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The subtlety of distinctiveness: What von Restorff really did

R. REED HUNT
University of North Carolina, Greensboro, North Carolina

The isolation effect is a well-known memory phenomenon whose discovery is frequently attributed to von Restorff (1933). If all but one item of a list are similar on some dimension, memory for the different item will be enhanced. Modern theory of the isolation effect emphasizes perceptual salience and accompanying differential attention to the isolated item as necessary for enhanced memory. In fact, von Restorff, whose paper is not available in English, presented evidence that perceptual salience is not necessary for the isolation effect. She further argued that the difference between the isolated and surrounding items is not sufficient to produce isolation effects but must be considered in the context of similarity. Von Restorff's reasoning and data have implications for the use of distinctiveness in contemporary memory research, where distinctiveness is sometimes defined as perceptual salience and sometimes as a theoretical process of discrimination. As a theoretical construct, distinctiveness is a useful description of the effects of differences even in the absence of perceptual salience, but distinctiveness must be used in conjunction with constructs referring to similarity to provide an adequate account of the isolation effect and probably any other memory phenomena.

Hedwig von Restorff is remembered for her contributions to research on memory, and especially for the effect that bears her name—a rather remarkable accomplishment, given the unfortunate brevity of her career. She worked as a postdoctoral assistant to Wolfgang Köhler at the Psychological Institute of the University of Berlin up to the time that Köhler resigned in protest against Nazi interference with the Institute. The incident that precipitated Köhler's resignation in 1935 was the dismissal of the postdoctoral assistants, who included not only von Restorff but also Karl Duncker (Henle, 1986).

During her time in Köhler's laboratory, von Restorff published two papers, the second of which she coauthored with Köhler (Köhler & von Restorff, 1935). This paper, on the topic of spontaneous reminding, included a prescient discussion of the role of intentionality in the memory test. In the first paper, she presented her dissertation research (von Restorff, 1933) and reported the phenomenon named for her. My discussion will be focused on this widely cited but little read piece.

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The classic 1933 paper has never been published in English and is likely to surprise the contemporary reader on several dimensions. For example, the first page is devoted to defending studies of memory that use lists of nonsense materials against charges of ecological invalidity. Even though Titchener (1915) had proclaimed Ebbinghaus's innovation of nonsense syllables as the most important advance in the study of memory since Aristotle, criticism of the technique had gained momentum by 1933 on the grounds that memorization of lists was a meaningless activity and consequently would yield no useful information about real-world memory (see, e.g., Bartlett, 1932). Von Restorff's rejoinder is unique: "After all, we do not want to fool ourselves: Millions of people remain in the same work situations day after day, even though their tasks are no more meaningful than the experimental tasks. One would hardly criticize the classical psychology of memory for being too far removed from everyday experience, just because the subjects were engaged in meaningless tasks" (von Restorff, 1933, p. 300). Her substantive points related to distinctiveness are equally crisp.

THE VON RESTORFF EFFECT AND DISTINCTIVENESS

The von Restorff effect is known to most psychologists as the generic label for the effects of distinctiveness on memory. This attribution stems from the fact that all the experiments in the 1933 paper used the isolation paradigm, the essential feature of which is that one item in a list differs from the remaining items on one or more dimensions. For example, subjects might be asked to remember the two lists depicted in Table 1. Each list con-

Table 1
An Example of Isolated and Homogeneous Lists

Isolated	Homogeneous
9	TOZ
12	DUQ
3	HOL
16	COS
QXK	QXK
5	DRF
14	TXP
11	XMS
2	FTH
7	HZL

sists of 10 items, but the isolation list has a syllable embedded in the numbers. The homogeneous list serves as a control in that the same syllable appears in the same serial position. Results from this paradigm show better memory for the syllable in the isolation list than for the same item in the homogenous list. This is the effect that has come to be associated with von Restorff and that is generally ascribed to distinctiveness. Indeed, most instances of distinctiveness effects on memory have come to be categorized as von Restorff effects: "The unusual, bizarre, or distinctive event seems inherently more memorable than common everyday occurrences. Psychologists often refer to this phenomenon as the von Restorff effect" (Schmidt, 1991, p. 523).

Distinctiveness as an Independent Variable

Distinctiveness, as used in the foregoing, is a descriptive term for events that violate the prevailing context—that is, for events that are perceptually salient. In this sense, distinctiveness is an independent variable whose effects on memory must be explained. The isolation paradigm is one method for manipulating the variable of distinctiveness, and the isolation effect thus comes to be viewed as an instance of distinctiveness effects in memory. The intuitive explanation of the isolation effect in particular and distinctiveness effects in general is that the perceptual salience of the distinctive event attracts additional processing. This intuition is most readily realized through the mechanism of selective attention. Jenkins and Postman (1948) were the first to propose that differential attention could be a necessary condition for the isolation effect, and most prominent theories have since followed suit.

Green (1956) argued that the isolation effect resulted from surprise induced by the change from preceding items: "Surprise increases the attention paid to the item and hence the likelihood of recall" (p. 340). Surprise, the emotional response to perceptual salience, explicitly elicits attention to the item in Green's theory. But why should attention enhance memory? Rundus (1971) suggested that the function of attention was to engage rehearsal in such a way that an isolated item is remembered better because it receives more rehearsal than other items.

More recently, Schmidt (1991) proposed his incongruity hypothesis as an explanation of distinctiveness effects in memory, including isolation effects: "According to this definition, distinctive events are those that are inconsistent with active conceptual frameworks, or that contain salient features not present in active memory. These events lead to increased attention in direct proportion to the degree of incongruity" (p. 537). Thus, Schmidt's hypothesis continues the emphasis on differential attention resulting from salience at presentation of the item, although his idea is considerably more sophisticated than its predecessors. In particular, Schmidt explicitly says that differential attention is not sufficient for enhanced memory, because the retrieval context must be taken into account. Nonetheless, it is clear that differential attention at the time of item presentation is a necessary condition for the incongruity hypothesis.

In these accounts, distinctiveness is treated as an independent variable. The effects of distinctiveness are then explained by the postulation of additional processes, beginning with differential attention to the distinctive event and followed by more elaborative encoding processes. In essence, distinctiveness causes more elaborative processing that in turn facilitates retrieval. Von Restorff's isolation effect is always cited as the progenitor of this view of distinctiveness.

Distinctiveness as a Theoretical Construct

Distinctiveness has recently come to be used in a very different sense. During the theoretical refinement of levels of processing (Craik & Lockhart, 1972), the concept of depth of processing evolved into the concept of distinctive processing. The empirical foundation of levels of processing was the superiority of semantic, as opposed to nonsemantic, encoding tasks. Craik and Tulving (1975) suggested that semantic orienting tasks produced more elaborate memory traces than did nonsemantic tasks, but this raised the question of why elaborative processing facilitated retrieval. Subsequently, theorists invoked the concept of distinctiveness as the answer.

For example, Lockhart, Craik, and Jacoby (1976), suggested that "the beneficial effects of depth of encoding is that deeper, richer encodings are also more distinctive and unique" (p. 86). Craik and Jacoby (1979) proposed that "the notion that greater depth and greater degrees of elaboration of the stimulus allow formation of a more distinctive, discriminable trace" (p. 19). The idea essentially is that the more one knows about something, the less like other things it becomes. The same idea was advocated by others in the context of research on levels of processing (e.g., Eysenck, 1979; Hunt & Elliott, 1980; Nelson, 1979). Distinctiveness in this sense is a theoretical construct describing characteristics of the encoding that supports discriminative processes at retrieval.

The two definitions of distinctiveness as a theoretical construct and as an independent variable cannot be em-

ployed in the same explanation. To do so results in a tautology. In one case, distinctiveness causes elaborative processing, and in the other case, elaborative processing results in distinctiveness. Conflating the two usages produces a circular explanation. For example, one might say that an isolated item is distinctive, but to attribute the memorial advantage of isolation to distinctiveness would then be blatantly circular. We can describe the isolated item as distinctive and then go on to postulate psychological processes that mediate the effects of distinctiveness, or we can say that isolation affects psychological processes responsible for discrimination at retrieval which we call theoretical distinctiveness, but we should not do both.

The distinction is clear but subtle, and the subtlety can create confusion. For example, Schmidt (1991) correctly observes that distinctiveness has been used to explain a vast array of phenomena, but then goes on to advocate limiting its use to situations with common operational definitions. On Schmidt's definition of distinctiveness ("distinctive events are those incongruent with active conceptual frameworks" p. 537), the meaning of distinctiveness is limited to that of an independent variable. The theoretical sense of the term that evolved from levels of processing would be proscribed.

There is reason to resist this advice, and ironically, the reason can be found in von Restorff's (1933) original report. The irony is that while the von Restorff effect is taken to be the mother of all distinctiveness effects, she explicitly argued against such an interpretation. In what follows, her reasoning and results will be described along with their implication for contemporary views of distinctiveness.

WHAT VON RESTORFF REALLY DID

As it happened, von Restorff neither pioneered the isolation paradigm nor championed distinctiveness interpretations of the isolation effect. Numerous experiments using the isolation paradigm were reported prior to von Restorff's (1933) paper (e.g., Calkins, 1894, 1896; Jersild, 1929; van Buskirk, 1932—just to mention a few of the papers written in English). Most of these earlier experiments were designed in order to study the effect of vividness on memory. Vividness was taken to be an independent variable and was manipulated in a variety of ways, all of which amounted to isolating an item from other items on some dimension. This early work established the beneficial effects of vividness on memory; that is, the isolated item was remembered better than nonisolated items. Von Restorff, however, was not interested in demonstrating the effects of vividness further and ultimately argued that vividness was not a necessary condition for the isolation effect.

The details of von Restorff's research have been leveled in secondary sources over the years. Her paper has never appeared in English, and the last detailed secondary descriptions of her work appear in Koffka (1935) and Woodworth (1938). By the time of the 1954 revision of Woodworth (Woodworth & Schlosberg, 1954), all reference to von Restorff had disappeared. Although many subsequent texts have mentioned the von Restorff effect (e.g., Crowder, 1976; Hall, 1971; Hilgard & Bower, 1975; Kausler, 1974), none describe the experiments to be discussed here. Osgood (1953) does provide a discussion of an important subsidiary issue that will be mentioned below, but not even Wallace's (1965) excellent review of research on isolation effects describes von Restorff's concern with isolation effects and perceptual salience.

The context for this concern lies in von Restorff's principal interest in interference effects. She used the isolation paradigm as a tool to investigate interference effects (see Bower, Thompson-Schill, & Tulving, 1994, for an account of von Restorff's contribution to this issue), and along with Koffka (1935), she offered the Gestalt interpretation of retroactive interference as instantiated by the isolation effect. Similarity among the massed items of either a homogeneous list or the nonisolated items of the isolated list resulted in agglutination of those items. The isolated item was not aggregated to the homogeneous items because of its lack of similarity. Thus, the isolated item stood out as figure against the ground of the homogeneous items. Using the metaphor of perception, the isolation effect in memory was thus explained essentially in terms of the discriminablity of the isolate.

This general explanation was intended as a model of memory processes derived from perception, but von Restorff was sensitive to the possibility that the effects could be due to perception, not memory. What she meant by this distinction between perception and memory was that the isolation effect could result from either the perceptual salience of the isolated item at presentation or to factors subsequent to the presentation of the item. Her resolution of this issue is what has been lost from secondary accounts and is critical to the difference between the two usages of distinctiveness.

The reason why perceptual salience intuitively appears to be necessary for the isolation effect is that most studies place the isolate around the middle serial position of the list. If the goal is to study distinctiveness or vividness as an independent variable, this methodology makes perfect sense. Preceding the isolate with some number of homogeneous items maximizes the probability that the isolate will be perceptually salient. However, von Restorff actually employed this procedure in only one of the numerous experiments that she reported.

In the first experiments in her paper, von Restoff used paired associate lists consisting of five different types of materials. The members of each pair were of the same type of material, and eight pairs constituted a list. Here is an example taken from her paper:

laf – rig

– +
dok – pir
89 – 46
red square – green square
zul – dap
S – B
tog – fem

Four pairs were of the same type (the nonsense syllables in this example), and the four remaining pairs represented each of the four other types of material. Thus, four of the pairs were homogeneous and four of the pairs were isolated in the sense that they were the only pair from that type of material. She obtained better recall for the isolated pairs than for the homogeneous pairs, but she does not report data relating recall of the isolated pair to its serial position in the list.

In a subsequent recognition experiment, von Restorff isolated a single item in the middle of the serial list for the only time in all of her experiments. The list consisted of 20 items—either 19 syllables and 1 number or 19 numbers and 1 syllable. She moved to this more extreme isolation because her studies of recognition that used several isolated items in a list produced smaller differences between isolated and homogeneous material than she had found in recall. The more stringent manipulation was successful in enhancing the difference between recognition of isolated and homogeneous items beyond that even of the recall data. However, the issue of perceptual salience now occurred to von Restorff, because, unlike the method used in her earlier experiments, the presentation of a different item following 10 homogeneous items might induce perceptual salience.

She explicitly addressed the issue with simple, elegant reasoning, arguing that perceptual salience should not accrue to an item isolated early in the list. Introducing the next experiment, she wrote, "In Lists 1 and 2, the syllable and number were presented at the beginning of the list, namely at the second and third positions, at which point the subjects could not know anything about the contents of the whole list. Thus, the isolated item was not perceived as unusual and was not particularly salient to the subject" (von Restorff, 1933, p. 319). The explicit motivation for this experiment was to separate the effects of isolation on memory from the well-established effects of isolation on perception. "We wanted to avoid the situation where the critical item would stand out as perceptually unique" (von Restorff, 1933, p. 319).

In addition to the issue of perceptual salience, von Restorff raised a second question that is central to the theoretical construct of distinctiveness. Is the isolation effect due exclusively to differences between the isolated item and surrounding items? Von Restorff's point here is at once obvious and widely appreciated and at the same time quite subtle. The obvious component of her discussion is that the isolation effect depends on a strong similarity relationship among the nonisolated items of the list. That is, the isolate must be obviously different from the other items of the list. The more subtle point that is pertinent to our discussion of distinctiveness is that difference between the isolate and the remaining items is not sufficient to produce an isolation effect.

Von Restorff illustrates this argument in the following fashion. Suppose we begin with a standard isolation list consisting of 9 numbers and 1 syllable. The difference between the syllable and numbers is substantial, and this difference should produce an isolation effect for the syllable. But now suppose we substitute a line drawing for one of the numbers; we then would have 2 isolated items (the drawing and the syllable) and 8 numbers. The drawing and the syllable are different from the numbers, but they also are different from each other. We continue to substitute items of different materials (e.g., a symbol, a word, an object) for the numbers in the original list. Ultimately, we have a list of 10 unrelated items, but the difference between the syllable (the original isolate) and the other items is just as great as the difference between the syllable and the numbers. "In the end, the difference between all other items among themselves and the syllable is equivalent to the initial difference between syllable and numbers" (von Restorff, 1933, p. 313). Thus, if the isolate were remembered better than the same item in the same serial position of an unrelated list, "then one could argue that other factors besides the difference between one item and other items are important" (von Restorff, 1933, p. 314).

The reasoning, in brief, is that the transition from an isolation list to an unrelated list is a change in the similarity of the homogenous items, not in the difference between the isolate and the remaining items. The isolate remains as different from the other items in the unrelated list as it does in the isolated list. If, then, an isolation effect occurs in relation to an unrelated control list, the effect cannot be due exclusively to the difference between the isolated and homogeneous items.

In describing this reasoning, Osgood (1953) suggested that the experiment would determine whether the superiority of the isolated item was due to the distinctiveness (his word) of the isolate or to the agglutination of the nonisolated items: "Since the critical item was equally unique in both cases (isolated and unrelated lists), any difference must be due to the agglutination (indiscriminability) of the 'massed' items" (p. 567). The critical aspect of Osgood's recounting is his recognition of von Restorff's point that the item would be "equally unique" in either an isolation list or an unrelated list.

Von Restorff's reasoning about similarity and difference converges with her primary point about perceptual salience. Not only is perceptual salience unnecessary for the isolation effect, difference alone is insufficient to account for the effect. We shall find this reasoning instructive in using the contemporary concept of distinctiveness.

Experimental Method and Results

The remaining details of von Restorff's experiment are straightforward, but will be briefly described. Subjects saw three separate lists, one on each of 3 succeeding days. All subjects saw the unrelated list on the 1st day and separate isolation lists on the 2nd and 3rd days. The unrelated list was shown first in order to enhance the camouflage of the isolation lists—so that the isolate in the isolation list would not be perceptually salient. Each list consisted of 10 items. The unrelated items were a number, a syllable, a color patch, a single letter, a word, a photograph, a symbol, an actual button, a punctuation mark, and the name of a chemical compound. The subjects recalled the names of each item—for example, the color name, or "button," or the contents of the picture. The critical lists were 9 nonsense syllables and 1 number or 9 numbers and 1 nonsense syllable, with the isolated item located in either the second or the third serial position. Von Restorff does not say how frequently the item appeared in the second or the third position.

The subjects were given intentional memory instructions, following which the items were shown successively for 1.5 sec each. After list presentation, a distractor task required subjects to read a prose passage for a subsequent memory test. Ten minutes were devoted to reading the passage. Then a verbal free recall test of the list was administered, followed by recall for the passage. This procedure was repeated on each of the 3 days of testing. A total of 15 subjects participated in the experiment.

We replicated von Restorff's original procedure with two important changes. The first was to present the lists between subjects rather than within subjects, so that a given subject saw only the unrelated or the isolation list. Two lists were constructed for the isolation condition, one consisting of nine nonsense syllables and one digit and the other of nine digits and one nonsense syllable. The isolated item always appeared in the second serial position, which was the second major change from von Restorff's method. The unrelated lists contained either a digit or a syllable in the second serial position. A total of 40 subjects, all undergraduate volunteers, participated, with 20 subjects in each of the isolation and control conditions. Each list was presented to half the subjects in the appropriate condition. Thus, our subjects experienced one list and, following a 10-min distraction of reading prose, were asked to free recall the list.

Correct recall of the isolated item as a function of list type is the important measure from these experiments. Von Restorff reported average correct recall of .70 for the isolation list and .40 for the control list. In our replication, the proportion correct for the isolation list was .70 for an isolated syllable and .80 for an isolated digit. The corresponding recall from the unrelated control lists was .40 for syllables and .30 for digits. Thus, our results provide a close replication of von Restorff's data in spite of our procedural changes.

IMPLICATIONS

Von Restorff's results clearly show an isolation effect when the isolate occurred early in the list—in either the second or the third serial position—and she concluded that perceptual salience was not a necessary condition for the isolation effect. Unfortunately, von Restorff did not report how often the isolate appeared in the second as opposed to the third position. With the isolate in the third serial position, one might worry that the first two items provided sufficient context to render the isolate perceptually salient. Two considerations argue against this conclusion. First, von Restorff went to some lengths to camouflage the isolate by presenting the unrelated list first. Second, our replication placed the isolate exclusively in the second serial position, and the data are remarkably consistent with von Restorff's. Even more convincing is an experiment by Pillsbury and Raush (1943), who reported a substantial isolation effect even when the isolate appeared in the first serial position. Perceptual salience apparently is not necessary for obtaining an isolation effect.

This conclusion is inconsistent with all recent theories of the isolation effect (see, e.g., Green, 1956; Rundus, 1971; Schmidt, 1991). These theories share the premise that differential attention to the isolate is necessary for the isolation effect, and that the source of differential attention is the perceptual salience or contextual incongruity of the isolate. On these assumptions, an isolation effect would not be expected if the isolated item were presented prior to some consistent context. In fairness, these theories were all designed to explain data from paradigms in which the isolate occurred after context had been established. Under these circumstances, it is reasonable to assume that the isolate was perceptually salient and attracted additional processing. It may even be the case that this additional processing contributes to enhanced memory for the isolate. If so, the isolation effect would result from a manipulation of distinctiveness.

The mistake is to assume that perceptual salience is necessary for the isolation effect, particularly if the attribution is to von Restorff's research. The important cost of this mistake is not so much in the interpretation of the isolation effect, although it is interesting to realize that this simple effect may require further theoretical work; rather, the cost comes in the confusion about distinctiveness. If one assumes that the isolation effect requires perceptual salience and that the isolation effect is the paradigm case of distinctiveness, any subsequent use of distinctiveness should be traceable to operations producing perceptual salience.

Equating perceptual salience with distinctiveness blurs a fundamental distinction between distinctiveness and difference. *Difference* refers to the objective condition of being dissimilar, whereas *distinctiveness* refers to the psychological effect of dissimilarity. Difference is a description of the characteristics of events or items or

the relationship among them, whereas distinctiveness is a psychological construct describing cognition of the differences. Technically, difference is the independent variable that gives rise to the psychological process of distinctiveness. Thus it is the effect of difference that requires explanation.

The typical isolation paradigm is a seductive scaffold on which to mount the explanation because the incongruity between the isolate and context is obvious and extreme. The extremity misleads us into the assumption that perceptual salience is the psychological process arising from difference and that perceptual salience is necessary for a difference in materials to affect memory. Although perceptual salience may be one consequence of difference, the data from von Restorff and others showing an isolation effect when the isolate occurs early in the list argue against the necessity of perceptual salience for effects on memory.

Difference need not produce perceptual salience to affect memory; it is only necessary that sufficient item information be encoded to represent the differences among the items. This essentially is the idea that evolved from levels-of-processing research as the theoretical construct of distinctiveness. Difference, induced by manipulations of materials and orienting tasks, produces a distinctive trace—that is, a trace that includes features unique in relation to those of other items from the episode. Distinctiveness enhances memory by facilitating discriminative processes at retrieval. As a theoretical construct, distinctiveness encompasses not only the effects of perceptual salience and conceptual incongruity but, more generally, any effect of difference.

Thus, the difference between distinctiveness as an independent variable and as a theoretical construct is really the same as von Restorff's distinction between perceptual salience and memorial salience. No one doubts the reality of perceptual salience as a psychological phenomenon, and perceptual salience probably enhances memory for the salient item. It is also the case, however, that differences among items affect memory even if those differences are not operationally salient at the time of perception. That is, processes subsequent to initial perception and comprehension are influenced by difference. Distinctiveness has been used to describe both perceptual and memorial salience, but, as argued above, the two definitions of distinctiveness cannot be employed in the same explanation. Indiscriminate mixing of the meanings invariably results in circular explanations.

The concern about the circularity of distinctiveness (e.g., Schmidt, 1991) is legitimate, but it can be managed easily. Operations that draw attention to differences among items are the antecedents to distinctiveness, and a given experiment can provide indices of distinctiveness that are independent of memory, providing converging operations on the validity of the manipulations (see, e.g., Hunt & Einstein, 1981). In short, distinctiveness is a useful theoretical construct to explain the effects of differences on memory.

Even so, distinctiveness alone is insufficient to account for the isolation effect and probably any other memory phenomenon. Von Restorff argued, largely on empirical grounds, that the isolation effect could not be explained solely as a matter of differences. The argument was that if difference alone caused distinctiveness, the isolation effect should not occur relative to performance on an unrelated control list in which the differences were maximized. In Schmidt's (1991) terminology, each item of an unrelated list should be incongruent with the active conceptual framework established by the preceding item, and hence distinctive. Nonetheless, the isolate was remembered better in the isolation list than in the unrelated list.

The obvious difference between the isolation list and an unrelated list lies in the similarity among the nonisolated items of the isolation list, and von Restorff appealed to this factor to explain the results. Her argument may appear trivial, in that no one is surprised that the similarity of the nonisolated items is critical for the isolation effect; but we must keep in mind the fact that perceptual salience is not necessary. Therefore, the importance of similarity among the nonisolated items cannot be to establish an encoding context in which the isolate is incongruent. Rather, in her terms, the nonisolated items are agglutinated in memory (the differences among the items are lost to the dimension of similarity) while the isolate remains distinct.

There is some parallel between the Gestalt interpretation of the isolation effect and the contemporary principle of cue overload (Watkins & Watkins, 1975), an empirical principle stating that cue effectiveness is inversely related to the number of items sharing a cue. In accord with cue overload, the nonisolated items may all share a single cue—for example, the label for the dimension of similarity. The isolated item has a unique cue and thus has an advantage at retrieval. However, if we extend this analysis to the complete pattern of results from the isolation experiments, an important point about the effects of similarity and difference on memory is revealed along with the insufficiency of cue overload as even an empirical summary of the data.

Unadorned, the principle of cue overload cannot describe the advantage of an isolation list in comparison with an unrelated control list. In both lists, the critical item is different from the other items and presumably then would not share cues with the other items. Recall of the critical item from an unrelated list should be equivalent to recall of the same item in an isolation list. That this does not happen is an indication of the importance of similarity's establishing a context within which difference functions (Hunt & Kelly, in press). In other words, the effects of difference are relative to the effects of similarity.

The relativity of difference has been appreciated by advocates of distinctiveness as a theoretical construct (Craik & Jacoby, 1979). The attributes of individual items that are encoded for memory will be affected by

the context of the event, affected in such a way that the perceived differences are aligned with the context. In their recent theory of similarity, Medin, Goldstone, and Gentner (1993) suggest that functional encoded differences are relative to the dominant dimension of similarity. They propose a process of alignment by which the properties of items are brought into correspondence; that is, a dominant dimension of similarity is extracted on the basis of relations among the items and contextual factors such as current intent. The same process of alignment yields attributes that differ among these items. For example, the words *robin*, *eagle*, *ostrich* will be aligned along the dimension of *bird*, but the encoding may also include different attributes, such as *song*, *predator*, *large*. In contrast, unrelated items (e.g., *robin*, *gasoline*, *computer*) will be represented by attributes that differ, but the differences will not be aligned to any dominant dimension of similarity.

When extended to memory, one might suggest that the different attributes function distinctively in retrieval, and thus, for both related and unrelated items, distinctiveness is present. However, the effects of distinctive processing are relative to similarity in that distinctiveness in the context of similarity facilitates performance more than does distinctiveness unaligned to similarity. Indeed, Markman and Gentner (1993) have shown that aligned differences come to mind more readily and more frequently than unaligned differences. Subjects were asked to list the differences between two words that varied in similarity. Highly similar pairs elicited more differences than did less similar pairs. Furthermore, the differences for the similar pairs were much more likely to be aligned to some relation between the items (e.g., cars have four wheels and motorcycles have two wheels) than were the differences between less similar pairs (e.g., cars use gasoline, computers do not).

Medin et al.'s (1993) analysis provides a conceptual footing to von Restorff's empirical argument that difference alone is insufficient to account for the isolation effect. Unaligned differences (e.g., an object that does not use gasoline) are of little diagnostic value at retrieval, and it is in this sense that Medin et al.'s theory provides a basis for von Restorff's argument. Distinctiveness must work in concert with some concept that characterizes similarities and their effects on memory. A reasonable candidate for this role is organization. Thus one would attempt to explain the simultaneous effect of similarity and differences on memory by developing a theory of the concurrent operation of organization and distinctiveness, an exercise in which we and others have been engaged (Hunt & McDaniel, 1993). Regardless, the point is that the concept of distinctiveness is not useful as an absolute explanation of memory phenomena. Von Restorff could have taught us this.

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