Integrative cognitive style among Middle Eastern immigrants to Canada and native-born Euro-Canadians was assessed by looking at their performance on a multidimensional classification task and an object sorting task. Results showed high levels of integrative thinking in Middle Eastern immigrants compared with Euro-Canadians. The contrasting differentiative cognitive style was avoided by the Middle Eastern group, whereas a higher level of differentiation was observed in the Euro-Canadian groups. These results are congruent with previous studies showing higher levels of integrative style in Middle Eastern groups than in Euro-Canadian groups. A secondary finding revealed higher levels of integrative thinking among Middle Easterners with comparatively low levels of Western education. In sum, findings show preferences for integrative thinking in Middle Eastern groups, and through new measures of cognitive style, qualitative aspects of integrative thinking, which have traditionally been viewed indirectly as the opposite of differentiative thinking, are revealed.

INTEGRATIVE COGNITIVE STYLE IN MIDDLE EASTERN AND WESTERN GROUPS
Multidimensional Classification and Major and Minor Property Sorting

SAMAR ZEBIAN
J. PETER DENNY
University of Western Ontario

The variation that human cognition shows is particularly evident in cross-cultural investigations of cognitive style. Three bipolar cognitive style dimensions have emerged that account for much of the variation in thinking styles across cultures; reality-hypotheticality (Au, 1983; Bloom, 1981), contextualization-decontextualization (Heath, 1983; Hutchins, 1980; Lave, 1996), and integration-differentiation (Berry, 1966, 1976; Berry et al., 1986; McIntyre, 1976; Zebian & Denny, 1996; see Denny, 1991, for arguments and more recent evidence for treating these as separable styles of thought). The current study investigates the integration-differentiation dimension, focusing on integrative thinking and how it is qualitatively distinct from the more intensively studied differentiative style. To carry out our investigation, Smith's (1981) Sets 5 Multidimensional Sorting Task was used to assess integrative thought. Although this task has not been used to investigate cognitive style, and comes from the completely separate research tradition of multidimensional classification, it was used because it provided a direct measure of both integrative style and differentiative style, and it had the further advantage of showing how integrative style fits into current theory and research in cognitive psychology. The second task, developed anew for this study, was based on an ethnographic study of object sorting conducted by Heath (1983), which, we will argue, revealed qualitative aspects of integrative style. As we explored the nature of integrative style with these new tasks, it was still important to maintain a link with previous studies that viewed integration as lack of differentiation. Because such studies most commonly used the Embedded Figures Test (EFT) as their test of differentiation, the EFT was included among our measures.

Together, all three measures were used to investigate whether levels of integrative and differentiative thinking varied between two cultural groups, an immigrant Middle Eastern group compared with a native-born Euro-Canadian group. Additionally, the effect of

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Western education, which has been shown to be an unavoidable source of variability in cross-cultural cognitive style research, was investigated (Berry et al., 1986; Mishra, Sinha, & Berry, 1996; Sinha, 1988). In the current study, Western education was treated as a nested factor, not a single variable that crosscuts culture orthogonally. Consequently, each cultural group was made up of two subgroups. The Middle Eastern group was divided into a traditional Middle Eastern group, with no Western education, and a modernizing Middle Eastern group, with at least high school–level Western education. The Euro-Canadian group was divided into an average Euro-Canadian group, with high school levels of education, and a university group, with university education.

COGNITIVE STYLE

DEFINING COGNITIVE STYLE

The term *cognitive style* is used to describe domain-general modes of thinking that emphasize some kinds of processing over others; they are not abilities that some have and others lack (Berry, 1987; Denny, 1991; Sternberg, 1997). Moreover, cognitive styles are related to but remain distinct from processes that may not vary cross-culturally; that is, integrative style is distinct from the automatic integration of *geons* (building blocks of complex 3D forms) during object perception. An integrative style, which involves a special emphasis on integrative processes beyond that needed for universal cognitive processing, is defined as a skill for strengthening and maintaining the interconnections among elements inside a thought unit, the main block of information that the processor is concentrating on. For example, in object perception, it is apparent that integrative thinkers prefer to deal with object gestalts, which emphasize the connections between elements of the object concept (Heath, 1983, p. 106). In comparison, differentiative thinkers show skill in attending to parts separate from the overall content of the thought unit as revealed by the EFT (Berry, 1966, 1976; Berry et al., 1986; McIntyre, 1976).

ECOCULTURAL INFLUENCES ON COGNITIVE STYLE

Three decades of cross-cultural research in cognitive style, which is summarized in Berry's ecocultural model, has revealed some consistent patterns in the way cognitive styles vary across cultures (Berry, 1987, 1993; Berry et al., 1986; see also Denny, 1991). The model proposes that the cognitive abilities of individuals are adaptive to the ecological and cultural contexts in which they develop. The most extensively studied ecological variables linked to cognitive style variability are type of subsistence activity, the predominant way a culture obtains food, shelter, and clothing; settlement patterns; and population size. Additionally, two sociocultural variables, social stratification and socialization emphasis, have also been found to vary consistently with different forms of subsistence (Barry, Child, & Bacon, 1959; Murdock, 1969; Nimkoff & Middleton, 1960). Linkages between these factors and cognitive style can be summarized as follows: Cultural groups that show low levels of differentiative thinking, as measured by the EFT, rely on agriculture for subsistence and typically have midsized populations, high levels of social stratification, and strong socialization emphasis and show sedentary patterns of settlement (Berry, 1976; Berry et al., 1986). These low-differentiation cultures are the ones we would expect to show high levels of integrative thinking. This profile has been compared with that of cultural groups that show high levels of

differentiative thinking and have the following socioeconomic patterns: industrial forms of subsistence, highly dense sedentary populations, and comparatively low levels of social stratification and socialization emphasis (Berry, 1966, 1976). Based on this model, Middle Easterners, who historically engaged in irrigation-agricultural subsistence activities, should show higher levels of integrative thinking compared with Euro-Canadians of Western industrial culture.

Sociohistoric Approach to Cognitive Functioning

We wish to go beyond describing the linkages between ecocultural context and cognitive style to offer at least a partial explanation of the sociohistoric conditions in the Middle East that require high levels of integrative style. In doing so, we espouse a sociohistoric approach to cognitive functioning, an approach that has gained considerable acceptance in the general field of cultural psychology (Cole, 1993; Hutchins, 1995; Vygotsky, 1978).

According to Denny (1991), an emphasis on integrative style is hypothesized to have developed in sociocultural contexts that require unusually high levels of social coordination to sustain economic activity. High levels of social coordination were required in historic Middle Eastern irrigation-agricultural societies because cultural groups were largely responsible for the administration of their own civil affairs, including the communal irrigation works themselves. In this historical context, cultural groups remain relatively independent of state authority (Baldwin, 1973; Flannery, 1965), and thus the kinship unit, as opposed to a paid corps of civil servants, ensures the coordinated effort of large work groups for irrigation activities across large geographic areas at certain crucial times of the year (Gilsenan, 1996; Street, 1984). We posit that this socioeconomic reality is primarily mediated by shared spoken discourse, which enables complex social arrangements. This requires individuals to think in ways that emphasize the interconnections among many diverse considerations and de-emphasizes the separateness of such factors. This way of thinking meets our definition of integrative style that involves maintaining and building interconnections among diverse elements in a thought unit; in this case, the thought units are typically sets of sociocultural considerations constituting particular episodes of decision making about work situations.

In comparison with irrigation-agricultural societies, individuals in Western industrial societies are relieved of a significant portion of the task of social coordination by a corps of paid civil servants who are responsible for the administration of civil affairs. In further contrast with irrigation-agricultural societies, high levels of social coordination on a personal level are not needed to maintain the social structures of the highly specialized and individualistic industrial economic system. Two mechanisms are especially crucial in industrial societies for achieving coordination between members. First, the employer in the employee-employer relationship ensures that members in an industrial work group carry out roles that coordinate with the roles of other members, thus reducing the amount of social coordination that must be done by individual employees to maintain productivity. Second, the exchange of money for labor and goods allows agreed-on valuation of specialized work, without developing intensive and elaborate social relations to mediate exchange. Together, these special mechanisms ensure that members of industrial societies can give much less attention to maintaining large networks of intensive social relations, so that levels of personal effort at social coordination remain low enough that they do not have to be supported by an integrative cognitive style.

Acculturational Influences

The patterns of thought that develop in these sociohistoric contexts lag behind relatively fast ecocultural changes due to immigration and rapid industrialization, changes that place extreme demands on the individual to think in novel ways. The prediction that follows from the ecocultural model is that cultural changes that, in part, operate through sociopolitical institutions—such as Western education—will modify indigenous cognitive style preferences. Two studies have shown that Western education is related to higher levels of differentiative thinking as measured by the EFT in agricultural groups (Berry et al., 1986; Sinha, 1988). In the current study, Western education was a nested variable that crosscuts culture orthogonally. Consequently, two education effects were studied, the modernizing education effect in the Middle Eastern group and the university education effect in the Euro-Canadian group.

EXPERIMENTAL CROSS-CULTURAL RESEARCH ON INTEGRATION AND DIFFERENTIATION

Cross-cultural experimental studies of integrative style are very sparse; only one study and possibly a second directly assess it. In the first study, Zebian and Denny (1996) showed high levels of integrative thinking among immigrant Middle Eastern groups in discourse and decision-making tasks that measured the number and diversity of topics linked together in a thought unit. In that study, Middle Eastern discussants responded to the question "Why does a person need education?" by linking the topic of education to an average of five other topics. This is an example of integrative style because it involves the linking of many diverse topics drawn from a large range of topics. The opposite of this, focusing on one topic at a time, which weakens the linkages to other topics, was observed in a Western industrial control group that linked education to an average of fewer than two topics drawn from a much smaller set of topics.

The finding that Middle Eastern groups were more integrative than Western industrial groups seems supported by one other study (Soliman, 1989), which measured the integrative styles of thought among Kuwaiti university students. However, the evidence provided was rather weak because no explicit connection has been established between the "integrative thinking" measure used, *Your Style of Thinking and Learning* (Torrance, Reynolds, Ball, & Riegel, 1978), and the integrative style currently being studied. Nor has performance on this test been compared with the main test of differentiation, the EFT.

Turning to research on differentiative style, no known investigations have assessed levels of differentiative thinking for traditional irrigation-agricultural societies in the Middle East; however, three studies have measured differentiation in Asian irrigation-agricultural groups. In one study of EFT performance among Chinese irrigation-agriculturalists and fisher groups, the irrigation-agricultural group showed lower levels of differentiative thinking compared with the fisher group (Dawson, 1981, cited in Bond, 1986). Consistent with Dawson's findings, a more recent study conducted by Turner, Berry, Bennett, and Denny (1993), which compared EFT performance across a wide range of cultural groups, showed low levels of differentiation as assessed by the EFT in a Chinese irrigation-agricultural group compared with an Ojibwa hunter group and a Canadian industrial group. The findings from both studies are consistent with the ecocultural model, which predicts lower levels of differentiation in irrigation-agricultural groups compared with higher levels of differentiation in hunter and industrial groups (Berry, 1976, 1987). In the third study of two urban industrial Japanese groups, one in Japan and the other temporarily residing in England, Bagley, Iwawaki, and Young

(1983) found high levels of differentiation in both groups, similar to levels found in their Western industrial groups. These findings, which might seem inconsistent with those of Chinese irrigation-agricultural groups reported above, are explainable within the ecocultural model that predicts higher levels of differentiative thinking in groups acculturating to industrialism, such as the Japanese, who are known to be the most highly industrialized of non-Western societies (Berry et al., 1986; Sinha, 1988; see Schooler, 1991, for a discussion of Japanese industrialism).

MULTIDIMENSIONAL CLASSIFICATION

The most pressing issue identified in the literature review up to this point has been the lack of experimental research on integrative style. Thus, we turned to research outside the cross-cultural literature but within the experimental psychological literature, which investigates various aspects of what we are here calling integrative style but that has been referred to as holistic or gestalt processing (Boulter & Kirby, 1994; Cooper, 1990; Kemler Nelson, 1989). In a parallel way to our integration-differentiation dimension, the opposite of holistic processing, usually termed analytic processing, involves aspects of the differentiative style. In the Multidimensional Sorting Task, which requires participants to sort sets of objects that vary on multiple dimensions, two types of sorting strategies, multidimensional and unidimensional (which will be described shortly) are treated as indices of, respectively, holistic and analytical processing. It is these specific sorting indices that we will argue show aspects of integrative and differentiative style.

Sorting Strategies as Indicators of Cognitive Style

The multidimensional sorting strategy involves grouping objects that are similar on multiple dimensions, showing aspects of integrative style because as attention is distributed across the separable features of the object the interconnectedness of the dimensions is emphasized. In comparison, unidimensional sorting involves grouping objects that are very similar (or identical) on only one of the varying dimensions, showing aspects of the differentiative style because attention is directed to a single feature of the object, weakening the interrelations between the elements that make up the object gestalt.

In the present study, we explored for the first time whether differences in levels of integrative thinking influence adult multidimensional sorting performance in different cultural groups. The current focus is different from much of the past multidimensional sorting research, which has focused on the role of selective attention skills in sorting performance. This body of work has revealed that habitual unidimensional sorters compared with multidimensional sorters show higher levels of selective attention skill, suggesting that multidimensional sorting is an automatic strategy whereas unidimensional sorting is learned (J. Smith & Kemler Nelson, 1984; L. Smith, 1984, 1989; Ward, 1983, 1985; Ward, Foley, & Cole, 1986). Beyond the role of selective attention and closer to our current focus on the role of cognitive style in multidimensional classification, Smith and Baron (1981) found habitual preferences for either multidimensional or unidimensional sorting, which were not related to selective attention skill. Based on these results, they suggested that "individual differences represented by free classification may be a true dimension of cognitive style in adults, a preference

or tendency to process in a particular way" (p. 1143). Supporting Smith and Baron's hypotheses, Ward (1985) and Ward et al. (1986) conducted a series of studies that revealed a correlation between skilled EFT performance, the standard measure of differentiative cognitive style, and high levels of unidimensional sorting. Based on all three studies, Ward et al. claimed that the tendency to sort a certain way reflects a "classifications style" or "a mode of processing" that involves an ability to "break down stimuli into component dimensions" (Ward, 1985, p. 476). This skill is clearly a part of the differentiative style and the opposite of this style, which Ward did not identify, is our integrative style. Similar explanations were used to describe the individual differences observed by Smith and Baron (1981). In the current study, we investigated whether a tendency to sorting unidimensionally or multidimensionally is related to cross-cultural preferences for differentiative and integrative thinking.

MAJOR AND MINOR PROPERTY SORTING TASK

To investigate whether the integrative style is domain general, it was essential to observe its expression in more than one task. Hence the Major and Minor Property Sorting Task, which was based on Heath's natural observations of sorting behavior in a Black American working-class community, was developed.

In a quasi-experimental situation, Heath (1983) presented children with pieces of wood varying in the major properties of shape and size and asked them to "put together those pieces which were alike" (p. 107). The children sorted the pieces into two unexpected groups: One group consisted of objects with bits of glue on them left over from an art project, and the other group consisted of objects with no glue on them. Counter to Heath's expectations, the Black children used a minor property, the presence of glue, to make groupings, and not the major properties of shape and size. Prompted to make further groupings, the children further broke down the glue/no glue grouping into two more subgroups based on the wood grain pattern, showing attention to another minor property. This preference for minor property sorting was observed on separate testing occasions with other objects. The minor property sorting observed by Heath contrasts with the well-known sorting behavior of middle-class children and White working-class children, who sort objects based on major properties, such as length and shape (Cole & Scribner, 1974; Gay & Cole, 1967; Heath, 1983; Hess & Shipman, 1965). We assume that these early sorting preferences for major and minor property sorting do not change without explicit instruction and therefore are likely to show up in adult sorting.

Aspects of integrative and differentiative style, we argue, are revealed in the contrast between minor property and major property sorting. Major properties, such as shape, are processed in the early stages of object perception and are perceptually integrated to form the object gestalt (Humphrey, Goodale, Jakobson, & Servos, 1994). It is argued that because further processing is needed to break down the object gestalt into its constituent properties, major property sorting involves aspects of differentiative style. The highly differentiative thinker is more likely to classify the objects according to major property similarities because they are skilled at perceiving the properties separately from the object gestalt. Minor property sorting, on the other hand, indicates that the object gestalt is kept intact because it does not require the sorter to weaken the interconnections among elements of the object gestalt, particularly among the major properties.

METHOD

PARTICIPANTS

Four groups participated in this study. Participants were classified into one of the four groups based on the following information: place of birth, family origins, and the level of Western education received. All 29 members of the *traditional Middle Eastern* group were born in a Middle Eastern country and had Middle Eastern parents and grandparents. The type of education they received was either (a) apprenticeship, (b) traditional Quaranic education, or (c) education in a private village school that provided some grade schoollevel of Western instruction. These conditions meant they had no more than a limited Western education. The 25 members of the *modern Middle Eastern* group were born in the Middle East, had Middle Eastern parents and grandparents, and had at least 1 year of university training in a state-run Middle Eastern university that was modeled after a Western system of education. The 12 participants in the *average Euro-Canadian* group were born in Canada or in Western Europe or its offshoots (United States, Australia, etc.) and had Canadian or Western European parents and grandparents. They had up to but not beyond high school education. The smaller number of participants in the average Euro-Canadian groups reflects the difficulty we had in recruiting middle-aged Euro-Canadians with less than a high school level of education. The 29 participants in the *university Euro-Canadian* group were 1st-year university students, were born in Canada or a Western European country, and had parents and grandparents from Canada or Western Europe.

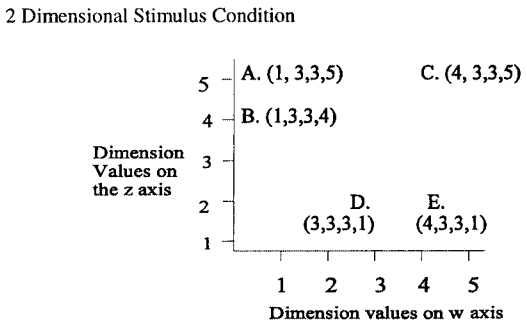
The age range and average age of each group were as follows: traditional Middle Eastern, 22-67 (M = 39.90), modern Middle Eastern, 18-47 (M = 33.84), average Euro-Canadian, 22-66 (M = 42.50), and university Euro-Canadian, 19-27 (M = 20.14).

SETS 5 INSECT SORTING TASK

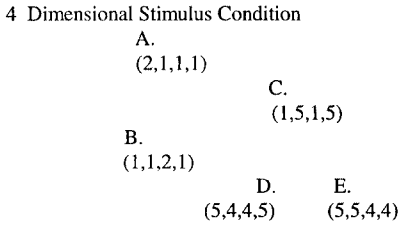
The Sets 5 Insect Sorting Task was a slightly modified version of the Sets 5 Multidimensional Sorting Task created by Smith (1981). The objects of the current task were insectlike, rather than Smith's assembled geometric shapes, and the values of each dimension were established through a just-discriminable norming procedure such that the values were 1 JND apart. The sorter was instructed to "group the objects that are most similar into two, three, or four groups."

Each set in the Sets 5 Insect Sorting Task was made up of five insectlike objects; each object was composed of four dimensions and each dimension could take on one of five values. The four dimensions and the five possible values (in centimeters where relevant) that each dimension could take were as follows: head width, 0.7, 1.0, 1.4, 1.9, 2.3; body length, 2.1, 2.7, 3.2, 3.8, 4.5; wingspan, 2.7, 3.1, 3.7, 4.2, 5.0; and number of legs, 2, 4, 6, 8, 10. Within each set of objects to be sorted, the values of each dimension for the objects varied in a way that allowed the experimenter to determine whether the sorter was classifying the objects according to one or to more than one dimension.

In this task, we included two types of objects in two different stimulus sets: objects that varied on all four dimensions (4D stimulus condition) and objects that varied on only two of the four dimensions (2D stimulus condition). Both of these conditions were used because we wished to assess a fuller range of sorting performance and because a considerable amount of research has shown higher levels of multidimensional sorting in the 4D stimulus condition



NOTE: The letters represent the objects and the four numbers beside each letter are the values of each dimension, respectively.



NOTE: Each of the four numbers represents the values on the w, x, y, and z dimensions, respectively.

Figure 1: Schematic Representation of the Two- and Four-Dimensional Stimulus Conditions of the Sets 5 Insect Sorting Task

compared with the 2D condition (Foard & Kemler Nelson, 1984; J. Smith & Kemler Nelson, 1984; L. Smith, 1981).

The values of each dimension for each object varied depending on the stimulus condition. In the 4D stimulus condition, the values of each of the four dimensions varied across the five objects such that no one object had the same combination of values across all dimensions but various groupings of objects could be made because different objects had some similar and some identical dimensions, as shown in Figure 1. The four numbers beside the objects labeled A, B, C, D, and E show the value of each respective dimension, w, x, y, and z, for that object. The first number listed next to each object represents the value of the head width dimension (dimension w), the second number gives the value for body length (dimension x), the third number is for wingspan (dimension y), and the last number is the value for the number of legs (dimension z).

In the 2D condition, only two of the four dimensions varied across the five objects whereas the other two nonvarying dimensions were held at a constant value of 3 (see Figure 1). The dimension that varied on the x-axis is shown as the first value beside each object, and the dimension that varied on the z-axis is shown as the last value. The two dimensions that are held constant at value 3, for example, wingspan and number of legs in Figure 1, are shown as

the two middle values, positions 3 and 4. Note that for both stimulus conditions, each dimension appeared once in each of the four value positions shown in Figure 1, such that 24 sets of five objects were generated for the 4D stimulus condition and another 24 sets for the 2D condition.

Scoring the Sets 5 Insect Sorting Task

Two main types of sorting strategies, multidimensional, our measure of integrative thinking, and unidimensional, our measure of differentiative thinking, were used by participants to sort the objects in both the 2D and 4D stimulus conditions. Each main sorting type contains two substrategies. Although the interest in the current investigation was to compare the frequency of multidimensional sorting with unidimensional sorting, these sorts can be scored only if the substrategies that comprise them are defined. The multidimensional sorting type breaks down into overall-similarity sorting and overall-identity sorting. The overall-similarity sorting pattern, which is the same for both the 2D and 4D conditions, is as follows: object A with B, object D with E, and object C alone (refer to Figure 1). The crucial grouping that showed that multidimensional sorting of the overall-similarity type occurred was the grouping of objects D and E. This grouping indicated that the sorter was not concerned with how objects compared on a single dimension; otherwise, the sorter would have grouped objects C and E or grouped objects A and C. Rather, the overall-similarity sorter is concerned with how the combined dimensions of an object compare with the combined dimensions of another object. In a parallel way, the AB grouping was also taken as evidence for the overall-similarity type of multidimensional sorting.

The 2D and 4D overall-identity sorting pattern, the less frequent multidimensional substrategy, is as follows: either A with B, and C, D, E in separate groups, or alternatively E with D, and A, B, C each in separate groups. In previous studies, the separation of each object into a single-member group was used as evidence for overall-identity sorting; however, in the current investigation, because participants were instructed to make at least two groups, this sorting pattern was not available to participants. Consequently, the crucial grouping pattern that showed overall-identity sorting was the placing of objects C, D, and E or objects A, B in separate groups. Note that for multidimensional sorting in the 4D stimulus condition, the structure of the stimuli allowed us to determine precisely whether the sorter was using one or more than one dimension in the classification decision; it does not allow us to determine whether two or three or four dimensions were used to classify objects.

In a parallel way, unidimensional sorting can also be broken down into (the frequent) dimensional-identity sorting and (the rarer) dimensional-similarity sorting (Smith, 1981, 1989; Smith & Evans, 1989). Looking first at the 2D condition, the dimensional-identity sorting patterns for each of the two varying dimensions are as follows: for dimension w, AB, CE, D; for dimension z, AC, DE, B. The crucial grouping that showed that the information from one dimension was extracted, on the w dimension, for example, was the CE and D groupings; the grouping of objects AB is not unique to dimensional-identity sorting and therefore does not constitute a crucial grouping. Turning to the 4D condition, the dimensional-identity sorting patterns for each of the four varying dimensions are as follows: dimension w, BC, DE, A; dimension x, AB, CE, D; dimension y, AC, DE, B; and dimension z, AB, DC, E.

The dimensional-similarity sorting patterns, the other subtype of unidimensional sorting, for both the 2D and 4D conditions for each of the two varying dimensions are as follows: dimension x, AB, CDE; and dimension y, ABC, DE.

A special problem also found in Smith (1981) appears in the scoring of both unidimensional substrategies that may weaken the inference that only one dimension was used for these sorts. The grouping of objects A and B, used to claim that dimension x is the only one used, is also found in the overall-similarity subtype of multidimensional sorting, which may weaken the inference that only one dimension is used in unidimensional classification. However, we reasoned that a unidimensional sort that may include an AB grouping is not entirely incompatible with a unidimensional strategy because the sorter makes other object groupings that are unambiguously unidimensional sorts.

Two dependent variables, number of 2D multidimensional sorts and number of 4D multidimensional sorts, each composed of the respective substrategies, were used to assess levels of integrative thinking.

EMBEDDED FIGURES TEST

A selection of six embedded-figure items (from the original items developed by Witkin, 1950) that have proven valid in cross-cultural research (Turner et al., 1993) was used to assess levels of differentiative cognitive style. The items in the current test were enlarged to allow the participant to outline the embedded figure with his or her figure without the requirement of fine motor control. The target figure and the complex figure in which it was hidden were presented separately, although the participant could flip back and forth between them if needed. The dependent variable was EFT completion time.

MAJOR AND MINOR PROPERTY SORTING TASK

The Major and Minor Property Sorting Task was created for this study to assess which object properties, major or minor, were used to group objects. In the current task, stripe density and decorative design constituted the minor properties and color and shape were the major properties. In the object perception literature, the color of artifacts is considered a minor or surface property because it is most often ignored in the automatic stages of object; however, Humphrey et al. (1994) also note that color can be opportunistically treated as a major property under some conditions and for some tasks (see also Treisman, 1988). We believe that in sorting artificial objects, color is treated as a major property; this is routinely true of sorting tasks in Western educational settings.

For the current task, the sorter was instructed to "choose two objects which were most similar" from a set of three objects. Each wooden object in each triad set was made up of two major properties, shape and color, and two minor properties, stripe density and decorative design. Each of these properties could take on one of three values: color, red, blue, and yellow; shape, pyramid, cube, and rectangle; decorative designs, half moons, waves, and squares (there were approximately 10 small items on each object); and stripe density, fine, medium, and dense. To randomize the availability of the various properties for sorting, four blocks of stimuli were generated from these properties and their values. The blocks were generated in a way that forced sorters to make groupings either based on major or on minor properties, by holding two properties constant, one major property and one minor property (relevant properties) while allowing the other major property and the other minor property to vary across the objects (irrelevant properties). A relevant property was a major or minor property having the same value for two of the three objects in the triad set; the third object in the set took the adjacent value of the relevant property in question. An irrelevant property was a major or minor property that took on different values for each of the three objects in the

triad set. Each object in each block was composed of four properties: one relevant major property, one relevant minor property, one irrelevant major property, and one irrelevant minor property. The combination of every possible relevant and irrelevant property, in all possible combinations, produced a total of 432 possible triad combinations. However, due to time constraints only 10 triad sets, randomly selected from each of the four blocks, comprised the testing stimuli.

The Two Sorting Strategies for the Major and Minor Property Sorting Task

There were two ways in which the object triads of the Major and Minor Property Sorting Task could be sorted. Sorters could choose to sort objects based on either the relevant minor property similarity or the relevant major property similarity. There should be no other criteria for sorting the objects; however, there is the possibility that other sorts could be made. These were recorded as "other" and the sorter was asked to explain their sorting strategy. Because the frequency of these other sorting strategies was so low, four in total, they were not given further consideration. The number of minor property sorts variable was used to assess levels of integrative thinking.

Procedure

The participant was first given the Sets 5 Insect Sorting Task. Ten randomly selected sets from the 2D stimulus condition were sorted and then 10 randomly selected sets from the 4D stimulus condition were sorted. The 2D and 4D stimulus conditions were always presented in this fixed order. An analysis that investigates potential effects of the fixed order will be reported in the Results section.

Next, the Major and Minor Property Sorting Task was administered. The triad sets were randomly presented, and within each set the objects were randomly arranged in front of the participant, who was instructed to "choose the two objects that are most similar." Participants were administered 10 sets of three objects.

The EFT was administered last. The participant was first given two practice items. The six test items were not given until the participant solved the practice items correctly. Participants were aware that the experimenter was recording the time taken to solve each item.

RESULTS

A multivariate analysis of variance (MANOVA) was used to analyze a 2×4 nested design with two levels of cultural type, Middle Eastern and Euro-Canadian, and two levels of education nested within culture; the traditional and modern subgroups were nested within the Middle Eastern cultural group and the average and university groups were nested within the Euro-Canadian group. The two cultural groups, Middle Eastern and Euro-Canadian (collapsed across level of education) and the two sets of nested subcultural groups were compared on the following set of dependent variables from the three tasks that assessed integrative and differentiative cognitive styles: number of 2D multidimensional sorts and number of 4D multidimensional sorts from the Sets 5 Insect Sorting Task, EFT completion time, and number of minor property sorts from the Major and Minor Property Sorting Task. Higher scores on 2D and 4D multidimensional sorting and on minor property sorting were indica-

tions of the integrative cognitive style, whereas a lower score on the EFT completion time variable was an indicator of the opposite, differentiative style.

ASSESSING THE EFFECT OF STIMULUS CONDITIONS IN THE SETS 5 INSECT SORTING TASK

To begin, a MANOVA was conducted with the data from the Sets 5 Insect Sorting Task only to investigate whether the type of stimulus set, 2D or 4D, in the Sets 5 Insect Sorting Task had an effect on sorting strategy for the various sub-cultural groups. A $2 \times 2 \times 4$ nested design with repeated measures on the stimulus condition (2D and 4D) was conducted. The first, second, and third factors were, respectively, stimulus condition, culture, and education within culture. Results were similar to those of the first MANOVA indicating a significant main effect for culture, $F(1, 91) = 18.12$, $p < .001$, and a significant education within culture effect, $F(2, 91) = 7.54$, $p < .01$. The main effect for stimulus condition was also significant, $F(1, 91) = 32.18$, $p < .001$, indicating that higher levels of multidimensional sorts were made in the 4D compared with the 2D stimulus condition, replicating previous results (Smith, 1981). Most important, culture did not interact with stimulus condition, $F(1, 91) = .79$, $p > .05$; likewise, the education within culture by stimulus condition interaction was not significant, $F(2, 91) = 1.47$, $p > .05$. This analysis indicates that the two stimulus conditions do not have to be treated separately for further analyses concerning the effects of culture and education within culture, and therefore, the results reported in following analyses are collapsed across the two stimulus conditions.

OVERALL MANOVA FOR ALL THREE TASKS

The first MANOVA was conducted to assess the effect of culture, and the effect of education nested within culture, on the entire set of dependent measures across the three tasks. Results of the overall Pillais statistic assessing the cultural effect was significant, Pillais =.386, approximate $F(4, 86) = 13.84$, $p < .001$. Similarly, there was a significant education within culture effect, Pillais = .530, approximate $F(8, 178) = 8.23$, $p < .001$. A series of univariate homogeneity of variance tests for each dependent variable was conducted because there was an unequal number of participants in each group. The results of each Cochran C test with an alpha level of .05 indicated that the homogeneity assumption was not violated for any one of the four dependent variables. Next, the univariate and post hoc tests for each dependent variable will be reported.

Considering the cultural effect first and looking at the 2D multidimensional sorts variable, the univariate test indicated that the Middle Eastern group ($M = 6.09$) used this sorting strategy more than the Euro-Canadian group ($M = 3.70$), $F(1, 91) = 13.53$, $p < .001$. Turning to the 4D condition, the univariate test of the culture effect indicated that the Middle Eastern group ($M = 7.77$) scored higher than the Euro-Canadian group ($M = 6.10$), $F(1, 91) = 7.77$, $p < .01$. Turning to the EFT, means for the EFT completion times variable indicated that the Euro-Canadian group had faster times ($M = 43.36$) than the Middle Eastern group ($M = 83.54$), $F(1, 91) = 40.15$, $p < .001$. Finally, considering the Major and Minor Property Sorting Task, the univariate test showed that the Middle Eastern group made more minor property sorts ($M = 4.90$) than the Euro-Canadian group ($M = 1.53$), $F(1, 91) = 43.05$, $p < .001$. To summarize, the univariate tests revealed that the Middle Eastern group had higher levels of integration and lower levels of differentiation.

The level of education within culture effect, which was shown to be significant in the overall MANOVA reported above, will be looked at in more detail next. The two level of education effects, one for the Middle Eastern group and the other for the Euro-Canadian group, were labeled the modernizing education effect and the university education effect, respectively.

Beginning with the 2D multidimensional sorts variable, the overall level of education within culture effect was significant, $F(2, 91) = 6.55$, $p < .01$. Subsequently, a set of planned comparisons was conducted using the Tukey HSD procedure to determine whether each of the subcultural comparisons showed the effect. Results indicated that the traditional Middle Eastern group ($M = 7.51$) in comparison to the modern group ($M = 4.68$) showed significantly higher levels of 2D multidimensional sorting; however, a significant effect was not found for the Euro-Canadian subgroups.

Turning to the 4D multidimensional sorting variable, the univariate test for the overall education within culture effect was significant, $F(2, 91) = 9.41$, $p < .01$. The planned comparisons indicated that the traditional Middle Eastern group ($M = 9.10$) in comparison to the modern group ($M = 6.44$) showed higher levels of integration; however, for the Euro-Canadians, the average Euro-Canadian and university Euro-Canadian groups did not differ significantly.

Turning to the EFT time variable, the univariate test for the overall education within culture effect was significant, $F(2, 91) = 30.69$, $p < .01$. The planned comparisons showed that the traditional Middle Eastern group ($M = 109.67$) in comparison to the modern group ($M = 57.41$) showed lower levels of differentiative thinking, and in the Euro-Canadian groups the average group ($M = 64.16$) in comparison to the university group ($M = 22.56$) showed significantly lower levels of differentiative thinking.

Finally, turning to the minor property sorts variable, the education within culture effect was significant, $F(2, 91) = 27.63$, $p < 01$. The planned comparisons showed a significant difference in minor property sorts only between the Middle Eastern subcultural groups, with traditional Middle Easterners ($M = 7.13$) showing higher levels of integrative thinking compared with modern Middle Easterners ($M = 2.68$).

DISCUSSION

It was predicted that culture, defined within a sociohistoric framework, and level of Western education will influence cognitive style as assessed in three domains: multidimensional classification, embedded figures, and minor and major property use in object sorting. The results showed a cultural effect. The Middle Eastern group, subgroups combined, was more integrative than the Euro-Canadian group for the following measures: higher levels of 2D and 4D multidimensional sorting in the Sets 5 Insect Sorting Task and higher levels of minor property sorting in the Major and Minor Property Sorting Task. Furthermore, slower EFT completion times showed the Middle Eastern group to be less differentiative, and by implication more integrative, than the Euro-Canadian group.

Results also showed partial support for the second hypothesis, which examined the two level of education effects. Looking first at the Middle Eastern groups, results showed a modernizing education effect such that the traditional Middle Eastern group (with no Western education) was more integrative and less differentiative than the modern Middle Eastern group (with at least high school levels of Western education), as indicated by higher levels of multidimensional sorts and minor property sorts and slower EFT completion times. Turning

to the Euro-Canadian groups, results showed a separate university education effect, only for the EFT completion time variable, with very high levels of differentiation among the university Euro-Canadian group compared with levels of differentiation not as high in the average Euro-Canadian group.

CONTRIBUTIONS TO CROSS-CULTURAL COGNITION

The cultural differences observed that showed higher levels of integrative thinking among Middle Eastern groups compared with Euro-Canadian groups agree with past experimental studies and with natural observations that showed high levels of integrative thinking among members of irrigation-agricultural groups (Lomax & Berkowitz, 1972; Soliman, 1989; Zebian & Denny, 1996). The findings agree with the cross-cultural research that has shown lower levels of differentiative thinking among traditional irrigation-agriculturalists, in contrast to more differentiative thinking among Western industrial groups (Berry, 1966, 1976; Dawson, 1981b, cited in Bond, 1986; Mishra et al., 1996; Turner et al., 1993).

The findings of the current study are an important contribution to the cross-cultural literature for several reasons. For the first time, the cognitive styles of Middle Eastern groups of irrigation-agriculturalists were studied; previously, only Asian irrigation-agricultural groups had been examined. It is significant that irrigation-agricultural groups in distant geographical locations and with distinct cultural histories show similar skill in integrative style. These findings support claims made by Berry (1987, 1993) and Denny (1991) that irrigation subsistence activities have a distinct effect on cognitive style that is different from industrial and also hunter-gatherer subsistence activities. In addition, comparing immigrant to native-born groups within industrial subsistence cultures indicated that relatively stable aspects of cognitive style, which we argued develop over time in sociocultural contexts, persist even among Middle Eastern immigrant groups currently practicing industrial subsistence activities.

As a further contribution, the current study extends the effects of the integrative style to yet another new domain, classification. Our previous experimental study had observed cross-cultural variability in integrative style in discourse and decision making (Zebian & Denny, 1996). The mounting evidence suggests that a number of different cognitive domains are affected by integrative cognitive style.

Another contribution involves the two new tasks, the Sets 5 Insect Sorting and the Major and Minor Property Sorting Tasks, which provided a means of qualitatively assessing both integration and differentiation as opposing cognitive styles. Previous research, using the EFT, was sensitive only to varying levels of differentiation and did not directly assess qualitative aspects of integrative style. Additionally, this investigation showed a new aspect of integrative style that involved maintaining the interconnections between elements in the thought unit to preserve object gestalts. This aspect is related to the aspect of integrative style revealed in discourse and decision making where integrative thinkers created linkages between elements of a thought unit (Zebian & Denny, 1996).

MULTIDIMENSIONAL CLASSIFICATION LITERATURE

The findings from the Sets 5 Insect Sorting Task revealed that the Middle Eastern group compared with the Euro-Canadian group more frequently used an integrative cognitive style, as shown in its multidimensional sorting strategies. Under our interpretation, multidimensional sorters are viewed as using the integrative style to maintain the interconnections

among the dimensions of an object while they are sorting it, whereas unidimensional sorters and those skilled in the EFT are using the differentiative style to weaken the interconnections among the dimensions of an object. The full implications of the current findings are shown even more clearly when we consider how selective attention, which has been given special consideration in the multidimensional classification literature, and cognitive style interact to influence sorting performance. Synthesizing our own views on attention with those of Smith (1989), we suggest that multidimensional sorters' use of several dimensions in the classification decision, which is an aspect of their integrative style, is due, in part, to automatic attentional resources that are distributed more or less equally across the dimensions of the object so as to maintain the holistic representation of the object. In comparison, unidimensional sorters, whom we interpret as showing a preference for differentiative style, employ selective attention to one dimension as the automatic representation of the object is formed. We suggest that these attentional resources, which may be controlled by cognitive style, are habitual and can be overridden by conscious effort only to a partial degree.

Our interpretation of the attentional processes involved in multidimensional sorting is supported by evidence that shows lower levels of selective attention to one dimension by habitual multidimensional sorters and higher levels of selective attention by habitual unidimensional sorters (Smith, 1984). Furthermore, our interpretation is congruent with L. Smith's weighted dimension plus identity model, which holds that unidimensional sorting requires higher levels of selective attention to one dimension in comparison to multidimensional sorting, which involves a more equal distribution of attentional resources.

LEVEL OF EDUCATION EFFECTS

A modernizing Western education effect was found for the Middle Eastern groups on each of the three tasks: It was seen in the traditional group, who used higher levels of integration on the Sets 5 Insect Sorting Task and the Major and Minor Property Sorting Task, and lower levels of differentiation on the EFT. A level of education effect for Middle Eastern groups was found in a previous study that assessed verbal integration in everyday discourse and decision making (Zebian & Denny, 1996). The discrepant findings in these different cognitive domains suggests that a modernizing education effect will be expected for skills that are explicitly learned in a Western educational system, such as categorizing objects as assessed. Level of Western education may not have a strong effect on verbal integration because it is learned implicitly and is deeply embedded in sociocultural practice.

A university education effect was found for the Euro-Canadian group on only one task: The university Euro-Canadian group showed higher levels of differentiative thinking as assessed by the EFT compared with the average Euro-Canadian group. The average Euro-Canadian group did not show higher levels of integrative thinking as predicted for the Sets 5 Insect Sorting Task and the Major and Minor Property Sorting Task. These results agreed with those of Zebian and Denny (1996), which also showed no level of education effect for average-educated compared with university-educated Euro-Canadians on two quite different tests of verbal integration.

Overall, the higher levels of Western education seem to lower levels of integration in groups that are already highly integrative, such as the Middle Eastern group, but have no further effect on integrative cognitive style among groups that already have a low level of integration. Altogether, the results for each cultural group across all three tasks suggest that the modernizing Western education effect in Middle Eastern groups was found at the integrative

end of the integration-differentiation variable, whereas the university education effect in the Euro-Canadian industrial groups was found at the differentiative end of the variable.

FUTURE DIRECTIONS

The current study offers several directions for empirical research on integrative cognitive style. We require research that extends our understanding of how various aspects of integrative style are revealed in a broader range of cognitive domains. Furthermore, our discussion of the relationship between selective attention and cognitive style highlights the need for research, supported by a cognitive science framework, that considers the basic cognitive processes involved in these stylistic preferences.

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Samar Zebian received her M.A. degree from the University of Western Ontario where she is now a doctoral candidate in cognitive psychology. Her interests are in integrative cognitive style in real-life settings, cultural aspects of everyday mathematical cognition, and ethnographic approaches to cognitive psychology.

J. Peter Denny is a member of the Psychology Department at the University of Western Ontario. He has published articles on cognitive styles, the cognitive linguistics of classifiers, mathematical terms and spatial terms, and culture history.