Expertise

Questions

• What are differences between novices and experts?
• How to become an expert?
• Speed of learning

Characterization of Experts

• Experts excel mainly in their own domains
• Experts perceive large meaningful patterns in their domain
• Experts are fast
• Experts see and represent a problem in their own domain at a deeper level than novices – they see structural similarities between problems
• Experts work forwards from givens to unknowns
• Experts have strong self-monitoring skills
Experts excel mainly in their own domains

- experts are masters in their own domain
- the skill does not cross into different domains

Experts perceive large meaningful patterns in their domain

- Experts have extensive knowledge
- Allows them to notice meaningful patterns
- top-down processes -- giving meaning to what it is we see

See anything unusual?

- Experts need only a few seconds to see what is wrong (or what isn’t)
- Experts augment these incomplete images with extensive background information
Chess Studies

- (DeGroot, 1965; Simon & Chase, 1973)

- For master chess players, depth of search is same as novices. Also, about the same number of moves are considered.

- However, masters spend more time on *good* moves.

- Masters rely on extensive experience: 50,000 patterns
Conclusion from Chase & Simon (1973)

- Experts do not have better memory in general
- Experts encode with large meaningful perceptual units → Chunks
- Experts organize knowledge differently – reflects a deep understanding.

Experts see and represent a problem in their own domain at a deeper level than novices…

- Experts see structural similarities
- Novices see surface similarity
What makes an expert an expert?

• Talent? IQ? Practice? Genetic factors?

• Study exceptional feats:
  – Memory experts
  – Chess experts
  – Musicians
  – Athletes

General & Inherited Factors

IQ tests
Short-term memory
Speed of reading
Reasoning ability
Attention

Do not predict superior performance

Experts are not better problem solvers in general. Expertise is domain specific
Practice

• 10 year rule
  – 10 years of deliberate practice needed to attain an international level. Arts, Sciences, sports
  – Master chess players spend 10,000 – 20,000 hours playing

• True for idiot savants & prodigies?

What about talent?

• Maybe exceptional performance in some area can be explained by talent – an innate predisposition that predetermines performance in a domain.

• Anders Ericsson et al.
  → disagree that concept of talent is useful or explains anything.
  → claim that expertise is mostly a matter of deliberate practice, not simply engaging in activity, but practicing in an effortful, intensive, self-monitored mode
  → this is controversial!

What about talent in athletic performance?

• Athletic performance:
  – Height
  – Physique
  – Size of heart
  – Number of capillaries for muscles
  – Proportion of types of muscle fibers

  \[
  \{ \text{genetic} \} \quad \{ \text{Practice has substantial impact} \}
  \]
What about musical talent?

- **Absolute pitch:**
  - Most musicians acquired it for their own instruments
  - Can be improved by training

- Ericsson shows that difference between good and exceptional musicians is related to the amount of practice (next slide)

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**Learning mechanisms**

- How does a skill improve over time?

- Learning curves – fine-tuning a skill
Practice with Cigar Rolling

Factors Affecting Practice

- Expectations can also mislead us; the unexpected is always hard to perceive clearly. Sometimes we fail to recognize an object because we
- Memorization can only be made if the actual process to be remembered is clear.

Original training on inverted test
- Retraining on normal test
- Retraining on normal test
• Deliberate practice improves performance
• Might take a long time to improve
• Skills show high level of retention (e.g., skiing)

Digit Span
• Number of digits that can be repeated after one presentation
  1 4 3 1 9 2 1 2 0 ..... 
• Normal digit span = 7 or 8 digits (phone number). Encoding strategies help
  1 4 3 1 9 2 1 2 0 ..... 

Growth in memory span for one subject (S.F.) with practice

Memory span for digits can be trained you too can have a 80 digit memory span