Eye Of the Tiger: Conditioning Conflict Anticipation in *Betta Splendens*

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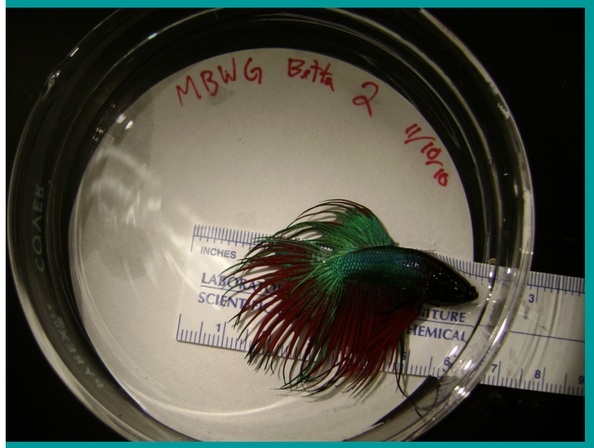
Will association with an unconditioned stimulus allow naturally confrontational fish to anticipate and be more aggressive in conspecific battles?



Siamese fighting fish are naturally aggressive, visually aware, display same the aggressive behavior to mirrors as they would other males, and are easy to house separately. Previous experiments have successfully conditioned aggression in Bettas. They are therefore perfect model organisms to study the effects of conditioning on fighting.

Why condition aggression?

Males defend territory in the wild, being able to adjust behavior for conflict would be advantageous (1)

Previous conditioning experiments with Bettas have successfully conditioned aggression to a novel stimulus, using mirrors(2).

Captive populations have history of being bred for aggression in male/mal

Abstract

The Siamese Fighting Fish (Betta Splendens) is characterized by aggressive tendencies in the males. In addition to providing a fitness advantage in wild, aggressive behavior has been selected for in captive populations. Previous experiments have successfully conditioned similarly aggressive fish to attenuate aggression in anticipation of a mating opportunity. Male Bettas (n=8) were measured and distributed into conditioned (experimental) and unconditioned (control) group, accounting for size. We attempted to use classical conditioning techniques to teach male Bettas to anticipate the presence of another male by associating exposure to a mirror (which previous experiments have shown to elicit a equivalent reaction to another male) with a red light. After a number of conditioning sessions, the males who had been trained to associate the light with an upcoming conflict were placed in an arena separated from a control male by an opaque divider. After presentation of the light, the divider was lifted and aggressive behavior was scored over ten minutes for both fish using an ethogram. Statistical analysis revealed no significant association between aggressive behavior and conditioning treatment or body size.

A male Betta in full aggressive display

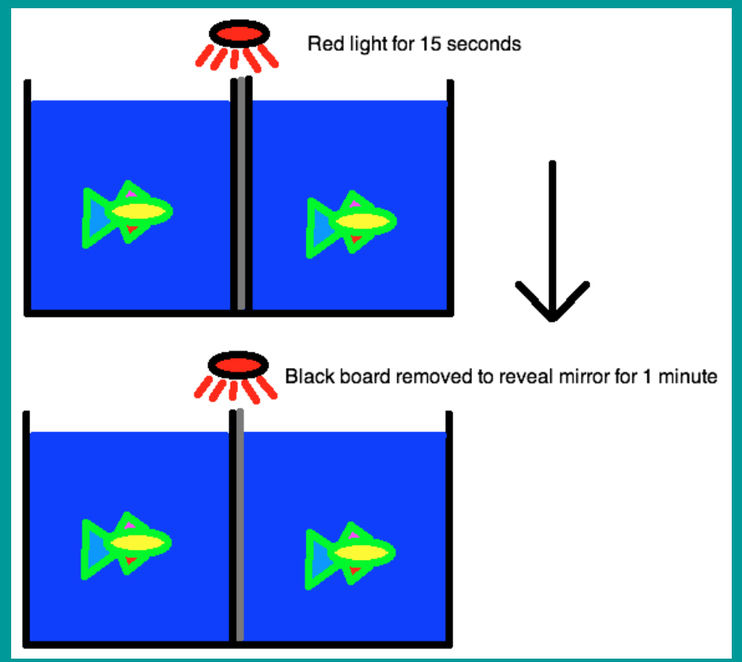
http://www.aquahobby.com/gallery/img/Betta_splendens_14.jpg

Experimental Design and Results:

Conditioning arena and scored battles

Hypothesis: Fish who have been conditioned to anticipate appearance of another male would display more total aggressive behaviors than those who haven't.

n=8 male Bettas were purchased from the Tropical Hut and photographed. Body area was measured using ImageJ(3) photo analysis software. Males were assigned groups based on body size. After six conditioning sessions, males were paired randomly with one from another group in an arena identical to conditioning tank. This time the divider was lifted (no mirror) and behavior for both fish was scored for 10 minutes using Jwatcher (4) software event recorder. Each experimenter scored one combatant, switching treatment each time.



- Group did not affect significantly aggression (one way ANOVA, p=.6270)
- Size did not affect significantly aggression (one way ANOVA, p=.1347)

Ethogram:
- Display
- Bite
- Charge
- Flee

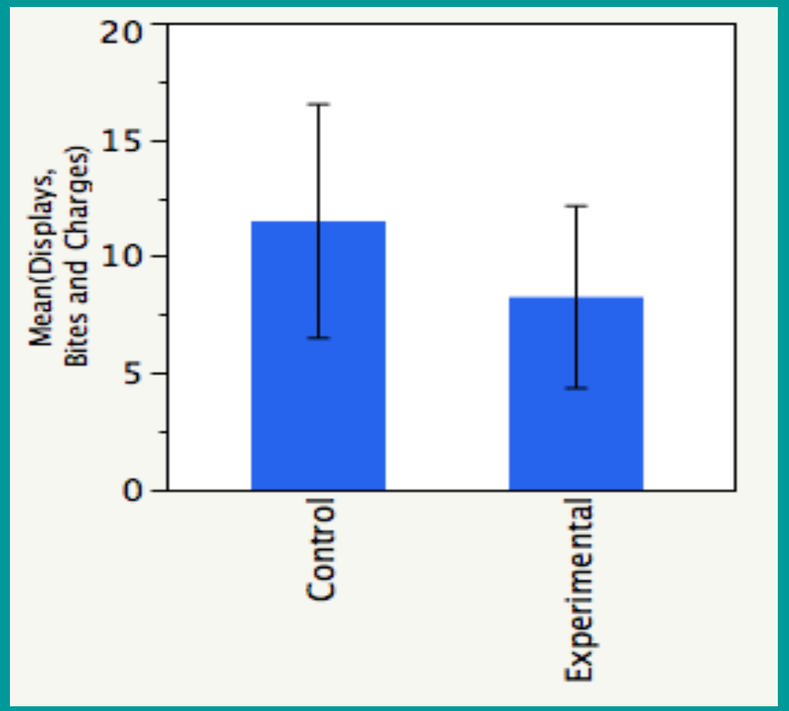


Figure 1: A diagram of the conditioning arena. A fish from each group was placed on opposite sides of an opaque divider. After 15 second of red light, divider was lifted to reveal a mirror to one fish. After one minute the divider was replaced, light turned off, and fish removed.

Figure 2: The mean sum of aggressive behaviors, defined as Bites, Charges, and Displays, between the conditioned and unconditioned fish. No significant difference was seen between the two treatments. Our hypothesis was not supported by the results of this study.

We Conclude that:

We failed to find a significant correlation between the conditioning of aggressive behavior and the probability of directed aggressive behavior. We're not positive that we induced an effective conditioned response. Perhaps more conditioning is necessary to see the aggressive response reported in previous literature [1,2]. Or perhaps we simply needed a larger sample size so as to reduce confounding variables. Regardless, it appeared that *Betta Splendens* is a great model organism for aggressive behavior in fish as it was very easy to induce a fight within 10 minutes and provide a clear winner.

Future Directions:

Daily conditioning, or multiple times per day, would increase the saliency of the light and strengthen the intended association. If the conditioning sessions lasted as long as the test fights (10 minutes) it may also reinforce the association. Collecting data from multiple fights for each fish over multiple days would give us more data and increase the likelihood of finding significant results.

References:

(1) Robertson and Sale, 1974 C.M. Robertson and P.F. Sale, Sexual discrimination in the Siamese fighting fish (Betta splendens regan), Behaviour 54 (1974), pp. 1–25.
(2) Thompson T, Sturm T. Classical conditioning of aggressive display in Siamese fighting fish. J Exp Anal Behav. 1965;8:397–403
(3) http://rsbweb.nih.gov/ij/
(4) http://www.jwatcher.ucla.edu/

Fighting Betta image from: http://advocacy.britannica.com/blog/advocacy/wp-content/uploads/betta11.jpg, all others original unless otherwise noted

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