IV. Response Probability and the Concept of the Repertoire

- **The concept of "response probability"**
- **The semantic priming procedure**
- **Characteristic results of the procedure**
- **The concept of the response repertoire**
- **Two thresholds: Observability/Emission**
- **The role of response probability in the interpretation of complex behavior**

Prompting and priming

Think of a word:

A state

Fort Pitt

Irving

Northwestern state

New Hampshire mountain

Cherry tree chopper

Valley Forge

District of Columbia

Martha's husband

Think of a word

- **A city**
- **Ancient**
- **Modern**
- **Twins raised by a wolf**
- **Seven hills**

- **The probability of a response is an important concept in the analysis of behavior. We say that reinforcement and punishment change the probability, or strength, of a response. But what is probability?**

Probability Measures

1. Rate of response

Shown to be highly sensitive to reinforcement contingencies. Excellent way to measure disturbance variables

2. Latency

Shown to be a good predictor in educational settings

3. Force

Example: My Italian speech

4. Resistance to extinction

Persistence in the face of failure

5. Prepotency over competing responses

Responses are always in competition with other responses.

Rate of response is the experimental measure that is most closely related to the term probability, so closely that we use it as a direct measure of probability. But rate is distinctively an experimental tool.

Rate is often useless in uncontrolled settings, where responses don't repeat themselves, but fluently follow one another in an endlessly changing stream.

Probability is the central theoretical term in the analysis of behavior:

Reinforcement alters the stimulus control of behavior, or the probability of a response in the presence of a stimulus.

Establishing operations alter the probability of a response.

The evoking or suppression of competing behavior alters the probability of a response.

Estimating Probability of Response Is Our Most Common Interpretive Task.

- Predict or control individual instances of behavior in novel settings in which many variables interact

- Explain the occurrence of a response that has already occurred, that is, reconstruct the fluctuations in the probability of the response prior to its being emitted.

- Our understanding of topics commonly called "cognitive," language, memory, problem solving, attention is just our understanding of fluctuating and interacting response probabilities.

The Difficulty in Interpreting Cognitive Behavior

- Histories are unknown
- Many variables interact
- Some of the performance is commonly covert

The Semantic Priming Procedure

- **A word or phrase is presented on a screen. A short time later, a second item is displayed on the screen, either a related word, an unrelated word, or a nonword. The first word is called the PRIME, the second the TARGET. The subject's task is to indicate whether the second item is, or is not, a word. For example, the subject will press one button if the word is "PEACH" or a second button if it is "PRECH." This task is called a Lexical Decision Task, (LDT).**

- **The dependent variable is the response latency, that is, the time that elapses between the display of the second word and the subject's response of pressing a button.**

A Typical Experimental Protocol:

1) * * * * * (360 ms)
2) (360 ms)
3) tone (140 ms)
4) BREAD (250 ms)
5) dark (50 ms)
6) BUTTER (indefinite)
7) "0" or "1" (end of trial)

Typical Findings

- **Response latencies to related words are lower than to unrelated words**

- Bread, Butter
- Lion, Tiger
- Glove, Hat
- Fruit, Pear

- **But also:**

- **Category, Example effects:**
- Fruit, Peach
- Fruit, Banana
- Fruit, Orange
- Fruit, Apple

Other Priming Effects

- **Homonym effects:**
- Straw, Sip
- Straw, Hay

- **Perceptual similarity effects:**
- Carrot, Paintbrush

- **Mediated relationships:**
- Lion, (Tiger), Stripes
- Bull, (Cow), Milk

- **Backward relationships:**
- Pan, Bed

More Priming Effects

- Inhibition
- **Swan, Apple relative to:**
- **XXXX, Apple**

- Priming over intervening items:
- **Nurse, Paper, Doctor**

- Subliminal priming:
- **Bird, (mask), Robin**

More priming effects

- **Frequency effects:**
  - Father-Son weaker than Ostrich-Neck
- **Predicted category effects:**
  - Building-leg (body part)
- **Auditory priming effects:**
  - Left ear=prime; Right ear=target;
- **Cross-modal priming effects:**
  - Visual-auditory and vice versa

More priming effects

- **Pictorial Priming effects**
  - Picture – word

- **Priming detected through EEG patterns.**

Effect Sizes & Parameters

- **Typical effects:**
- Relative to control, response latencies are shorter by 25—65 ms

- **Parameters:**
- Effects strongest when ISIs are short (e.g. 250ms) though it varies with modality
- ISIs up to 1.5 sec are used
- Effects greatest when the primes are "processed;" weak or absent when subjects respond only to form of word (Is it upper case?)
- Optimal ISIs increase with "processing," ie from physical to phonological to semantic

Implications of Priming

Since the decrease in latency is a measure of response probability, the priming procedure seems to offer a way to indirectly evaluate the effect of a stimulus on the probability, not just of *covert behavior*, but of *behavior that is not even emitted*.

Two Thresholds

- **Threshold of observability**
- Responses vary in magnitude and intensity. Whether they are observed depends upon the tools of the observer. Under any given conditions, there will be an intensity threshold above which the behavior is observed, below which it is not.

- **Threshold of Emission**
- Responses are in competition with incompatible responses. Whether a response is emitted depends on its strength and the strength of competing responses

Overt Behavior

Threshold of Observability

Covert Behavior

Threshold of Emission

Repertoire of Responses

A View of the Repertoire

- **The repertoire is a simmering cauldron of operants, rising and falling in probability, continually being stirred up by stimuli, elbowing one another aside as they work their way up to the top of the broth, where, at any moment, only the strongest are emitted.**

- **When a word is presented to a screen, or is spoken, or an object seen or felt, the event sets off a volley of effects on the repertoire, most of which are sub-threshold.**

- **The concept of *response probability* is central to our interpretations of complex human behavior.**
- **The priming procedure is a tool, relatively new to us, for evaluating the effects of verbal stimuli on the probability of subsequent responses.**
- **Typical findings suggest a view of the repertoire as a cauldron of sub-threshold competing responses.**
- **This view fits smoothly with our interpretations of supplementary stimulus control procedures in problem solving, recall, and the moment-to-moment fluctuations in stimulus control in autoclitic frames**