The Matching Law: Implications for Differential Reinforcement

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Acknowledgements
- Elizabeth Athens
- John Borrero
- Carrie Borrero
- Jason Bourret
- Kerri Peters
- George

Overview
- I will discuss “choice” behavior and the matching law.
- I will present some data showing that the matching law describes human behavior in a variety of situations.
- I will make a case that understanding the matching law is useful in the implementation of differential reinforcement procedures as behavioral treatment.

What I will not discuss
- Linear equations
- Y-intercepts
- Bias
- Slopes
- I will not discuss the generalized law, just the matching law in its simplest form
- You do not need a tutorial on the nuances of matching to understanding matching or the implications of matching for behavioral treatment

Why I will not be discussing those items
- Naptime
- Happy Hour
- Daughter Emily
- Real reason: you do not need a tutorial on the nuances of matching to understanding matching or the implications of matching for behavioral treatment

What do Behavior Analysts mean by “choice”?
- Allocation of responding on two or more response alternatives.
- Each alternative is associated with some schedule of reinforcement, punishment, or both.
- Allocation of responding is governed by the outcome of responding (consequences to behavior).
The Matching Law

- In a concurrent arrangement, the relative rate of one response alternative will essentially "match" the relative rate of reinforcement available for that response alternative.

\[
\frac{R_1}{R_1 + R_2} = \frac{r_1}{r_1 + r_2}
\]

Hypothetical Matching Example

Matching in Pigeon Key Pecks

Matching in College Basketball: 2 and 3 point shots


Matching in Child Problem Behavior


Averages

Borrero et al., 2010

Other factors influencing response allocation

- Quality of reinforcement
- Magnitude/duration of reinforcement
- Delay to reinforcement
- Response effort
- Punishment

Quality

- Tastes good
- 6 slices
- 15 minute delivery
- Friendly staff
- Delicious!!!
- 6 slices
- 15 minute delivery
- Friendly staff
Delicious
- 6 slices
- 15 minute delivery
- Friendly staff

12 slices (2 for 1 deal)
- Delicious
- 6 slices
- 15 minute delivery
- Friendly staff

Response Effort
- Delicious
- 6 slices
- 25 min delivery
- Friendly staff

No delivery (it takes 25 minutes to pick it up and get back home)
- Delicious
- 6 slices
- No delivery
- Friendly staff

Delay
- Delicious
- 6 slices
- 15 minute delivery
- Friendly staff

- Delicious
- 6 slices
- 30 minute delivery
- Friendly staff

Punishment
- Delicious
- 6 slices
- 15 minute delivery
- Rude and angry staff

- Delicious
- 6 slices
- 15 minute delivery
- Friendly staff

Differential Reinforcement of Alternative Behavior (DRA)
- DRA is essentially a concurrent schedule.
- Baseline circumstances (reinforcement schedules) usually favor problematic behavior.
- Ideally, treatment circumstances represent schedules that favor appropriate behavior.
- Ideally, Extinction vs. Reinforcement.
- However, there are circumstances when extinction is not possible or practical.

Magnitude

Response Effort

Punishment

Differential Reinforcement of Alternative Behavior (DRA)

Examples of factors influencing the application of extinction schedule

- Treatment integrity failures.
- Legal or ethical requirement to block attention-maintained self-injury or aggression.
- Automatic reinforcement.
- Large and/or fast individuals may produce escape even if we attempt escape extinction.

How does knowledge of the matching law help?

More complex examples

Differential Attention Baseline example

<table>
<thead>
<tr>
<th></th>
<th>Aggressive Behavior</th>
<th>Appropriate Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability of Attention</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
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<td></td>
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### Differential Attention

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<td>on average &gt; 20 sec</td>
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#### Solution

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<td></td>
<td></td>
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<td>Delay to Attention</td>
<td>&lt; 3 sec</td>
<td>&lt; 3 sec</td>
</tr>
<tr>
<td>Quality of Attention</td>
<td>Physical Attention</td>
<td>Verbal and Physical Attention</td>
</tr>
<tr>
<td>Duration of Attention</td>
<td>&lt; 10 sec</td>
<td>&gt; 20 sec</td>
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Athens & Vollmer, 2010

Empirical Evaluation


Greg

Verbal and Behavior


Empirical Evaluation

Athens & Vollmer, 2010

Gege
Considerations for escape behavior

- If escape is reinforcing, that means instruction is aversive.
- Do we want instruction to be aversive?
- Consider increasing positive reinforcement or providing NCR during instructional activity.
- This approach is compatible with a matching interpretation.

Summary

- It is nice to have a “law” of behavior.
- Understanding the law helps us establish better treatments because behavioral treatments represent concurrent operant schedules.
- Ideal behavioral treatments include an extinction component.
- When ideal treatment circumstances break down, all is not lost.