*KRCP Lecture 11*

*Reasoning & Intelligence*

**Deductive Reasoning**

* Conclusion follows certainly from premises
* **Syllogism**: consist of premises (containing quantifiers) followed by a conclusion
* **Atmosphere effect**: Some premises imply a special atmosphere and influence a person in the process of decision making
* **Categorical reasoning**: take two bits of information and conclude a third bit, validity is here not connected to soundness
* **Conditional reasoning**: Syllogistic reasoning
  + **Antecedent** = p, **Consequent** = q, Result, If p then q
  + **Modus ponens** (Method of affirming): P2=p, then the conclusion=q
  + **Modus Tollens** (Method of denying): P2=not q, then the conclusion=not p
  + **Denying the antecedent** error: P2=not p, C=not q
  + **Affirming the consequent** error: P2=q, C=p
  + **Wason Selection task**:
    - 4 cards on the table (letters on one side, numbers on the other)
    - Tell participants a rule
    - Which cards do you have to turn in order to test if rule is correct

**Inductive Reasoning**

* From a large body of evidence, we make conclusions that are probably true
* **Heuristics and Bias** (Heuristics are “rule of thumb”)
* **Availability heuristics**: biased by recency and frequency
* **Representativeness heuristics**: biased by an existing prototype in our minds

**Expertise**

* 3 stages of skill acquisition:

1. **Cognitive stage**: develop declarative encoding
2. **Associative stage**: errors eliminated and good actions strengthened
3. **Autonomous stage**: no more thinking required (procedural skills)

* **Power law of learning**: T=aP-b
  + T=time needed to solve/perform a task
  + a=learning constant
  + P=practice
  + b=scaling constant
* **Tactical learning**: you learn the sequence to solve a particular problem
* **Strategic learning**: you learn to organize solution differently
* **Deliberate practice**: motivated to learn, given feedback on performance, focus on improving performance

**Intelligence**

* IQ Test
  + Result is compared to **relative/normative** group
  + Different **subtests** that try to test different abilities, show correlation amongst them; combined into **factors** (one factor (g), multiple factors, or 2 **crystallized** **intelligence** (acquire knowledge) and **fluid intelligence** (ability to reason in novel domain) according to psychologist)
* **Flynn effect**: substantial and long-sustained increase in both fluid and crystallized intelligence test scores measured from 1930 to the present day
* **Construct validity**: degree to which a test measures what it claims to be measuring

**Artificial Intelligence**

* **Consistent**: a formal system is consistent if it does not contain a contradiction
* **Complete**: a formal system is complete if all the statements that can be made in a system are “decidable” within the system
* **INDUCE**: Medin, Wattenmaker, Michalski (1987), Heuristic (rule based) search, category validity vs. cue validity, humans use category, INDUCE cue
* **DEEP BLUE**: Chess computer, won against world champion
* **Dijkstra**: “Asking if computers can think is like asking if submarines can swim”