How Minds Work
Pandemonium Theory

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Selfridge’s Pandemonium Theory

- A theory of perception
- Demons—small, specific processes, waiting for a chance to act
- Demons identify objects
- Loudness of demon’s shout proportional to match of favored input with the object
- Demon that shouts the loudest wins
Pandemonium Perception in Action

• Stimulates demon for an R
• Stimulates demon for an O
• Stimulates demon for an Q even more
• Recognized as a Q
Pandemonium Theory of Mind

• Demons that act, internally & externally
• Living in a sports arena
• Almost all demons in the stands cheering
• A few performers on the playing field exciting the crowd
• Some, more excited, yell louder
• Loudest demon replaces another on the playing field
• Note similarity to Baars’ theater metaphor
Linked Demons

- Initial demons have built-in links
- Time on the field together strengthens old links and builds new (Hebb’s law)
- Demons on the field excite others in the stands to whom they are linked
Motivational “Gain”

• Gain is up when things are going well
• Down, even negative, when going poorly
• The higher the gain, the more links are strengthened by time together on the field
• Gain acts as affect to motivate and to facilitate learning
Goals

• High gain when goals are achieved
• Low gain when they are not
• Demons associated with improved conditions tend to reappear on the field
• System thus steers towards its goals
Sequences of Actions

- Improved conditions need coordinated sequences of actions
- Actions in sequence have stronger pulls than pushes
- Uphill links to new arrivals stronger than downhill links
- Sequences keep their order
Sequences in Action

• Demons gradually fade from the playing field, activation decaying
• First demon in sequence has a strong link to second, etc.
• Starting an habitual sequence causes it to be repeated
Sub-arena

- Measures the system’s well-being, adjusting gain
- Primitive sensing and acting capability built in to sub-arena
- Sensory input sends low-level action demons to the playing field
Concept Demons

- Demons with strong links merged into a single concept demon
- Component demons remain
- Relieves bottleneck of the playing field
- Can transfer solution of one problem to another problem
Compound Concept Demons

- Compound concept demons can arise
- Hierarchy of concept demons
- Higher order concept demons decay more slowly
- They linger longer on the playing field, having more affect on future actions
Decay of Links

- Links decay over time
- Negative links at a different rate
- High-level links at a slower rate
- Little used links disappear
- Recent associations count more
- Shows need for tuning such systems
Readings

Pandemonium Theory

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