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COMMENT

The Relationship Between Conscious and Unconscious Influences: Independence or Redundancy?

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Determining the relationship between conscious and unconscious influences is essential for obtaining valid estimates of the 2 types of influence. S. Joordens and P. M. Merikle (1993) recently argued that a redundancy relationship provides a plausible alternative to the independence model proposed by L. L. Jacoby, J. P. Toth, and A. P. Yonelinas (1993). In this article, the authors address Joordens and Merikle's concerns and still find the independence model preferable: First, the redundancy model requires the questionable assumption that a direct test (inclusion) is process pure. Second, results obtained with the independence model, but not with the redundancy model, converge with results from indirect tests. Finally, conclusions drawn from the independence model are in accordance with the theorizing that surrounds the concept of automaticity.

Findings of task dissociations have been important for theorizing about both unconscious perception and unconscious influences of memory (implicit memory). People show evidence of perception and memory on indirect tests although they are seemingly unaware of the event that gave rise to those effects when given a direct test (e.g., Roediger & McDermott, 1993). However, Reingold and Merikle (1990), as well as we (Jacoby, Toth, & Yonelinas, 1993) have argued against the practice of equating unconscious influences with performance on indirect or implicit tests and conscious influences with performance on direct or explicit tests. The difficulty is that conscious processes might contaminate performance on indirect tests and, less obviously, unconscious processes might contaminate performance on direct tests. Consequently, we have sought *process* dissociations rather than *task* dissociations. That is, rather than equating processes with tasks, our strategy has been to gain estimates of the contributions of conscious and unconscious processes to performance of a single task and to show dissociations of effects of variables on those estimates.

Joordens and Merikle (1993) agreed with us that researchers should search for process dissociations rather than for task dissociations, but they questioned our independence model. As a starting point for gaining estimates of conscious and unconscious influences, it is necessary to make an assumption about the relationship between the two types of influence. Whereas we assume independence, Joordens and Merikle argued that an assumption of redundancy is equally plausible. Elsewhere (Jacoby, Yonelinas, & Jennings, in press), we have provided evidence to show the advantages of the independence model over a redundancy model as well as over an exclusivity model (Gardiner & Java, 1993). In this reply, we restrict our comments to the redundancy model and to the specific issues Joordens and Merikle have raised.

The independence model holds that both conscious *(C)* and unconscious *(U)* influences contribute to performance on both inclusion and exclusion tests. Consider performance on the inclusion tests Jacoby et al. (1993) used. For the inclusion tests, subjects were instructed to complete word stems with words that they could consciously recollect or, if they could not do so, to complete stems with the first word that came to mind. According to an independence model, the effect of C is to increase the probability of completing a stem with an old word. In contrast, in the redundancy model (Joordens & Merikle, 1993), C plays no role in performance on an inclusion test; the direct inclusion test is treated as a process-pure measure of unconscious uses of memory (i.e., U = inclusion).

Suppose one estimated U using the independence model whereas in reality the redundancy model holds. By wrongly applying the independence model, one would subtract out effects of C on the inclusion test although such effects did not truly exist. The result, of course, would be an underestimation of unconscious influences. Alternatively, suppose one used the redundancy model to estimate U when in fact the two processes are independent. In this case, the contribution of unconscious influences would be overestimated, because treating an inclusion test as a pure measure of U would fail to acknowledge the contribution

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of conscious influences. How can one decide between the two models?

Evidence for Independence

We gain support for our independence model by building on the findings of task dissociations. Although sometimes contaminated by conscious processes (see below), performance on indirect tests primarily reflects unconscious influences. By use of the process-dissociation procedure, we seek to remove effects of conscious processing so as to gain a more accurate measure of unconscious influences than performance on an indirect test provides. Nevertheless, the majority of findings from indirect tests provides converging evidence for conclusions based on the use of the independence model but provides little support for the redundancy model.

Performance on indirect tests remains largely invariant across conditions that influence performance on a direct test. For example, manipulations of attention (e.g., Koriat & Feuerstein, 1976) and levels of processing (e.g., Jacoby & Dallas, 1981) have large effects on direct test performance but little or no effect on indirect test performance. Similarly, we expect estimates of *U* to remain invariant across conditions that influence estimates of *C*. Findings of such invariance can be used to support the independence model. If *C* and *U* are independent, it should be possible to find manipulations that influence one component but have no effect on the other component.

Dividing attention during the presentation of an item can have a large effect on *C* but leave *U* invariant. Table 1 shows estimates from experiments examining the effects of divided attention on unconscious influences of memory (Jacoby et al., 1993) and unconscious perception (Debner & Jacoby, 1994) using a stem-completion task. The invariance in *U* is striking and is observed across varying magnitudes of effects on *C*. The manipulation of attention is one of a group of manipulations that have been identified with the concept of automaticity (Hasher & Zacks, 1979; Posner & Snyder, 1975; Shiffrin & Schneider, 1977). Other variables identified with automaticity, such as speeded responding and aging, produce process dissociations that are similar to that produced by divided attention. Jacoby et al. (in press) examined estimates of *C* and *U* from 20 process dissociation experiments investigating the effects of variables associated with automaticity. Across those experiments, the average difference between conditions in *C* was .24 whereas that for *U* was −.002.

Table 1
Estimated Contributions of Conscious and Unconscious Influences to the Probability of Stem Completion

	Estimate			
	Conscious		Unconscious	
Experiment	Full attention	Divided attention	Full attention	Divided attention
Jacoby et al. (1993)				
1a	.20	.00	.27	.27
1b	.25	.00	.47	.46
Debner & Jacoby (1994)				
2	.83	.41	.76	.75
3	.75	.11	.66	.68
4	.62	.06	.50	.51

Joordens and Merikle (1993) noted that if our estimates of *C* and *U* are recalculated assuming redundancy, *U* does not remain invariant across the manipulation of attention; rather, estimates of both *C* and *U* are reduced when attention is divided. According to Joordens and Merikle, such results are plausible. However, the pattern of results obtained from the independence model (i.e., invariance in *U*) is in general agreement with that found on indirect tests. Also, the invariance in *U* is found consistently enough that it must be accounted for by any adequate model. To account for the observed invariance, the redundancy model (and the exclusivity model) must claim that our results reflect a delicate balance such that the "true" effects on *U* are perfectly offset by the error in our estimations. Given that the invariance in *U* has been found across a wide range of estimates of *C* and across a wide range of manipulations and tests, the required balance becomes even more delicate. We feel that the burden of proof is on those who propose such delicate balances; that is, they must explain why our results mimic independence so frequently.

As further evidence for independence, Jacoby et al. (1993) showed that a read–generate manipulation produced opposite effects on *C* and *U*. Joordens and Merikle (1993) used the data from that experiment to recompute estimates of *C* and *U* using the redundancy model. In contrast with independence, their model led to the conclusion that the read–generate manipulation left unconscious influences invariant—performance on the inclusion test was identical in the read and the generate conditions. Again, the pattern of results revealed by the independence model is supported by converging evidence from findings of task dissociations (e.g., Jacoby, 1983; Roediger & McDermott, 1993). Joordens and Merikle provided no rationale nor converging evidence for their conclusion that the read–generate manipulation left *U* invariant. Moreover, Toth, Reingold, and Jacoby (1994) have shown that although inclusion performance is not always equivalent following reading and generating, the opposite effects on *C* and *U* are consistently found; such findings cast further doubt on the use of the inclusion test as a process-pure measure of unconscious influences.

If a redundancy model is to be adopted, use of an indirect test would seem preferable to use of an inclusion test for estimating unconscious influences (see Jacoby & Hollingshead, 1990). Of course, the argument against equating unconscious influences with performance on indirect tests is that performance on such tests is at least sometimes inflated by conscious influences (e.g., Holender, 1986; Reingold & Merikle, 1990)—a suggestion that is consistent with the independence model. The probability of such contamination will likely be increased by instructing subjects to intention-

ally use memory, as is done for an inclusion test. That is, if performance on an *indirect* test does not provide a pure measure of unconscious influences, it seems unlikely that performance on a *direct* test (an inclusion test) will do so.

We question the use of the inclusion test as a process-pure measure of unconscious influences for the same reasons we question the use of indirect tests as process-pure measures. Although estimates of *U* generally agree with results from indirect tests, the two can diverge, presumably because *C* can contaminate performance on indirect tests. For example, although initial research showed that level of processing had little or no effect on indirect test performance (Jacoby & Dallas, 1981), more recent reports have shown a consistent, often significant advantage for elaboratively processed items (Challis & Brodbeck, 1992). Recent work using the process-dissociation procedure has strongly suggested that this advantage is due to conscious contamination. Toth et al. (1994) used a stem-completion task and showed that estimates of *C* are higher after deep processing than after shallow processing (.23 vs. .03), but estimates of *U* are near identical (.45 vs. .44). This finding of invariance is similar to that found with manipulations of attention (see Table 1) and provides additional support for the independence model.

To support our claim that manipulations such as dividing attention can influence *C* and leave *U* invariant, Joordens and Merikle (1993) have contended that we need to present evidence that is independent of our model. They seem to be asking for assumption-free measures of *C* and *U* that can be used to validate the claim that *C* and *U* are independent. We do not believe in the existence of assumption-free measures but rather find it necessary to rely on converging evidence. For example, we find it significant that the manipulations that produce invariance (e.g., divided attention) are those that have been traditionally associated with automaticity. In contrast, we see no reason for expecting manipulations such as reading versus generating to produce invariance, as Joordens and Merikle have suggested.

Conclusion

By adopting the independence model, we build on findings of task dissociations. Results from many experiments have revealed invariance in *U* across manipulations that have a large effect on *C*. The manipulations producing that pattern of results are ones that have been associated with theorizing about automaticity. A redundancy model must treat these findings of invariance as resulting from a delicate balance between true effects on *U* and errors in our estimation procedure. Accounts of that sort are less parsimonious than is adopting the independence assumption, and no evidence has been provided that would justify the sacrifice in parsimony. The invariance in *U* across a read–generate manipulation that is "revealed" by Joordens and Merikle's (1993) redundancy model is unmotivated, not replicable, and is in conflict with results from indirect tests.

One of the largest obstacles to obtaining valid measures of conscious and unconscious influences is the failure to define the relationship between the two. Unconscious influences on task performance cannot be measured in the absence of information about conscious influences to task performance, and vice versa (Jacoby et al., 1993). As Joordens and Merikle (1993) demonstrated, our process-dissociation approach does not require that one adopt the independence assumption; clearly, alternative assumptions should be considered. At present, however, the case for independence is not a bad one.

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