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REACTION TIME AS A PREDICTOR OF IMAGINATIVE SUGGESTIBILITY AND HYPNOTIZABILITY

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Abstract

The purpose of this exploratory investigation was to examine the relationship between reaction time, hypnotizability and imaginative suggestibility. The study participants were 119 undergraduate students who were assessed for non-hypnotic and hypnotic suggestibility, performed simple and go/no-go reaction time tasks and completed response expectancy, motivation, absorption and fantasy-proneness scales. Faster simple response times were associated with greater hypnotic suggestibility, hypnotizability, response expectancies, absorption, fantasy-proneness and non-hypnotic motivation. Go/no-go response time was not significantly correlated with any of these measures. With the other controlled, each reaction time measure was uniquely associated with hypnotic expectancy, hypnotic suggestibility, and hypnotizability, but in opposite directions.

Key words: hypnosis, reaction times, suggestibility

Introduction

Hypnosis has been a subject of scientific study ever since Benjamin Franklin was asked to investigate animal magnetism in 1784 (Franklin, Majault, Leroy, Sallin, Bailly, D'Arcet, De Borie, Guillotin and Lavoisier, 1785/1970). The development of the technological ability to measure reaction time (Hirsch, 1861) made that phenomenon a focus of attention at the dawn of modern experimental psychology (Donders, 1868). Because many early investigations of hypnotic phenomena were designed to explore the differences associated with an hypothesized hypnotic state (for a review, see Kirsch and Lynn, 1995), studies of hypnosis and reaction time tested for changes in reaction times as a function of inducing hypnosis. For example, Plapp (1967) reported slower reaction times during hypnosis and that this effect was independent of initial susceptibility to suggestion. Hunt (1969) reported that the latency of verbal responses to open-ended questions was longer when subjects were hypnotized and Ham and Edmonston (1971) found reaction times for participants after an alert hypnotic induction were significantly faster than those for both relaxation control subjects and study participants who received a relaxation hypnotic induction.

Without a strong theoretical basis for exploring the relationship between reaction time and suggestibility, researchers largely ignored the possibility. This is not to say, though, that experiments were not conducted which examined this topic. In the last

decade, several researchers have employed very specific reaction time measures in their pursuit of correlates of hypnotic suggestibility. For example, Wallace and Persanyi (1993) tested the effects of imagery vividness on word recognition and reported that vivid imagers and participants who were high in hypnotic suggestibility had faster reaction times, but only for high imagery nouns. A relation between reaction time and hypnotic suggestibility has been reported by Crawford, Harrison and Kapelis (1995) in a study designed to test visual field asymmetry in facial affect perception. The reaction time measure these workers employed was a binary choice task in which participants had to distinguish between angry and happy faces and then press either a switch labelled 'angry' or a switch labelled 'happy'. They reported that highly suggestible participants were significantly faster than those with low hypnotic susceptibility in both hypnotic and non-hypnotic conditions. They also found that shorter reaction times were associated with higher scores on the Tellegen Absorption Scale (Tellegen, 1982) and self-ratings of extremely focused attention on the Differential Attentional Processes Inventory (Grumbles and Crawford, 1981). Crawford et al. (1995) hypothesized that sustained attentional ability with little vulnerability to distractions was the characteristic responsible for these associations.

Given these findings of correlations between functionally specialized reaction times and hypnotic suggestibility (faster reaction time predicting greater hypnotic responsiveness), it was speculated that more general measures of reaction time might be associated with suggestibility and its correlates. In the present study, response latencies in two reaction time tasks were measured: simple reaction time and go/no-go reaction time. The simple reaction time task presents one invariant stimulus as the imperative stimulus that requires one invariant response (for example, *'When you see image A, click on the mouse.'*). Thus, participants are able to adopt both sensory and response sets (that is, stimulus expectancies and response intentions) in anticipation of each trial. The go/no-go task is a form of choice reaction time task that involves discrimination between two stimuli and a decision between two alternative responses (for example, *'If you see image A, click on the mouse, but if you see image B, do nothing.'*). The participant emits an overt response to only one of the two stimuli and inhibits that response when the other stimulus is presented.

When first devised, it was thought that go/no-go tasks required identification of the stimulus, but did not require choice of a response (Donders, 1868). It was soon recognized, however, that not making a motion is just as much a choice as making it. Thus, go/no-go tasks are similar to standard binary choice tasks in that preparation of facilitory sensory and response sets is attenuated, but different in that one of the choices is the inhibition of the other (Hommel, 1996). As an individual differences variable, then, longer go/no-go latencies, in part, reflect a relative bias in favour of inhibitory control whilst performing the task.

Based on the previously cited empirical findings, it was predicted that response to suggestion would be related to simple reaction time. In addition, Crawford (1994) and Gruzelier (1998) have presented models of hypnotic response to suggestion that include inhibitory processes related to those involved in the go/no go task. Consequently, highly suggestible participants were expected to exhibit slower go/no-go reaction times (that is, greater inhibitory control).

The relationship of simple and go/no-go reaction times to hypnotizability were assessed further, defined as changes in imaginative suggestibility after an hypnotic induction and operationalized as hypnotic suggestibility with non-hypnotic suggestibility controlled (see Braffman and Kirsch, 1999). As a stringent test of these

relationships, simple and go/no-go reaction time was assessed to see if it could account for variance in suggestibility and hypnotizability beyond that accounted for in previous research by response expectancy, motivation, absorption and fantasy-proneness (Kirsch, Silva, Comey and Reed, 1995; Braffman and Kirsch, 1999). It has been reported previously that non-hypnotic suggestibility, motivation and expectancy accounted for 53% of the variance in hypnotic suggestibility, and because this rivalled the test–retest reliability of our measure of suggestibility, we commented that there seemed to be little variance left to explain (Braffman and Kirsch, 1999). For that reason, we did not expect to find significant unique associations between reaction times and hypnotic suggestibility after controlling for these other predictors.

Method

Participants

The study participants were 119 undergraduate students (57 males and 62 females) at the University of Connecticut, who volunteered to participate in exchange for partial credit for an introductory psychology course. Their ages ranged from 18 to 32 years (mean 19.17 years; standard deviation (SD) 1.83 years).

Procedure

In order to control for potential context effects (Council, Kirsch and Grant, 1996), it was planned to collect data from a reaction time experiment that was administered independently to all participants as part of an introductory psychology laboratory course. However, this experiment was dropped from the curriculum after data were collected for the first 60 participants. For this first group, then, absorption and fantasy-proneness, non-hypnotic and hypnotic suggestibility, and reaction times were assessed in three separate contexts. Participants were not informed that there was any relationship between the three sessions (they had been recruited as if these were three independent studies). For the last 59 participants, who were recruited the following semester, however, absorption and fantasy-proneness were assessed in the same session with (and immediately following) the two suggestibility trials. Reaction times were measured in a second session several days later and participants were informed that it was part of the same experiment.

Suggestibility was assessed in groups of five to 45 participants. Reaction times were assessed in groups of one to 22 participants. Suggestibility was assessed on the suggestions contained in the Carleton University Responsiveness to Suggestion Scale (CURSS) (Spanos, Radtke, Hodgins, Bertrand and Stam, 1981) which was administered twice by audiotape, first without an hypnotic induction and then again after an hypnotic induction (Kirsch, Lynn and Rhue, 1993). This sequence was not counterbalanced for two reasons. First, previous research has shown a significant reduction in non-hypnotic responding when it is assessed after the assessment of hypnotic responding. Second, mean suggestibility scores when using a within-subjects design and measuring non-hypnotic suggestibility first are not significantly different from those scores when measured in a between-subjects comparison (see Braffman and Kirsch, 1999, Experiment 1).

The first trial was preceded by the following introduction, adapted from the introduction to the Stanford Hypnotic Susceptibility Scale, Form A (Weitzenhoffer and Hilgard, 1959):

> In this part of the study, we want to assess your ability to use your imagination to experience various things that will be described to you on audiotape. Your ability to experience them depends largely on your willingness to be receptive and responsive to ideas and to allow these ideas to act upon you without interference. So all you will need to do is close your eyes, relax, and try to imagine the experiences that I will describe to you.

The second trial was preceded by the following introduction:

> In this second part of the study, we want to assess your ability to experience the same suggestions, only this time we will ask you to experience them with hypnosis. So in this version of the audiotape, the suggestions will be preceded by an hypnotic induction.

Before being read the instructions for each trial, participants recorded their response expectancies and motivations for each suggestion. After each trial, they completed the self-scoring questionnaire of the CURSS.

Instruments

Hypnotic and non-hypnotic suggestibility were measured by behavioural scores on the CURSS. The CURSS includes three highly correlated subscores: behavioural, subjective and involuntariness. Because of the number of variables assessed in this study, only behavioural scores were analysed. The CURSS consists of seven test suggestions. Self-reported behavioural scores on the CURSS are obtained by having participants complete a questionnaire on which they indicate whether they had made the behavioural response called for by the suggestions (0 = no and 1 = yes). Behavioural responsiveness to suggestion is assessed as the sum of these ratings. A test–retest reliability of 0.67 has been reported for CURSS behavioural scores (Spanos, Radtke, Hodgins, Bertrand, Stam and Dubreuil, 1983). Validity has been established through high correlations with other measures of suggestibility (Spanos, Radtke, Hodgins, Bertrand, Stam and Moretti, 1983). The Comey and Kirsch (1999) modification of the CURSS suggestions was used. In this version of the CURSS, instructions and cues for goal-directed fantasies are replaced by additional repetitions of the suggestion. This modification of the CURSS results in a more normal distribution of response scores. Comey and Kirsch (1999) reported internal consistency coefficients (Cronbach's alpha) of 0.63 for behavioural scores on their modified version of the CURSS.

Response expectancy was assessed by providing participants with a written description of each suggestion and asking them to rate, on five-point Likert scales, the degree to which they expected to respond behaviourally and experientially (subjectively) to each. For the arm levitation suggestion, for example, participants were asked to predict how high their arms would rise (1 = not at all; 5 = very high) and how light their arms would feel (1 = not light at all; 5 = very light). Hypnotic response expectancy was calculated as the sum of these ratings. Internal consistency coefficients for non-hypnotic and hypnotic expectancies were 0.81 and 0.88, respectively, indicating high reliability.

Participants' motivations to experience each suggestion were assessed by asking participants to rate, on a five-point Likert scale, the degree to which they wanted to experience the suggestion. They were directed to report not what they thought would happen, but what they hoped would happen. For the arm levitation suggestion, for

example, participants were asked how much they would like to experience their arm feeling light and rising (1 = not at all; 5 = very much). Motivation was calculated as the sum of these ratings. Cronbach's alpha for this measure was a reliable 0.83 for non-hypnotic motivation and 0.89 for hypnotic motivation.

Absorption was assessed on the absorption subscale of the Differential Personality Questionnaire (Tellegen, 1982). Tellegen (1982) reported a Cronbach's alpha of 0.88. Evidence of the validity of the scale is reviewed in Roche and McConkey (1990).

Fantasy-proneness was assessed on the Inventory of Childhood Memories and Imaginings (ICMI) (Wilson and Barber, 1983). A Kuder–Richardson reliability coefficient of 0.89 has been reported, along with test–retest reliabilities ranging from 0.87 to 0.93 (Lynn and Rhue, 1986). Significant correlations between the ICMI and other measures of imaginative ability have been found in support of the validity of the scale (Lynn and Rhue, 1986). To avoid contamination of the relationships between fantasy-proneness and suggestibility by context effects (Council, Kirsch and Hafner, 1986), the version of the ICMI used in the present study did not include two items that assessed participants' attitudes and expectancies regarding hypnosis. In addition, one item that is only answered by females was presented but not scored.

Response time was measured with an instructional program written by a faculty member which was already in use in an introductory psychology laboratory course, and presented on a Macintosh SE/30 computer. After the concept of reaction time was explained, students were instructed to participate in the reaction time experiment. They were first presented with a black-and-white drawing, approximately 3.25" × 1.5", of a leopard and told to click on their mouse a soon as it appeared. The stimulus stayed on the screen until the participant responded. After each trial, the participant's response time was displayed at the bottom of the screen. The offset of this display marked the beginning of the inter-trial interval. There were 20 presentations of the leopard at inter-trial intervals randomized between 0.5 and 3.0 seconds. Participants were then shown a black-and-white drawing of approximately the same dimensions of a lion and told to click on their mouse as soon as it appeared. Using the same format as the leopard trials, there were then 20 presentations of the lion stimulus. As there is no reason to believe that the leopard and lion stimuli are qualitatively different, the two blocks are considered to be the same task and the 20 leopard trials are assumed to be practice trials. These two blocks of trials established proficiency in responding to both stimuli, which was a necessary precondition for the go/no-go trials. The results from the 20 lion trials were averaged to form the simple response time score. In the final block of presentations (go/no-go), students were told that either the leopard or lion might appear, but to click on the mouse only when the leopard appeared. There were then 40 presentations (20 leopard and 20 lion), randomized by stimulus type, with the same format and intertrial interval as in the first two blocks, except that inter-trial intervals after presentation of the lion stimulus began at offset of that image. False hits (clicking on the mouse when the lion appeared) resulted in both a visual and auditory message indicating an error had been made. The response times for the 20 leopard trials were averaged to create the go/no-go response time score. Errors (false hits) on the 20 lion (no-go) trials were also recorded. The program did not store individual trial times after the mean score was computed and so reliabilities for the reaction time measures could not be calculated.

Results

Previous research indicates that correlations between hypnotic suggestibility and other variables may be inflated artifactually when participants are aware that the variables are being measured as part of the same study (reviewed in Council, Kirsch and Grant, 1996). To test for these effects, separate regression analyses of non-hypnotic and hypnotic suggestibility on context were performed along with each of the predictor variables. These tests revealed no significant interactions between context and any of the predictor variables. Consequently the data were collapsed across context groupings in the analyses reported below.

Mean simple response time was 250.11 ms (SD 33.86 ms); mean go/no-go response time was 391.42 ms (SD 49.94 ms). A dependent-samples Student's *t*-test showed the go/no-go response time to be significantly longer than the simple response time (Student's $t(118) = 31.44$; $p<0.001$). The average number of errors on go/no-go trials was 2.5 (SD 1.66). For simple response time, skewness was 0.69, kurtosis was 0.72 and the first, second and third quartile scores were 227, 248 and 268 ms, respectively. For the go/no-go task, skewness was 0.41, kurtosis was 0.67 and the quartile scores were 359, 385 and 423 ms, respectively. These levels of skewness and kurtosis are well within acceptable limits for performing these statistical analyses.

Correlations between the predictors of suggestibility are presented in Table 1. Due to missing data, the sample sizes for correlations with absorption and fantasy-proneness are $n = 100$ and $n = 99$, respectively. Simple response time was significantly correlated with all of the correlates of suggestibility except hypnotic motivation, whereas go/no-go response time did not correlate significantly with any of these measures. The number of errors on the go/no-go task was associated only with the two expectancy measures. The correlation between simple and go/no-go response times was Pearson's $r = 0.37$; $p<0.001$, whereas neither was correlated with number of errors committed.

Correlations of these variables with non-hypnotic suggestibility, hypnotic suggestibility and hypnotizability (the change in suggestibility due to hypnosis, operationalized as hypnotic suggestibility after controlling for non-hypnotic suggestibility) are presented in Table 2. Non-hypnotic and hypnotic motivation, non-hypnotic and hypnotic expectancy, and fantasy-proneness were significant correlates of non-hypnotic suggestibility. Simple response time, hypnotic motivation, non-hypnotic and hypnotic expectancy, and fantasy-proneness were significant predictors of hypnotic suggestibility. Hypnotizability was associated with simple response time, non-hypnotic and hypnotic expectancy, and fantasy-proneness.

Simple and go/no-go response times share some variance, but are also affected by processes that are unique to each. To assess the relation of suggestibility to the unique features of simple and go/no-go response times, both measures were entered into simultaneous regressions on the three suggestibility variables. Neither simple nor go/no-go response times were unique contributors to non-hypnotic suggestibility. Both were significant predictors of hypnotic suggestibility and hypnotizability, but in opposite directions. After controlling for go/no-go response time, faster simple response times were associated with greater hypnotic suggestibility and hypnotizability. After controlling for simple response time, slower

Table 1. Correlations between predictors of suggestibility

	2	3	4	5	6	7	8	9
Simple	0.37***	–0.12	–0.29**	–0.27**	–0.20*	–0.28**	–0.21*	–0.15
Go/no-go		0.07	–0.09	0.05	0.03	0.04	–0.08	–0.08
Errors			0.09	0.18	0.26**	0.26**	0.11	0.07
Absorption				0.78***	0.30**	0.27**	0.31*	0.33**
Fantasy-proneness					0.38***	0.35***	0.26**	0.27**
Non-hypnotic expectancy						0.73***	0.25**	0.23*
Hypnotic expectancy							0.29**	0.40***
Non-hypnotic motivation								0.80***
Hypnotic motivation								–

Table 2. Correlates of suggestibility and hypnotizability

	Non-hypnotic suggestibility	Hypnotic suggestibility	Hypnotizability[a]
Simple	–0.15	–0.24**	–0.13*
Go/no-go	–0.03	0.10	0.12
Errors	0.08	0.09	0.03
Simple unique[b]	–0.17	–0.31**	–0.20**
Go/no-go unique[b]	0.03	0.21*	0.19**
Errors unique[c]	0.08	0.08	0.02
Non-hypnotic motivation	0.18*	0.13	0.00
Non-hypnotic expectancy	0.38***	0.44***	0.20**
Hypnotic motivation	0.29**	0.25**	0.05
Hypnotic expectancy	0.53***	0.62***	0.33***
Absorption	0.18	0.16	0.04
Fantasy-proneness	0.27**	0.34***	0.17*

[a] Regression coefficients with non-hypnotic suggestibility controlled.
[b] Regression coefficients for response times, with other response time controlled.
[c] Regression coefficients for go/no-go errors with go/no-go response time controlled.

go/no-go responding was associated with greater hypnotic suggestibility and hypnotizability (see Table 2).

Finally, all seven of the significant predictors of hypnotic suggestibility were entered into a simultaneous regression to determine which, if any, made unique contributions to the variance ($F(7,88) = 30.23$; $p<0.0001$). Only non-hypnotic suggestibility, hypnotic expectancy, and simple and go/no-go reaction times were significant, with adjusted Pearson's $r^2 = 0.68$. With all other predictor variables controlled, non-hypnotic suggestibility uniquely accounted for 24.7% of the variance, hypnotic expectancy for 11.2% of the variance, simple reaction time for 3.4% of the variance and go/no-go reaction time for 3.1% of the variance in hypnotic suggestibility.

Discussion

The results of the present study replicate the major findings reported by Braffman and Kirsch (1999). Most of the variance in hypnotic responding can be explained by non-hypnotic responses to imaginative suggestions and by response expectancy. Both hypnotic and non-hypnotic suggestibility are more highly associated with fantasy-proneness than with absorption, and so the findings of low but significant correlations between suggestibility and absorption (see review by Council et al., 1996) may be due to its shared variance with fantasy-proneness.

Although expectancy and non-hypnotic suggestibility accounted for a large amount of the variance in hypnotic suggestibility, simple and go/no-go reaction times also proved to be unique contributors. Participants with faster simple response times were the most responsive to hypnotic suggestion, regardless of whether go/no-go reaction time was controlled. In addition, with simple reaction time controlled, hypnotic suggestibility was associated with slower go/no-go reaction time. These findings, although modest in terms of effect size, are important because, despite the apparent stability of hypnotic suggestibility (Piccione, Hilgard and Zimbardo, 1989), very few unique correlates of this construct have previously been found, aside from those also measured in this study (see Kirsch and Council, 1992 for a review).

The correlation of simple response time with non-hypnotic suggestibility, although in the same direction (Pearson's $r = -0.15$), failed to reach significance. Unexpectedly, simple response time significantly predicted hypnotizability, measured as hypnotic suggestibility with non-hypnotic suggestibility held constant. Simple response time was also significantly associated with non-hypnotic and hypnotic response expectancy and with absorption, fantasy-proneness and non-hypnotic motivation. Participants responding more quickly on the reaction time task scored higher on all of these measures. However, the association of reaction time with hypnotic suggestibility and hypnotizability remained significant even with all other variables controlled.

Although simple response time was associated with absorption, fantasy-proneness, response expectancies, non-hypnotic motivation, hypnotic suggestibility and hypnotizability, go/no-go response time was not. Indeed, the correlation of hypnotizability with go/no-go response time (Pearson's $r = 0.12$), although not significant ($p<0.08$), was in the opposite direction of its correlation with simple response time. Thus, with non-hypnotic suggestibility controlled, the trend was for participants who were more highly responsive to hypnosis to have slower go/no-go response times.

Not surprisingly, simple and go/no-go response times were positively correlated with each other. The correlations of go/no-go response times with other variables, although non-significant, were in the opposite direction of the correlations of those variables with simple response time. Statistically, this pattern suggested that each of the two response time measures was acting as a suppressor variable on associations with the other response time measure. In other words, controlling for simple response time must necessarily increase the positive associations of go/no-go response time with other variables, and controlling for go/no-go response time must increase the negative associations of simple response time with those same measures. Furthermore, the dissociation between simple and choice reaction times that has been reported in the reaction time literature suggested that each should be looked at with the other controlled. Doing this would allow the evaluation of the relationship of various factors with whatever is unique to the different types of reaction time. Analyses examining the unique contributions of each reaction time measure after

controlling for the other bore this out. Regression coefficients for simple response time on hypnotic suggestibility and hypnotizability were enhanced in the negative direction, whereas coefficients for go/no-go response times reached significance and were positive.

The next step was to regress hypnotic suggestibility on all of the predictor variables. Because non-hypnotic suggestibility was included as a predictor variable in the analysis of hypnotic suggestibility, the coefficients for other predictor variables in that analysis can be interpreted as indicating the relationship of those variables to hypnotizability. Hypnotizability was predicted by simple and go/no-go response times, as well as by hypnotic response expectancy. Note, however, that the direction of the association with response time depended on the type of reaction time task. Hypnotizability was associated with shorter simple response times and longer go/no-go response times. These four predictors accounted for 68% of the variance in hypnotic suggestibility, with the corresponding multiple R of 0.82 exceeding the test–retest correlation (0.67) of the CURSS.

The association between simple reaction time and hypnotic suggestibility has a number of important implications, especially because it is independent of go/no-go reaction time. Simple reaction time has been linked to the adoption of a preparatory response set mediated by activity in the frontal lobe (Fuster, 1997; Henderson and Dittrich, 1998). For this reason, the association between simple reaction time and hypnotizability is consistent with the response set theory of Kirsch and Lynn (1997, 1999), according to which responses to suggestion are triggered automatically because of the adoption of two response sets:

- A generalized intention to respond to the hypnotist's suggestions.
- The expectancy that the response will occur automatically.

Also, empirically, hypnotic responding and simple reaction time are disrupted by competing tasks, but choice reaction time (in which the contributions of stimulus and response expectancies are attenuated) is relatively immune to that disruption (Henderson and Dittrich, 1998; Kirsch, Burgess and Braffman, 1999).

Although the association of simple reaction time with hypnotic suggestibility is consistent with the response set theory of Kirsch and Lynn (1997, 1999), its significant association with hypnotizability presents a challenge. Reaction time predicted the change in suggestibility produced by a hypnotic induction. Part of that association may be due to the variance that reaction time shares with hypnotic response expectancy, but part of it is also independent of that association. Similarly, the association between go/no-go response time and hypnotizability is not directly predicted by response set theory.

The most distinctive characteristics of the go/no-go task that are independent of simple reaction time are the requirements to recognize which stimulus has been presented and then to choose between making or inhibiting a specific motor response. Contrasted with choice reaction time tasks, the go/no-go paradigm shares the stimulus discrimination component and the need to prepare two responses, with the critical difference being that one response is to inhibit the other (Hackley, Schaffer and Miller, 1990). A negative correlation between choice reaction time and hypnotic suggestibility has been reported by Crawford et al. (1995). This finding, together with our data that latency on the go/no-go task is positively related to hypnotizability, suggests that the unique contribution of go/no-go reaction time after controlling for

simple reaction time may reflect the strength of the inhibitory response set. Consistent with this idea are previously reported findings that frontolimbic inhibitory systems are involved in the traditional hypnotic relaxation induction (Gruzelier, 1998), and that withholding the go response in the go/no-go task may reflect the activity of a response inhibition system in the dorsolateral prefrontal cortex (Yamaguchi and Knight, 1990; Jodo and Kayama, 1992). Both reaction time results, then, are consistent with the idea of hypnotic responding as requiring cognitive effort that places demands on both attentional and disattentional processes (Crawford, 1994; Crawford et al., 1995; Gruzelier, 1998).

However, the recent work on reaction time tasks raises some interesting questions about Crawford et al.'s (1995) interpretation of their data. These researchers concluded that the relationship between choice reaction time and hypnotic suggestibility reflected a sustained attentional ability with little vulnerability to distractions. The data reviewed by Henderson and Dittrich (1998), though, indicate that binary choice reaction time tasks similar to that used by Crawford et al. (1995) are relatively impervious to disruption by an attention-consuming competing task, indicating that undivided, sustained attention is not an important component of these tasks. In contrast, simple reaction time, in which the subject is required to make a simple predetermined response to the onset of a single unvarying stimulus, is greatly impeded by instructions to simultaneously perform a secondary task. Similarly, neuropsychological studies indicate simple reaction time, but not binary choice reaction time, is substantially impaired in patients in the early stages of Parkinson's disease. More generally, Parkinson's disease patients are impaired relative to control subjects on reaction time tasks that control subjects can perform quickly, but the relative deficit is attenuated as the task becomes more complex and control subjects' response latencies increase (Gauntlett-Gilbert and Brown, 1998).

This dissociation between simple and binary choice reaction times has been interpreted as establishing 'beyond a reasonable doubt that when executing simple reactions, participants are engaged in some attention-demanding activity that plays no role (or at least much less of a role) in choice reactions' (Henderson and Dittrich, 1998; p. 544). The most likely explanation of this dissociation is based on the widely held view that performance on simple reaction time tasks is facilitated by the adoption of an attention- demanding preparatory response set that allows automatic activation of the single behavioural response as soon as a stimulus is detected (Lange, 1888; Woodworth and Scholesberg, 1954; Hommel, 1996; Henderson and Dittrich, 1998). Similarly, hypnotic responding has been viewed as due to the adoption of an attention-demanding preparatory response set that allows automatic activation of behavioural responses to suggestion (Kirsch and Lynn, 1999; Kirsch et al., 1999). The prior adoption of this response set is inhibited in choice reaction time tasks, because the stimulus must be identified before the appropriate response can be selected and prepared for activation (see Hommel, 1996).

The methodology employed by Crawford et al. (1995) makes it difficult to speculate about an alternative explanation for their reported correlation between choice reaction time and hypnotic suggestibility. First, they did not assess simple reaction time. This is important because in our data, the zero order correlation between go/no-go response time and hypnotizability was non-significant; it was only when simple response time was controlled for statistically that the association was found to be significant. It is possible, then, that the correlation found by Crawford et al. (1995)

reflected a response set shared by all reaction time tasks such as a preparedness to respond that is independent of specific task demands. If so, controlling for simple response time might result in a non-significant relationship between choice reaction time and suggestibility. Second, Crawford et al. (1995) did not control for non-hypnotic suggestibility. The association they found was with hypnotic suggestibility, whereas ours was with both hypnotic suggestibility and hypnotizability. The next experimental test that is needed is to assess all three reaction time tasks in relation to both hypnotic and non-hypnotic suggestibility.

In summary, the present study presented two new findings. First, reaction time measures were associated with hypnotizability as well as hypnotic suggestibility. That is, they predicted the change in responsiveness produced by a hypnotic induction. Second, reaction time measures were associated with hypnotic and non-hypnotic response expectancies. Discerning the common elements of a response expectancy for an imaginative suggestion and preparation for a fixed response following an expected stimulus onset will require further exploration.

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