ADJUSTMENT TO A SHIFTED SET OF STIMULI

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Abstract

Two category rating experiments are described. In both experiments, one group of subjects first judged the upper half and another group first judged the lower half of a graded series of 16 squares. After four blocks of trials with the practice series, both groups were shifted to the total series. Specific instructions to modify or not to modify scales were given before the shift. Experiment 1 manipulated the instructions as a between-subjects variable and Experiment 2 manipulated them as a within-subjects variable. The results indicate that (a) presentation period can serve the function of a context cue, that (b) two contexts for the same set of stimuli (squares) can coexist in memory, and that (c) subjects have a great deal of control over the weighting of these two contexts at any moment. The results support the hypothesis that the principles of scale formation are the principles of paired-associate learning.

Numerous studies have shown that experience in a first series of stimuli affects the judgment of the second. Figure 1 shows the results of a typical experiment (unpublished) using a series of 16 squares whose widths varied from 12 mm to 102 mm, each step by 6 mm, in arithmetic progression. The participants were asked to judge each square with integers from 1 to 6 according to size. One group (H, n = 19) first saw the eight largest squares whereas the other group (L, n = 18) first saw the eight smallest. Each square appeared twice in a block with its occurrences separated by other squares. After four blocks of trials, both groups were shifted to the total range. The squares appeared, one at a time, in bright lines in the center of a 15-inch computer monitor. The intertrial interval was 3 s. Responses were to be made by pressing the appropriate number key. Response time was measured without the subjects' knowing.

To track the upward and downward movement of the scales, I calculated the neutral point of the series for each block of trials, that is, the average value of the squares assigned to the two middle categories (Categories 3 and 4). Figure 1 shows the resulting curves for Groups H and L. The vertical line marks the point of shift. One can see that the curves quickly approach each other but do not meet to the end of the experiment. After eight blocks of trials (i.e., 128 presentations) with the total series, the levels still differ by 1.6 stimulus units. The results suggest that the old impressions impede adjustment to the extended series.

Neither in this nor in any other experiment the participants, however, were warned of a possible shift in the distribution of stimuli, much less they were told how to react to. Thus it is possible that incomplete adjustment was merely a consequence of insufficient instructions. After noticing a shift in the range or frequency of stimuli, some subjects may have decided to stick to their old scales, others may have tried to establish new ones, and still others may have made a compromise between the two alternatives because they were reluctant to discard their earlier judgments. Those not being not fully aware of the shift may have tended to maintain their initial scales all the more. Consistent with this interpretation, many authors (e.g., Ward, 1987) have reported large individual differences in the amount of readjustment of scales.

My argument rests on the tacit assumption that subjects have a great deal of control over the weighting of successive contexts. Experiment 1 was designed to test this hypothesis by giving specific instructions to modify or not to modify scales to the subjects.

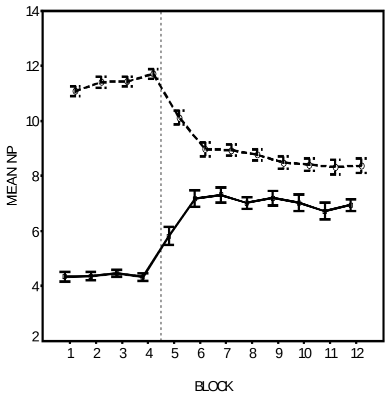

Figure 1. Upward and downward shift of neutral points within Group L (solid line) and Group H (broken line) when no specific instructions are given. The vertical line marks the point of shift. Vertical bars indicate the standard error of means (SE). Note that the data points are displaced horizontally against each other to avoid overlapping.

Experiment 1

Experiment 1 was identical with the one mentioned above except that Groups L (n = 18) and H (n = 18) were divided into two subgroups each. The members of Subgroups LO and HO were asked to stick to their old scales before they were shifted to the test series whereas the members of Subgroups LN and HN were asked to establish entirely new scales. Of course, no information was given of the nature of shift, much less of its direction; subjects were just asked to judge another series of squares. Because the results of an earlier experiment (Haubensak, 1993) indicated that giving instructions once before the shift might not be enough, the participants were reminded of the target context on every presentation by superimposing the label *old* or *new* on the bottom of the background field. As a minor change, the squares were presented on a some-hat larger computer monitor (17-in. color monitor, 800 x 600 pixels, 85 Hz refresh rate), and five categories were used instead of six because the neutral points could then be calculated directly from the width of the squares assigned to the middle category (Category 3).

Results

Figure 2 shows the upward and downward movement of the neutral points for Subgroups LO and HO (those asked to refer to the previous series). One can see that the neutral points move only slightly but the change from the last two blocks of preshift trials to the last two blocks of postshift trials is significant within both groups. The difference in the final levels between the two groups is also significant. Figure 3 shows the results for Subgroups LN and HN (those instructed to establish new scales). Unlike Figure 2, the difference in the final levels is insignificant. The power of the experiment, however, to detect a difference of less than half a stimulus step was extremely low, .10. Thus its is possible that there was still a small difference between the two groups.

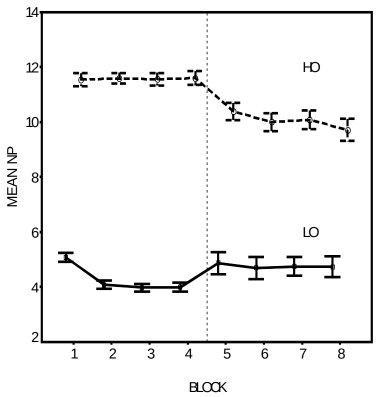

Figure 2. Upward and downward shift of neutral points in Experiment 1 (single judgment) under Instruction O for Group L (solid line) and H (broken line) separately.

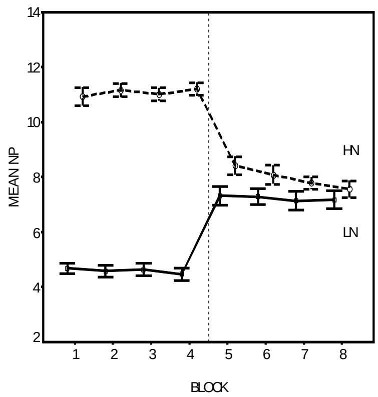

Figure 3. Upward and downward shift of neutral points in Experiment 1 (single judgment) under Instruction N for Group L (solid line) and H (broken line) separately.

Next, I plotted the final mean judgments against the physical width of the squares for each instruction. Under Instruction N, the curves were congruent and perfectly linear. Under Instruction O, the curves were concave downward for Group L (i.e., the width of the categories steadily increases as one goes up the scale) and upward for Group H (i.e., the width of the categories steadily increases as one goes down the scale). Finally, I analyzed the response times (RT) across the last two blocks of postshift trials. Because the distribution was positively skewed as usual, I took the logarithms. This reduced the positive skew to 0.5. RT was an inverted u-shaped function of the stimulus values, that is, responses to the smallest square (Square 1) were fastest, responses to the largest (Square 16) were next fastest, and responses to the middle stimuli were slowest. Interestingly enough, RT to the stimuli formerly defining the inward endpoints of the preshift series (Squares 8 and 9) had no special status, that is, they stood in a class with the other ones as far as response time and judgment variance was concerned.

In a second analysis, I grouped the stimuli into new and old ones. Mean RT to the new stimuli (those introduced after the shift) was about 200 ms shorter mean RT to the old stimuli (those formerly being part of the practice series). Mean RT (in antilogs) was also 135 ms longer when stimulus age (old/new) was concordant with the instructions (O/N). Both effects were significant. There was no significant interaction, however, between the two factors, stimulus age and concordance.

Discussion

The results indicate that people have a great deal of control over the weighting of successive contexts. They can ignore the previous context almost completely if instructed to. Thus, contrary to earlier claims, previous stimulus-response couplings do not always have profound effects on scaling responses on later presentations. They have if people are kept guessing about the nature of the task.

The subjects were somewhat less successful, however, in preserving their old scales. Perhaps the new responses interfered with the old ones because both were retrieved from memory and competed with each other at the time of judgment. Being constantly reinforced by the current context, the new responses might have intruded into the old ones sometimes. One special attraction of this hypothesis is that it can explain the difference in response time between the old and the new stimuli. Responses to the new stimuli would be faster because there are no old responses competing with the new ones.

The response competition hypothesis rests on the assumption that two contexts for the same set of stimuli (squares) can coexist in memory. Evidence for this assumption comes from everyday experience. People willingly accept statements like this: "For a booklet this weight is heavy but for a book it is light." Apparently, they can switch contexts on a fly. The hypothesis is inconsistent with unlearning, or adaptation, theories (Helson, 1964; Johnson, 1949), which postulate that the old context is replaced in memory by the new one as the presentations proceed. According to those theories, only one context can exist in memory for a given set of stimuli at any moment. The effective context is then assumed to be a weighted compromise between the previous and the current one. Experiment 2 was designed to decide between the two alternatives by manipulating the instruction as a within-subjects variable.

Experiment 2

Experiment 2 was identical to Experiment 1 but each postshift stimulus was repeated immediately. The participants were asked to judge the stimulus first in the old context and then in the new one or vice versa. They were told in advance that it was the same stimulus they were judging twice in succession. Again the subjects were divided into two groups, L (n = 20) and Group H (n = 20), according to previous experience. To remind them of the target context, the labels *old* or *new* were superimposed on the bottom of the screen on every trial.

Results

Because the effect of judgment order was insignificant, the data from Judgment Orders O/N and N/O were pooled. Figures 4 and 5 show the upward and downward movement of the resulting neutral points for each group separately. Again the new scales approach each other closely whereas the old ones shift rather slightly. The final difference between Scales LO and HO is clearly significant whereas the difference between Scales LN and HN is only marginally so. The difference between Scales HO and HN and, respectively LO and LN is also significant. To see this difference, compare Figures 4 and 5.

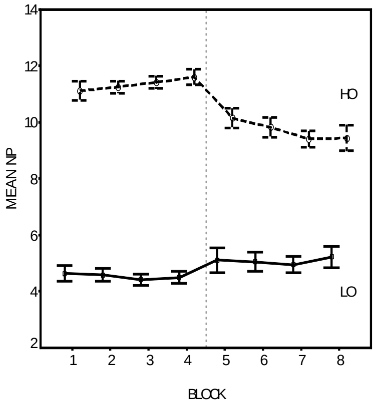

Figure 4. Upward and downward shift of neutral points in Experiment 2 (dual judgment) under Instruction O.

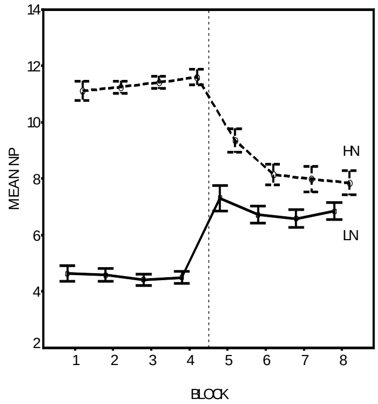

Figure 5. Upward and downward shift of neutral points in Experiment 2 (dual judgment) under Instruction N.

Discussion

One can see that the neutral point functions are similar to those from Experiment 1 (compare Figures 4 and 5 with Figures 2 and 3). Under Instruction N the two curves, however, are somewhat farther apart than in Experiment 1. Perhaps there is a little bit more interference when subjects have to switch contexts on every trial. In Experiment 1 they had to focus on either the old or the new context. Because the results of the two experiments are so alike, one must conclude that two contexts that people can select between two scales for the same set of unidimensionally varying stimuli. The response time and judgment variance data, however, suggest that doing so may be more costly in terms of time, error and effort. Therefore, people are inclined to make a compromise if they are free to choose.

Conclusions

Judgment scales are strikingly malleable. Many studies (e.g., Baird, Kreindler, & Jones, 1971; West, Ward, & Koshla, 2000) have shown that individuals can be trained to use experimenter-defined judgment functions. Others (e.g., Parducci, Knobel, & Thomas, 1976) have shown that people can establish separate contexts for two sets of stimuli, such as squares and circles, even if the stimuli are presented in a intermingled series. In those experiments, stimulus shape, line-style or color was used as a context-cue. This study goes one step further by showing that (a) presentation period can serve the same function, that (b) two contexts for the *same* set of stimuli (test squares) can coexist in memory, and that (c) subjects have a great deal of control over the weighting of these contexts at any moment. The results might be interesting for scaling theory as well as scaling practice.

Learning two scales in succession has much in common with learning two successive A-B, A-C lists. Previous judgments would correspond to Responses B and current judgments would correspond to Responses C. Because the results are so alike, one must conclude that the principles of scale formation are the principles of paired-associate learning (Siegel & Siegel, 1972; Tresselt & Volkmann, 1942). Presumably, subjects store part of previous stimulus-response associations in memory for later use as standards. This assumption has been shown to predict a number of context effects in category judgment including frequency effects, number-of-category effects, number-of-stimulus effects, and transfer effects (Haubensak, 1992a, 1992b). This is not to say that scale formation can be explained by paired-associate learning, for paired-associate learning needs itself explanation. Yet establishing a link between the two paradigms might still be profitable for both areas of research.

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