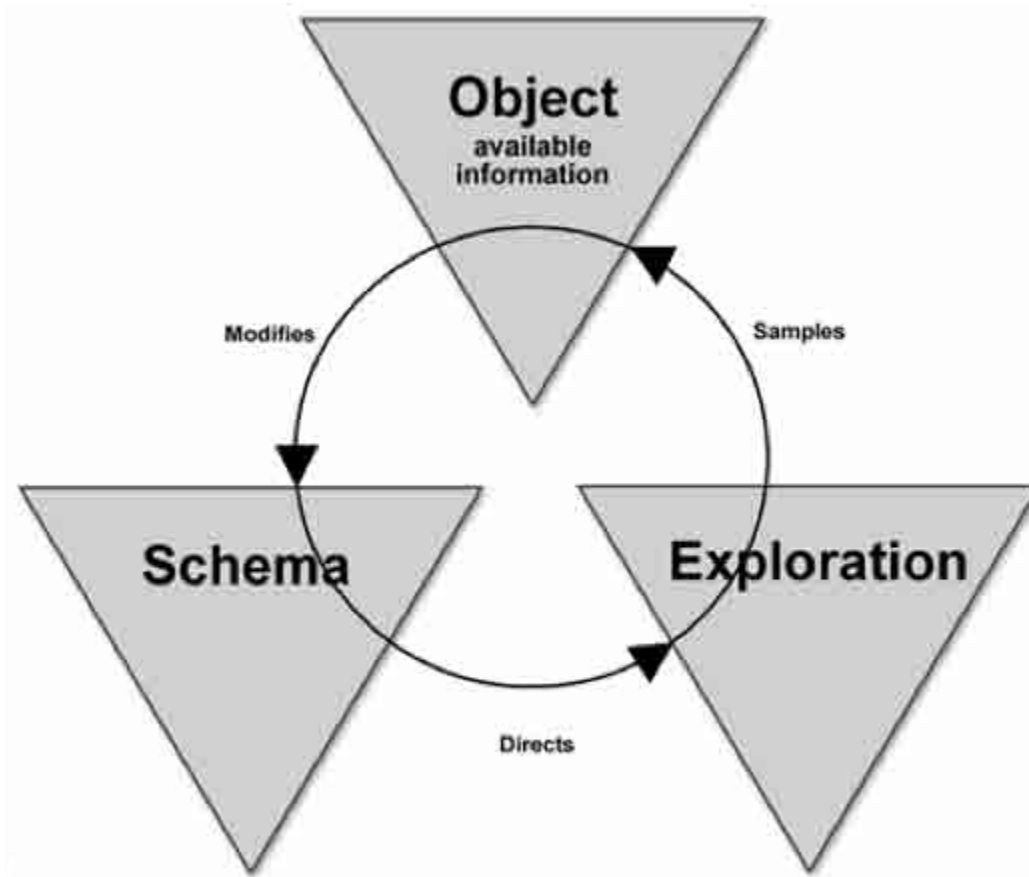
1. Ask a question
2. Analyze the answer (against possible solutions)
3. Use this new knowledge to ask the next question
... and repeat



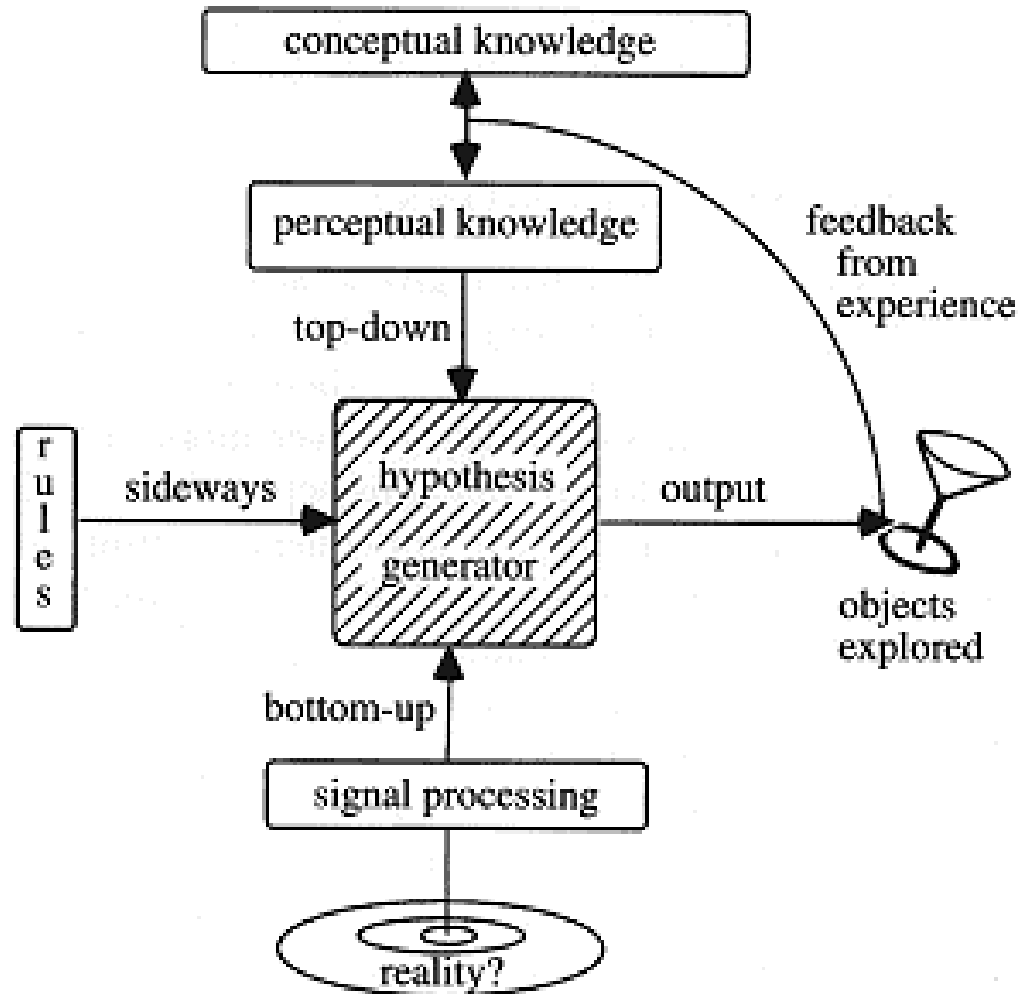
This question/answer (or perception-action) cycle has been studied in cognitive psychology for a long time



Neisser's Perceptual Cycle (1976)

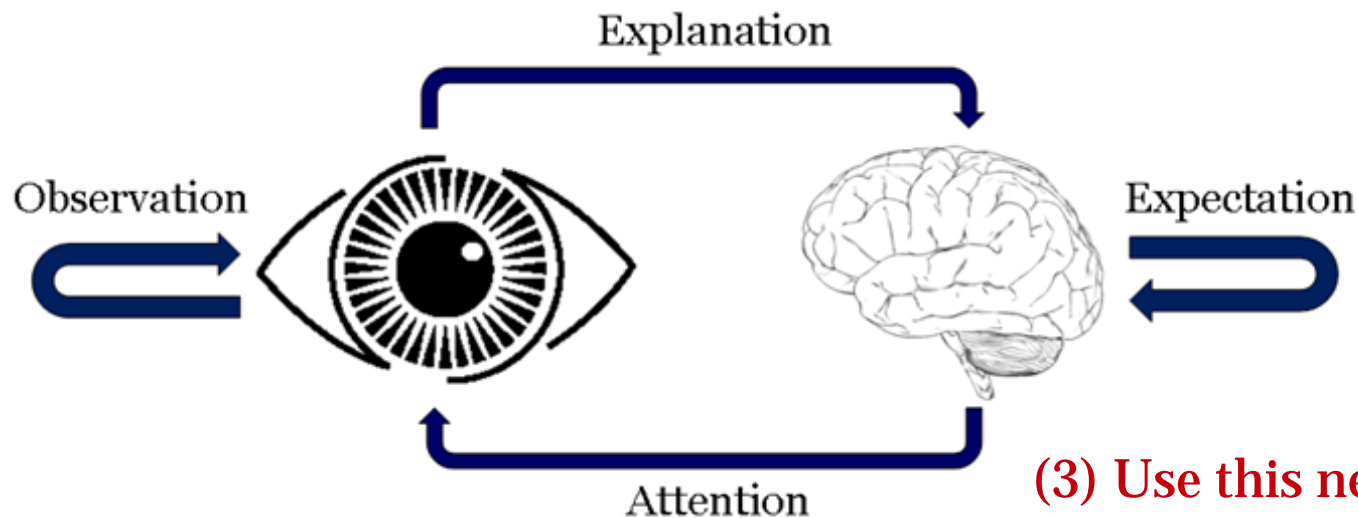


Gregory (1997) – *Knowledge in perception and illusion*



Active Perception* – Shanahan (2005) – *Perception as Abduction: Turning Sensor Data Into Meaningful Representation*

(2) Analyze the answer (against possible solutions)



(1) Ask a question

(3) Use this new
knowledge to determine
next question



This is great, but how does the questioner know which questions to ask to best narrow down the set of possible concepts?

Details of implementation are left out of the perception models



Intellego Perception – Norwich (1991) – *On the Fundamental Nature of Perception*

- *inter*: between, *lego*: to choose
- cognitive model of perception based on choosing between alternative explanations
- also called, Entropy Theory of Perception



Information Theory

- *Entropy* is a measure of uncertainty
- *Information Gain* is a measure of how much a new piece of evidence decreases the uncertainty



Active Perception + Intellego Perception

- provides a model describing how to actively iterate through the sensor search space (*active perception*) in order to choose the best alternative explanation (*intellego perception*)



Modified Rules (for sensors)

- There will be one questioner and 20 questionees.
- Each questionee is only able to answer a single question that is related to their area of expertise.
- The final solution (or "word") will always be an answer to the general question: "What is the situation?"



Passive Perception Strategy

- The questioner (analysis engine) asks questions of each of the 20 questionees (sensors), and collects the answers (observational values)
- After receiving all 20 answers, the questioner then analyses the answers and generates the best possible solution (description of the situation)



Active Perception Strategy

- The questioner asking a single question of one of the 20 questionees, and collecting the answer.
- The questioner then proceeds to analyse this single answer in order to generate a set of possible solutions, or descriptions of the situation.
- If there is more than one possible solution, then the questioner must ask another question.



Can sensors play 20 questions



Thank You

