

## BRIEF REPORT

# Effects of Stimulus Salience on the Magnitude of Latent Inhibition After Compound Conditioning

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The effect of stimulus salience on latent inhibition (the retardation of conditioning produced by prior exposure to the event to be used as the conditioned stimulus [CS]) was examined in an experiment using rats as subjects and the conditioned suppression procedure. The stimuli were a more salient light and a less salient tone—rats trained with light as the CS showed more suppression than rats trained with the tone as the CS; and rats tested with tone and light separately after conditioning with a CS consisting of a tone + light compound showed more suppression to the light than the tone. This pattern of results was reversed, however, in subjects given a series of nonreinforced presentations of the tone and the light separately prior to conditioning with the compound. We conclude that latent inhibition develops more readily for the more salient stimulus and that its effects can outweigh those that derive from the intrinsic salience of the stimulus. Theories of latent inhibition that predict, or can accommodate, this conclusion are considered.

*Keywords:* latent inhibition, stimulus salience, associability, conditioned suppression, rats

When the event to be used as the conditioned stimulus (CS) is repeatedly presented alone, subsequent CS/unconditioned-stimulus (US) pairings are, at least initially, less effective in producing successful conditioning (Lubow & Moore, 1959). This latent inhibition effect has been demonstrated to occur over a wide range of stimuli, species, and conditioning preparations (for a recent review see Lubow & Weiner, 2010).

Many theoretical accounts of latent inhibition have interpreted the learning that goes on during preexposure to a CS in terms of associative-learning principles derived from studies of orthodox (CS–US) classical conditioning. Thus, for example, Lubow's (1989) conditioned attention theory attributes latent inhibition to the conditioning of inattention, and, in the model proposed by Hall and Rodríguez (2010), loss of attention to the CS (referred to as its *associability* in their model) is the consequence of the formation of an association between the CS and the absence of consequences.

Other theories consider latent inhibition to be the result of the formation of an association between the CS and the context in which it is presented—an association that is held to interfere with the acquisition (Wagner, 1981) or with the expression (Grahame, Barnett, Gunther, & Miller, 1994) of a subsequently trained CS–US association. What follows for all these theories, despite their other differences, is that latent inhibition (like orthodox conditioning) should proceed more readily for a more salient CS than for a less salient CS.

We illustrate this prediction in terms of the model with which we are most familiar. In that proposed by Hall and Rodríguez (2010), the loss of associability during preexposure depends on a learning process that can be characterized as the acquisition of a stimulus/no-event association. This association (which may itself contribute to the observed latent inhibition effect) grows more rapidly for a more salient stimulus and the loss of associability is accordingly more rapid.

Figure 1 shows the results of simulations, using the equations of Hall and Rodríguez (2010), of the effects of nonreinforced exposure to stimuli of high and low salience. The model assumes that any novel stimulus will evoke an expectation that some event will follow. This might arise as a result of generalization from similar stimuli that the animal has previously experienced as being followed by some outcome. Given that salient stimuli enter readily into associations, it follows that a novel salient stimulus (which will activate the representations of other salient stimuli experienced in the past) will initially evoke a stronger expectation of some event than a less salient stimulus. But as Figure 1a shows that the expectation that some event will follow the stimulus, which is initially high for the salient stimulus, declines rapidly as an op-

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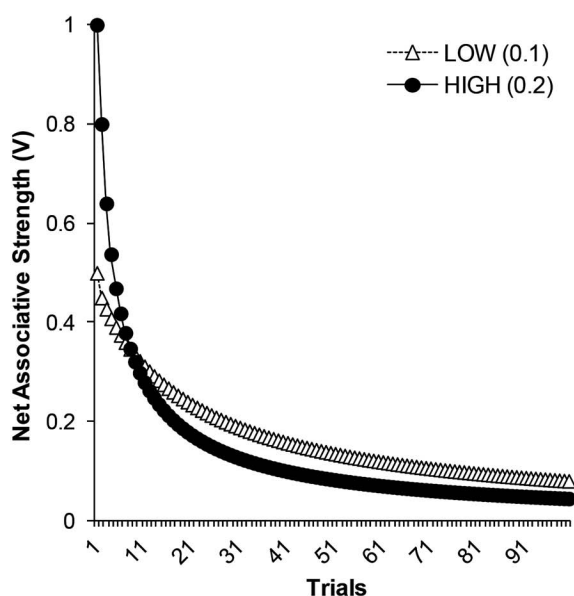
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### a: Net Associative Strength (V)



### b: Stimulus associability ( $\alpha$ )

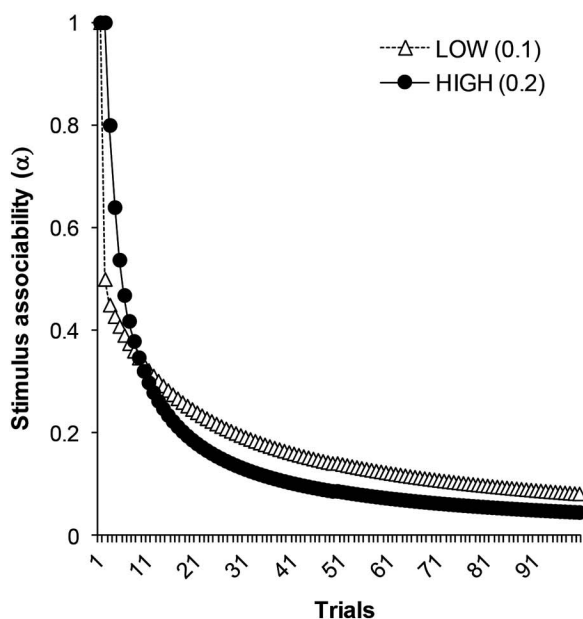


Figure 1. Simulation of preexposure effects over 100 nonreinforced trials using the Hall and Rodríguez (2010) model. Figure 1a shows the strength of the expectation that some event will follow the stimulus (net  $V_{\text{event}}$ ); this is initially high for a salient stimulus but it declines rapidly as an association between the stimulus and no event develops. The resulting change in the associability ( $\alpha$ ) of the stimulus is shown in Figure 1b. The stimulus in the LOW salience condition had a salience with a value of 0.1, an initial associability ( $\alpha$ ) with a value of 1, and an initial value of  $V_{\text{event}}$  of 0.5; the stimulus in the HIGH salience condition had a salience with a value of 0.2, an initial associability ( $\alpha$ ) with a value of 1, and an initial value of  $V_{\text{event}}$  of 1.

posing stimulus/no-event association is formed. The consequence for associability is shown in Figure 1b. Although associability is initially higher for the more salient stimulus, it declines rapidly and falls to a level lower than that governed by the less salient stimulus. The difference between the stimuli is most marked part way through training, and diminishes with extended training as asymptotic values are reached. The model can thus predict that, with an appropriate amount of training, latent inhibition will be more profound for the more salient stimulus. If the effect of low associability outweighs that produced by the intrinsic salience of the stimulus (which will also contribute to the rate of conditioning), acquisition of the conditioned response (CR) during subsequent CS-US pairings could be slower for the more salient CS.

Experiments investigating the effect of salience on the development of latent inhibition give only limited support to this hypothesis. Four published studies (Crowell & Anderson, 1972; Gilley & Franchina, 1985; Rodríguez & Alonso, 2002a; Schnur & Lubow, 1976, Experiment 2) have made use of the following experimental design. Different groups of rats were given exposure either to a salient stimulus, a less salient stimulus, or no preexposure, prior to conditioning, either with the more or the less salient cue as the CS. Crowell and Anderson (1972) and Schnur and Lubow (1976) used the conditioned suppression procedure and auditory cues differing in intensity; the other two studies used a taste-aversion procedure with different concentrations of saccharin (Gilley & Franchina, 1985) or salt (Rodríguez & Alonso, 2002a). Two further studies (Lubow, Markman, & Allen, 1968, Experiment 2, using the rabbit's pinna response to shock; and Solomon, Brennan, & Moore, 1974, Experiment 1, using the rabbit's nictitating membrane response) have investigated the effects of preexposure to louder or softer tones on conditioning with these same stimuli.

The results for subjects that experienced a change of stimulus from preexposure to the test are difficult to interpret, given that generalization decrement is likely to occur, reducing or precluding transfer from training to the test (see Schnur & Lubow, 1976, for discussion; and also Rodríguez & Alonso, 2002b). For the other groups, the prediction is that (other things being equal) for non-preexposed subjects, conditioning should proceed more rapidly with the more salient CS, but in preexposed subjects, the pattern could be reversed, with those preexposed and conditioned with the more salient stimulus showing slower learning than those trained with the less salient.

No such effect was possible in the experiment by Crowell and Anderson (1972), in which the difference in intensity failed to produce a difference in the rates of conditioning, even in the nonpreexposed groups. In the other experiments, the expected difference between the nonpreexposed groups was found, and in all, the effect of preexposure was to retard conditioning. With the exception of the experiment by Solomon et al. (1974), the others all found that the latent inhibition effect was greater in subjects trained and tested with the more salient stimulus, although in none was there a reversal of the effect of stimulus salience. This outcome is consistent with the hypothesis being examined, but it is not theoretically decisive. The results show that the reduction in the measured size of the CR resulting from preexposure to a salient CS is relatively larger than that produced by equivalent training with a less salient CS, but such a result is ambiguous. The difference between the two CSs may indeed indicate greater latent inhibition for the salient stimulus, but, equally, it could be the case that a

given degree of latent inhibition produces a more substantial effect with a strong CR than a weak CR. For an unequivocal demonstration the effect of salience on latent inhibition, it is necessary to show that the difference expected on the basis of the intrinsic salience of the cues can be reversed by giving preexposure—to show that, after preexposure, conditioning occurs less readily with the more salient cue.

More encouraging results come from a study by Lubow, Wagner, and Weiner (1982, Experiment 2). This made use of a different experimental design in which the stimuli were of different modalities: a tone of relatively low salience and a light of higher salience. Conditioning was given with the tone–light compound as the CS, allowing the possibility that the well-established overshadowing effect (e.g., Kamin, 1969; Pavlov, 1927) would enhance differences in the readiness with which the component stimuli would acquire associative strength. Some subjects received preexposure to the tone, some to the light, and others no preexposure. Consistent with overshadowing, greater suppression to the light than to the tone was found in subjects given no preexposure. If both tone and light undergo latent inhibition, then preexposure to the tone (the overshadowed stimulus) might be expected to increase the size of this difference, and preexposure to the light (the overshadowing stimulus) to reduce it. The results showed, however, that the size of the effect was not much influenced in subjects given preexposure to the tone, but that it was abolished in subjects given preexposure to the light. This outcome is consistent with the suggestion that, in these training conditions, a substantial latent inhibition effect was found only with the more salient stimulus.

To investigate this matter further, in the present experiment, we adopted the compound conditioning procedure of Lubow et al. (1982), with modifications intended to enhance the likelihood of seeing a reversal of the standard effect of salience. In our experiment, the preexposure procedure was arranged so as to allow a within-subject comparison of the stimuli; we also included the controls necessary to demonstrate the occurrence of overshadowing. The critical groups were given conditioning with a tone + light compound, either after no preexposure or after a series of nonreinforced presentations of the tone and the light. We expected, for the former group, that the salient light would evoke more suppression on test than the less salient tone. But we hoped to choose preexposure parameters that would allow us to see a reversal of this difference in the preexposed subjects, as might be expected if latent inhibition to the light is more profound than to the tone.

We used rats trained in the conditioned suppression procedure and a tone (T) and a light (L) as the stimuli. There were four groups of subjects (the design is summarized in Table 1). One group of subjects (the TL group) received conditioning trials with

the TL compound, followed by test trials in which T and L were presented separately. Previous experiments from our laboratory have shown that, for the apparatus and the strain of rats to be used in this experiment (Wistar), the light is a more salient stimulus than the tone (e.g., Rodríguez & Alonso, 2011). We expected, therefore, that L would evoke more suppression than T on the test. In order to confirm difference between T and L, and to allow a demonstration of overshadowing in the TL group, we include two further groups: one conditioned with just the tone, and one with just the light. The fourth group (PTL in the table) received a phase of preexposure, consisting of separate presentations of T and L, prior to conditioning with the TL compound as the CS. If latent inhibition is more profound with the more salient stimulus, we could find that suppression is greater to the tone than the light in these subjects. As we have noted, the likelihood of obtaining of this result is likely to depend on the amount of preexposure given. Lubow et al. (1982) found an indication of the effect of interest in rats given 40 presentations of a stimulus of 20-s duration (a total of 800 s); guided by this, we gave 24 presentations of each our 30-s duration stimuli (a total of 720 s per stimulus).

## Method

### Subjects

The subjects were 32 male Wistar rats with a mean ad lib weight of 400 g (range = 274 to 494 g). They had previously served in an experiment using flavor-aversion conditioning techniques, but they were naive to the present stimuli, apparatus, and procedures. The rats were housed in pairs with continuous access to water, and were maintained at 80% of their ad lib weights by a schedule of controlled feeding. The colony room was artificially lit from 8:00 a.m. to 8:00 p.m. each day; the experimental procedures occurred in the afternoon phase of the light cycle.

Eight Skinner boxes (Coulbourn Instruments, Allentown, PA) were used. The ceiling and front and rear walls of each box were made from aluminum, and the two side walls were made from transparent plastic. The floor of the box was composed of stainless steel rods 6 mm in diameter and spaced 1.5 cm apart center to center. The floor could be electrified by a Coulbourn Instruments AC shock generator. Each box was equipped with a response lever located on the front wall, 6 cm above the floor. The food tray was 2 cm from the floor in the center of the front wall, situated to the right of the lever, and was connected via a plastic tube to an external 45-mg pellet dispenser. Each box was housed in a sound-attenuating cubicle equipped with a fan that supplied a background noise of 48 dB. Two different stimuli were used as CSs. The first was the illumination supplied by the simultaneous lighting of three bulbs (28V and 0.04 A), aligned horizontally 11 cm over the response lever. This stimulus will be referred to simply as “L.” The second CS was a continuous tone (referred to as “T”) of 4.5 kHz and 85 dB, generated by a loudspeaker located 6 cm over the bulbs. Both stimuli had durations of 30 s.

### Procedure

Experimental sessions were given daily and lasted 60 min. Training was conducted in darkness. Rats were assigned to one of four equal-sized groups (Groups PTL, TL, T, and L) before the

Table 1  
*Experimental Design*

Group	Preexposure	Conditioning	Test
PTL	T, L	TL +	T, L
TL	—	TL +	T, L
T	—	T +	T, L
L	—	L +	T, L

Note. T = tone; L = tone and light; + = footshock.

start of pretraining. The assignment of the subjects to the groups was arranged to be orthogonal to their past experimental treatments.

**Pretraining.** In initial training, food pellets were delivered on a variable-time 60-s schedule, whereas lever-press responses were continuously reinforced. This phase of training was completed when a rat had made 100 lever presses. The rats then received six sessions of lever-press response training (baseline). The lever press was reinforced with one food pellet on a variable interval (VI) 30-s schedule during the first session. In the remaining sessions, reinforcement was delivered according to a VI 60-s schedule. This schedule remained in force throughout the following experimental sessions.

**Preexposure.** This phase consisted of six sessions in each of which rats in Group PTL received four exposures to the tone and four exposures to the light; these were presented intermixed, in pseudorandom order. The intertrial interval (intertribal interval [ITI]) was variable with a mean of 360 s. The first exposure trial of each session occurred 6 min after the beginning of each session. Subjects in the remaining three groups (Groups TL, T, and L) were placed in the apparatus and continued to respond on the VI-60 schedule without any stimulus presentations.

**Conditioning.** This phase consisted of five sessions of conditioned suppression training during which the VI 60 schedule was maintained. Each session included four conditioning trials on which the presentation of the CS was immediately followed by the delivery of a 0.5-s, 0.5-mA shock. For Groups PTL and TL, the CS was the simultaneous presentation of the light and the tone; for Group L it, was the presentation of the light; and for Group T, it was the presentation of the tone. The mean of the variable ITI between the onset of the successive trials was 720 s, and the first trial of each session occurred 12 min after the beginning of the session.

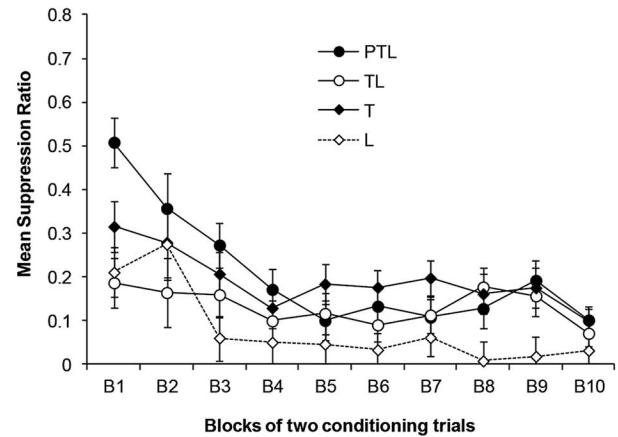
**Test.** The test phase comprised two sessions in each of which all the animals received two nonreinforced presentations each of the light and of the tone. In each session, half of the animals in each group received the test trials in the order TLLT; the other half received the sequence LTTL. The mean of the ITI between the onset of the successive trials was 720 s, and the first trial of each session occurred 6 min after the beginning of the session.

**Data analysis.** Lever-press responses were recorded and standard suppression ratios to the CS were calculated in accordance with the formula  $X/(X + Y)$ , where X is the number of lever press responses during the CS, and Y represents the number of lever press responses during a period of equal duration immediately prior to the onset of the CS. Data were analyzed by the analysis of variance (ANOVA). Simple effects were examined using Duncan's multiple-range tests. A criterion of statistical significance of  $p$  less than .05 was adopted. Effect sizes for ANOVAs are reported as partial eta squared, and those for pairwise comparisons are reported using Cohen's  $d$ . The 95% confidence intervals (CIs) around the effect sizes are also reported.

## Results

The development of conditioned suppression during the conditioning phase is summarized in Figure 2a, which shows group mean suppression ratios over blocks of two conditioning trials. It is apparent from the figure that the PTL group showed less

### a: Conditioning



### b: Test

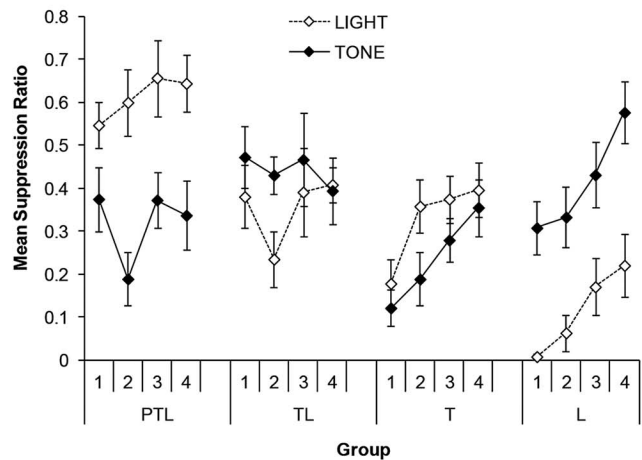


Figure 2. Experimental results. Figure 2a (Conditioning): Mean suppression ratios to the conditioned stimulus (CS) across blocks of two conditioning trials. Figure 2b (Test): Mean suppression ratios to the light and the tone across the test trials. For subjects in Groups PTL and TL, the CS during the conditioning was the simultaneous presentation of the tone (T) and the light (L). For subjects in Group T the CS during the conditioning was the tone and for Group L it was the light. Before conditioning, subjects in Group PTL (P: Preexposed) had received 24 nonreinforced presentations of the tone and 24 of the light. Vertical bars represent the standard errors of the mean (preexposed and given conditioning to the compound consisting of the simultaneous presentation of the tone and the light).

suppression than the other groups during the early conditioning trials. This is consistent with the occurrence of latent inhibition in this group, but may also be a consequence of unconditioned suppression evoked by stimuli presented for the first time, in the other groups. All the groups acquired suppression over the course of the subsequent conditioning trials, achieving similar final levels. Group L acquired suppression more readily than did Group T, supporting the expectation that the light would be more salient than the tone.

The data summarized in the figure were subjected to an ANOVA, with group and conditioning block as the variables. This

revealed significant main effects of group,  $F(3, 28) = 4.94, p = .007, \eta_p^2 = 0.34, 95\% \text{ CI } [0.04, 0.51]$ , and block,  $F(9, 252) = 11.36, p < .001, \eta_p^2 = 0.29, 95\% \text{ CI } [0.18, 0.35]$ ; for the Group  $\times$  Block interaction,  $F(27, 252) = 1.53, p = .05, \eta_p^2 = 0.14, 95\% \text{ CI } [0.00, 0.14]$ . Further analyses, performed in order to examine the source of this interaction, revealed a significant difference among the groups on Blocks 1, 3, and 9; smallest  $F(3, 28) = 3.00, ps < 0.047, \eta_p^2 > 0.24, 95\% \text{ CI } [0.00, 0.42]$ . Duncan multiple-range tests showed that Group PTL showed less suppression than Groups TL, T, and L on Block 1; and Group L showed more suppression than Groups PTL, TL, and L on Blocks 3 and 9. The remaining comparisons for each of the trials were not statistically significant. In addition, the effect of block was significant for Groups PTL, T, and L, smallest  $F(9, 63) = 4.22, ps < .001, \eta_p^2 > 0.38, 95\% \text{ CI } [0.11, 0.46]$ , but not for Group TL,  $F < 1$ .

The treatments administered during the conditioning phase did not differentially influence the groups' baseline response rates. Thus, over the five sessions of conditioning, the mean responses rates were 7.1, 11.0, 10.4, and 9.1 responses per minute for Groups PTL, TL, T, and L, respectively. An ANOVA showed that these means did not differ significantly ( $F < 1$ ). Over the two sessions of the test, the mean baseline response rates were 8.3, 12.5, 18.9, and 12.8 responses per min for Groups PTL, TL, T, and L, respectively. Although these means appear to differ substantially, they did not differ significantly ( $F < 1$ ), and Bayesian analysis indicated that the null hypothesis was far more likely, given the observed data ( $p = .98$ ), than the alternative ( $p = .02$ ). The latter analysis was conducted using the techniques developed by Wagenmakers (2007) as presented by Masson (2011), in which the Bayes factor is estimated from the change in the Bayesian Information Criterion as  $e^{-.5(\Delta\text{BIC})}$  with  $\Delta\text{BIC} = n * \ln(SS_{\text{effect}}/[SS_{\text{effect}} + SS_{\text{total}}]) + \ln(n) * D_{\text{effect}}$ .

Figure 2b shows group mean suppression ratios for each trial of the test. Dealing first with the groups that were not given preexposure, those conditioned with a single stimulus (the T and L groups) showed substantial suppression to both stimuli at the start of the test. This may reflect the ability of these stimuli to evoke unconditioned suppression when they are presented for the first time, and (or) some degree of generalization between the light and the tone. Nonetheless, subjects in the L group showed more suppression to the light than to the tone, and subjects in the T group showed more suppression to the tone than to the light. Additionally, the suppression shown to the light by Group L was greater than the suppression to the tone shown by the Group T, supporting the conclusion that the light was more salient than with the tone. This is confirmed by the results for the group (TL) conditioned with the compound CS, which showed more suppression to L than to T on the test. The fact that suppression to a given stimulus was less after conditioning in compound (Group TL) than after conditioning in isolation (Groups T and L), is consistent with the occurrence of overshadowing during compound conditioning.

The results of central interest are those from the PTL group. These subjects showed more suppression to the tone than to the light, just the opposite of the pattern of results observed in Group TL. This outcome supports the hypothesis that motivated this experiment—that the more salient light would suffer more latent inhibition than the less salient tone.

Statistical analysis substantiated these observations. An ANOVA was performed on the scores shown in Figure 2b, the

variables being group, test stimulus, and trial. This revealed main effects of group,  $F(3, 28) = 6.62, p = .002, \eta_p^2 = 0.41, 95\% \text{ CI } [0.09, 0.57]$ , and of trial,  $F(3, 84) = 9.74, p < .001, \eta_p^2 = 0.26, 95\% \text{ CI } [0.09, 0.38]$ . The main effect of test stimulus was not significant,  $F < 1$ , but, importantly, there was a significant Group  $\times$  Test Stimulus interaction,  $F(3, 28) = 23.56, p < .001, \eta_p^2 = 0.72, 95\% \text{ CI } [0.46, 0.80]$ . Further analyses performed in order to examine the source of the this interaction revealed a significant effect of stimulus in all the groups: Group PTL,  $t(7) = 3.45, p = .011, d = 1.73, 95\% \text{ CI } [0.37, 3.01]$ ; Group TL,  $t(7) = 2.42, p = .046, d = 1.21, 95\% \text{ CI } [0.03, 2.35]$ ; Group T,  $t(7) = 2.92, p = .022, d = 1.47, 95\% \text{ CI } [0.20, 2.67]$ ; and Group L,  $t(7) = 9.13, p < .001, d = 4.57, 95\% \text{ CI } [1.42, 5]$ . In addition, there were significant differences among the groups in their responding both to the light,  $F(3, 28) = 19.01, p < .001, \eta_p^2 = 0.67, 95\% \text{ CI } [0.39, 0.76]$ , and to the tone,  $F(3, 28) = 4.63, p = .009, \eta_p^2 = 0.33, 95\% \text{ CI } [0.03, 0.50]$ . Duncan multiple-range tests showed that Group PTL showed less suppression to the light than Groups TL, T, and L, and that Group L showed more suppression to the light than Groups TL and T. Groups PTL and T showed more suppression to the tone than Groups TL and L. The remaining comparisons among groups for each test stimulus were not statistically significant.

Finally, although the Stimulus  $\times$  Trial and the Group  $\times$  Stimulus  $\times$  Trial interactions were not significant ( $F_s < 1$ ), the Group  $\times$  Trial interaction was significant,  $F(9, 84) = 2.01, p = .048, \eta_p^2 = 0.18, 95\% \text{ CI } [0.00, 0.24]$ . Further analysis revealed a significant effect of trial in Groups PTL, T, and L, smallest  $F(9, 63) = 2.46, ps < .02, \eta_p^2 > 0.26, 95\% \text{ CI } [0.01, 0.34]$ , but not in Group TL,  $F(9, 63) = 0.701, p = .76$ . In addition, significant differences among the groups were found on Trial 1,  $F(3, 28) = 11.49, p < .001, \eta_p^2 = 0.55, 95\% \text{ CI } [0.23, 0.68]$ , and on Trial 2,  $F(3, 28) = 3.37, p = .032, \eta_p^2 = 0.27, 95\% \text{ CI } [0.00, 0.44]$ , but not on Trial 3,  $F(3, 28) = 2.69, p = .066$ , and Trial 4,  $F(3, 28) = 1.06, p = .405$ .

Our critical finding is the opposite patterns of test performance in Group TL (more suppression to L than to T) and in Group PTL (more suppression to T than to L). To confirm the reliability of this finding we conducted a further, separate analysis of the data from these two groups. A 2 (group)  $\times$  2 (stimulus)  $\times$  4 (test trial) ANOVA revealed no main effect of group,  $F(1, 14) = 1.18, p = .296$ , a borderline main effect of stimulus,  $F(1, 14) = 4.38, p = .055$ , but, critically, a significant interaction between group and stimulus,  $F(1, 14) = 17.26, p = .001, \eta_p^2 = 0.55, 95\% \text{ CI } [0.14, 0.73]$ .

These results demonstrate that when two stimuli differing in salience are preexposed in isolation and then conditioned in compound, the less salient stimulus acquires the ability to evoke the CR more readily than does the more salient stimulus. This is just the opposite of what happens when the stimuli are conditioned in compound but without exposure. As we have noted, previous experiments have been only partly successful in obtaining such a reversal. Our success in this may be a consequence of the use of a compound of both stimuli as the CS in the conditioning phase of our experiments. According to many theories (e.g., Pearce & Hall, 1980; Wagner, 1981), this arrangement will produce overshadowing, in which the degree to which acquisition of associative strength by one stimulus limits acquisition by the other. The overshadowing effect can be expected to magnify the conse-

quences of differences in associability between the component stimuli, and thus allow the effects of preexposure to be seen more clearly on the test.

### Discussion

The theories mentioned in the introduction to this article all suppose that the learning process responsible for latent inhibition will proceed more readily for a more salient than a less salient stimulus, and thus, in principle, gain support from the results reported here. We have already detailed how the Hall and Rodríguez (2010) model can predict the results obtained in this experiment. We now consider the application of other relevant theories.

Theories that explain latent inhibition in terms of associations formed between the CS and the context during preexposure can accommodate our findings. For Wagner (e.g., Wagner, 1981), preexposure allows the formation of an association between the context and the stimulus, with the former acquiring the ability to activate the central representation of the latter. A stimulus representation that is associatively activated ("primed") is less able to respond directly to the presentation of the stimulus itself, and is thus less able to function as an effective CS during subsequent CS-US pairings, producing the latent inhibition effect. As the strengthening of the context-stimulus association will depend on the salience of the stimulus, it follows that latent inhibition will be greater for a more salient stimulus. With appropriately chosen parameters, it would be possible for the effect produced by priming to outweigh that produced by the intrinsic salience of the stimulus on acquisition of a CR.

For comparator theory (e.g., Miller & Matzel, 1988), the critical association is between the CS and the context. According to this theory, performance to a CS after simple excitatory conditioning will depend on the relative strengths of the association between the CS and the US, and that between the context of training (the comparator) and the US. The latter association is activated by way of the association between the CS and the context, acquired during conditioning. Applying this to latent inhibition (e.g., Grahame et al., 1994; Savastano, Arcediano, Stout, & Miller, 2003), it is suggested that initial nonreinforced preexposure to the CS will result in the formation of a particularly strong CS-context association. As a consequence, the ability of the comparator to activate the US representation will be enhanced, and the effectiveness of the CS in evoking its CR will be reduced. The role of stimulus salience can be readily incorporated into this framework by assuming that the CS-context association will develop rapidly during preexposure for a salient stimulus. Activation of the comparator during testing would thus be enhanced for such a stimulus, and the CR reduced accordingly. Again, with an appropriate choice of parameters, the reversal effect could thus be predicted.

The analysis just presented was concerned with the effects to be expected for a single stimulus trained in isolation; our experiments, however, used a compound as the CS, and produced evidence of overshadowing of the tone by the light in subjects given no preexposure. This slightly complicates the application of the comparator hypothesis (see Blaisdell, Bristol, Gunther, & Miller, 1998), but does not change the central predictions. The overshadowing effect (as seen in the TL group) is attributed to the formation of a within-compound association during conditioning, which establishes one component as the comparator for the other. It is

assumed, however, that prior exposure to a stimulus will establish a strong CS-context association, and that this will ensure that the context remains the comparator for this CS, despite the subsequent compound conditioning trials. The interpretation outlined above for the effects of preexposure on conditioning to a single stimulus thus still apply.

Lubow (1989, p. 197) presents the notion that latent inhibition will be a positive function of stimulus intensity as one of the central predictions of his conditioned attention theory. It is not certain, however, that this theory can predict the findings of our experiment. Conditioned attention theory holds that a novel stimulus evokes an attentional response that is stronger for a more than a less salient stimulus. This response declines with repeated nonreinforced presentations of the stimulus. As the decline is held to depend on a conditioning process (in which the effective US is the absence of an event), it will occur more rapidly for the more salient stimulus. It does not follow, however, that the attentional response to the more salient stimulus would ever reach a level lower than that evoked by a less salient stimulus given the same number of preexposures. That is, although the change in the attentional response will be *relatively* greater for the more salient stimulus (given the higher starting point of this response), it will not reach an absolute level that is less than that evoked by the less salient stimulus. The theory can predict that nonreinforced preexposure will have a greater effect on a more salient than on a less salient stimulus when it comes to conditioning, but not the reversal of the effect of salience that we have observed.

It will be evident that conditioned attention theory has something in common with that proposed by Hall and Rodríguez (2010), in that both attribute latent inhibition to the effects of some form of conditioning in which the absence of a consequence supports learning. They differ, however, in that conditioned attention theory expresses the effects of this learning in terms of a single parameter (the strength of the attentional response). This does not allow the theory to predict the reversal effect. Hall and Rodríguez, on the other hand, distinguish between salience and associability and it is the effect of the former on the associative learning process that determines associability that allows this theory to predict the results. This hybrid theory (incorporating both associative learning and an attentional parameter, associability) is certainly more complex than alternatives that focus solely on the strength of the association between the context and stimulus, and for this reason the latter may be preferred in accounting for the data reported here. But the theory's proposal that associative processes produce a change in associability gives it an advantage over those other theories by allowing it to deal with effects (like those that prompted the original Pearce and Hall, 1980, model, on which it is based) that seem best explained in terms of associability change.

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