How are Experts Different From Novices?

• Experts have larger chunks
• Experts have more abstract representations
• Experts perceive differently
• Experts have a lot more practice, not talent
Chunking in expertise

- Experts do not have larger STM for digits
- Chase & Simon’s task
  - Look at chess board and then try to reconstruct it
  - Experts no better for random boards
  - Experts better at real board
  - Experts reconstruct board one chunk at a time
- Experts create larger chunks for meaningful material related to their expertise
Experts have more abstract representations

- Novice physics students sort physics problem according to superficial features
  - “These go together because they all involve incline planes”
- Expert physicists sort problems according to deeper, physics principle
  - “These problems all involve conservation of energy”
- Experts spend more time on representation building, and can see analogies between superficially dissimilar situations in their domain
Novice 2: "Angular velocity, momentum, circular things"

Novice 3: "Rotational kinematics, angular speeds, angular velocities"

Novice 6: "Problems that have something rotating: angular speed"

Novice 1: "These deal with blocks on an incline plane"

Novice 5: "Inclined plane problems, coefficient of friction"

Novice 6: "Blocks on inclined planes with angles"

Expert 2: "Conservation of energy"

Expert 3: "Work-energy theorem. They are all straightforward problems."

Expert 4: "These can be done from energy considerations. Either you should know the principle of conservation of energy, or work is lost somewhere."

Expert 2: "These can be solved by Newton's second law"

Expert 3: "F = ma; Newton's second law"

Expert 4: "Largely use F = ma; Newton's second law"
Experts perceive better than novices

- Experts can make more discriminations in their domain of expertise than can novices
  - Can create perceptual expertise by training
- Experts are better at isolating the dimensions that make up an object within the domain
  - Wine experts can isolate the tannin in wine
  - Color experts can attend to saturation and ignore brightness of a color
- Experts also create single units to represent familiar objects
  - Letters are unitized for all of us
  - New objects come to be identified as quickly as letters with training
Omphalotus olearis  Cantharellus cibarius
For each doodle, respond whether it is the target or not.

Even without feedback, people get better at distinguishing one doodle from other doodles with practice.
Novel objects come to be treated like familiar units with practice.
Experts have a lot more practice, not talent

- Performance is often very well predicted by amount of training
  - Power function: $RT=AN^B+C$
  - $RT=$Response time, $N=$Number of trials
  - $A=$Total amount of training, $B=$Speed of improvement, $C=$Asymptote
  - Power laws predict straight lines in log-log graphs

- Ericsson: Musical performance is almost entirely predicted by number of hours of deliberate practice
  - Professional musicians practice much more than novice musicians
  - Correlation between practice and skill is greater than 0.85
  - Good news: you can become an expert if you want
  - Bad news: it will take a lot of work and time
where $T$ is the recognition time and $P$ is the number of days of practice. This is called a power function because the amount of practice $P$ is
Figure 9.1 Time to produce a cigar as a function of amount of experience. (From Crossman, 1959. Reprinted by permission from Taylor & Francis.)
Expectations can also mislead us; the unexpected is always hard to perceive clearly. Sometimes we fail to recognize an object because we

saw another object of a kind that is similar to the one we are looking for. It was the

wrong object that was recognized. The more similar the objects, the more likely it is

that the wrong one will be recognized. Even a difference of 1% in the area of an object

can make it look like a different object.

Several theories and approaches to the study of object recognition and identification

exist. The oldest is the Gestalt theory, which postulates that the whole is greater than

the sum of its parts. According to this theory, an object is recognized by its overall

shape and arrangement of parts. A newer theory is the feature detection theory, which

postulates that an object is recognized by detecting its characteristic features. Another

theory is the template matching theory, which postulates that an object is recognized

by matching its image to a stored template. Different theories may be applied to different

tasks, and it is likely that a combination of theories will be required to explain all

object recognition phenomena.

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Figure 9.3 Some examples of the spatially transformed texts used in Kolers's studies of the acquisition of reading skills. The asterisks indicate the starting point for reading. (From Kolers & Perkins, 1975.)
**Figure 9.4** The results for readers in Kolers’s reading-skills experiment (1976) on two tests more than a year apart. Subjects were trained with 200 pages of inverted text with occasional pages of normal text interspersed. A year later, they were retrained with 100 pages of inverted text, again with normal text occasionally interspersed. The results show the effect of practice on the acquisition of the skill. Both reading time and number of pages practiced are plotted on a logarithmic scale. (From Kolers, 1976. Copyright by the American Psychological Association. Reprinted by permission.)