

## CHAPTER TWO

# Refining the Concept of Psychological Compensation

Timothy A. Salthouse  
*Georgia Institute of Technology*

According to the *American Heritage Dictionary of the American Language* (1992), *compensation*, as the term is used in psychology, refers to behavior that develops either consciously or unconsciously to offset a real or imagined deficiency. A more specific definition is that compensation exists when the same, or a superior, level of proficiency on some criterion activity is achieved, despite deficiencies in one or more behavioral constituents of that activity.

The term *compensation* has been widely used in psychology, particularly in reference to individuals who have (or had) some type of deficit or impairment and yet still manage to perform at a competent level in a related activity. The idea that a limitation or impairment in one presumably relevant aspect of behavior does not necessarily preclude the attainment of a high level of functioning in a given domain is obviously very appealing. However, previous usages of the term *compensation* have been confusing and sometimes inconsistent. Thus, the concept runs the risk of becoming vacuous and devoid of meaning unless it can be clarified and unambiguously distinguished from alternative concepts.

The primary goal of this chapter is to discuss a number of issues relevant to the interpretation of the concept of compensation. My intention is not to redefine the concept, but instead to stimulate a closer examination of its meaning, and how it might be distinguished from related concepts. There are three major sections to this chapter. The first is concerned with distinguishing compensation from alternative concepts. The second raises a number of issues believed to be important in understanding the nature of compensation. Finally,

the third section consists of an examination of two research projects in terms of the questions and issues raised in the first two sections.

### WHEN IS COMPENSATION COMPENSATION?

A recent comprehensive review of compensation by Bäckman and Dixon (1992) identified three types of compensation: (a) development or activation of substitutable skills, (b) investment of more time or effort, and (c) relaxation of the criteria (or standards or expectations) for successful performance, or adoption of different goals. This classification scheme is useful because it is much more explicit than earlier references to compensation, which sometimes implied that compensation could be inferred to exist whenever convergent group-by-task interactions were found, in which a poor-performing group improved more with variations in the task conditions than did a higher-performing group (e.g., Bäckman, 1989).

Nevertheless, questions can still be raised regarding whether each of the categories discussed by Bäckman and Dixon should be considered examples of compensation, as opposed to manifestations of alternative concepts. Consider the last category first. If the performance standards change, or if there is a shift in the nature of the criterion behavior, one can question whether it may be more accurate to state that the subject has adapted, or accommodated, to the deficit rather than compensated for it. That is, if there is a change in the nature of the goal, rather than in the means used to achieve the same goal, one can question if it might be more meaningful to classify the phenomenon as *accommodation* instead of compensation (Salthouse, 1987, 1990a, 1990b).

It seems reasonable that as deficits appear, changes may occur in the nature of the activities in which one engages, or in the level of expectation in the same activities, in order to minimize the consequences of those deficits. However, if the criterion behavior is no longer the same, it is not obvious that the concept of compensation is relevant.

Of course, if one views goals or criterion behavior in broad terms, such as ensuring adequate self-esteem, it could be argued that a change in the nature of the activities in which one engages is consistent with maintaining the same level of overall or global competence. This is a plausible perspective, although the assessment of competence is clearly much more difficult with such a broad interpretation of behavioral goals. Furthermore, the linkage between a deficit or a loss in one aspect of behavior and the level of functioning in a different type of activity is often tenuous when different behavioral domains are involved.

A similar objection to such a broad interpretation of compensation was raised by Bäckman and Dixon (1992) in their discussion of empirically evaluating Adler's views on compensation:

Because we all have defects, it is possible to take any behavior, relate it to some presumed feeling of inferiority, and classify the behavior as an example of compensation or overcompensation. However, a variety of behaviors that may be interpreted as a result of feelings of inferiority may instead be prompted by other causative factors. (p. 271)

Now consider the second category of compensation mentioned by Bäckman and Dixon. In this case, the same degree of criterion competence is achieved, but only after the individual has invested more time and effort than that typical of people without the deficit. Notice that the presumed compensatory activity is not at the level of constituents of the criterion behavior, but instead is at a higher level concerned with what is responsible for, or enables, the changes in the relevant mechanisms. The question therefore arises as to whether alterations at different levels should be considered examples of compensation.

One possible interpretation is that compensation necessarily involves changes at the same level as the behavioral deficit. For example, Bäckman and Dixon suggested that there is some consensus in the view of compensation as overcoming a behavioral deficit by an increase of some other behavioral component. The implication of this particular interpretation is that the deficit and the compensatory component are at the same level. Other levels, both higher (e.g., motivation) and lower (e.g., neurophysiological), are interesting and ultimately need to be understood—but, at least from this perspective, they may not be central to the question of how competence in a given criterion activity is achieved.

An alternative view of *compensation* is that the term is applicable whenever some type of deficit is not associated with expected limitations in relevant aspects of behavior. In other words, the level at which potential consequences of the deficit are overcome may not be germane to the classification of a phenomenon as compensation.

The issue of the level of analysis is particularly relevant in the present context because at least two different types of mechanisms could be affected by increased time or effort, and yet it is debatable whether either of them would be considered examples of compensation. To illustrate, one possibility is that the greater time and/or effort served to eliminate the initial deficit, and if the deficit has truly been remediated, there may be less need for compensation. That is, to the extent that the initial deficit no longer exists, the individual is not distinct from "normals" without the deficit, and hence the concept of compensation may be superfluous. The term *remediation* has been proposed to apply to situations in which an initial deficit has been eliminated by the investment of more time and/or effort, or by some other means (Salthouse, 1987, 1990a, 1990b).

A second possible outcome of the investment of greater time and effort is a different level of skill, in which the deficient component is no longer

relevant to competence in the criterion activity. In research on skill acquisition, it has been suggested that the components shift in importance as a skill is acquired (e.g., Ackerman, 1989; Anderson, 1982). This could occur because the deficit is only relevant to the initial stage of learning, but not to later stages where other components become more important. Alternatively, the skill could have been compiled such that the efficiency of the component is no longer pertinent to the criterion behavior.

A key feature in both of these interpretations is that the critical component may not be important or relevant to the criterion behavior after the investment of time and/or effort has resulted in a higher level of learning. If this is the case, then at a functional level the deficit no longer exists, and hence there is no need for compensation. It has been proposed that the term *elimination*, or possibly *compilation*, should be used when the deficit still exists but is no longer relevant to the criterion behavior (Salthouse, 1987, 1989, 1990a, 1990b).

The first compensation category mentioned by Bäckman and Dixon (1992) appears consistent with the exchange, balance, or offset mentioned in most definitions of *compensation*. A fundamental aspect of this interpretation is that the same (or higher) level of criterion functioning is achieved by means of different processes or mechanisms. However, several additional issues still need to be considered before one can have confidence in the classification of a phenomenon as involving true compensation. Therefore it may be prudent to treat it as only possible compensation until the phenomenon has been subjected to further examination.

The distinctions discussed earlier are summarized in the flowchart illustrated in Fig. 2.1. It is important to realize that there is not yet any resolution to the issues and questions that have been raised in the preceding paragraphs. Nevertheless, representing potential alternatives in the form of a flowchart raises the possibility that the term *compensation* may be applicable to many fewer situations than is sometimes assumed. At the very least, consideration of how the concept of compensation is distinct from other concepts should serve to clarify the meaning—by increasing the discriminative validity, of this term.

#### FURTHER ISSUES

If the alternatives of accommodation, remediation, and elimination or compilation of the critical component are ruled out, what additional issues need to be considered before deciding that a phenomenon is true or genuine compensation? Six issues relevant to the interpretation of compensation are discussed in this section. The issues are framed in the form of questions about the nature of compensation. No particular resolutions will be advo-

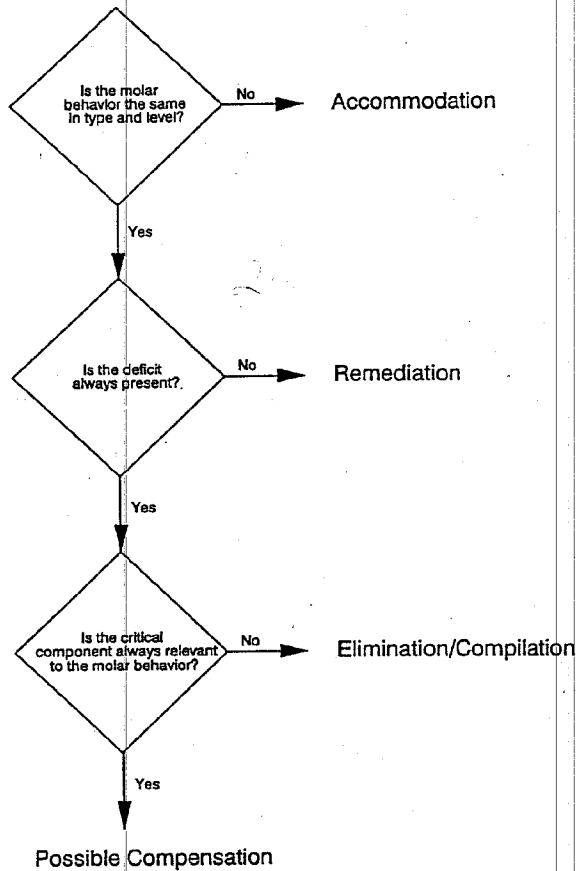


FIG. 2.1. Flowchart that might be used to distinguish compensation from other related concepts.

cated, but they are raised because of a belief that some consensus on all of them is necessary before the concept of compensation can be considered useful and meaningful.

### Identification of the Compensatory Component

Must a behavioral component or aspect associated with increased proficiency be identified in order for a phenomenon to be classified as involving compensation? This question originates from a logical analysis of what presumably occurs when compensation exists. That is, if the same (or higher) level

of criterion functioning is maintained and yet there is a deficit in a critical component, there is presumably a gain in some other component or aspect. Therefore, it seems reasonable to ask whether the phenomenon would still be considered an example of compensation if the compensating mechanism cannot be identified. In effect, the concern represented by this issue is whether we are justified in believing that compensation is involved if we cannot specify how the compensation is achieved.

On the one hand, it could be argued that some type of compensation must be operating if: (a) a deficit exists in a relevant behavioral component; (b) a high level of functioning is achieved in the criterion activity; and (c) the alternatives of accommodation, remediation, and elimination/compilation have been ruled out. On the other hand, it is not satisfying to invoke the concept of compensation when there is little understanding of what is actually doing the compensating.

#### **Causal Ordering of Gains and Losses**

Must the loss in the deficient component necessarily occur prior to the gain in the presumed compensatory component? This issue is of interest because several possibilities are inconsistent with the assumption of causality that seems to be implicit in the concept of compensation. For example, the gain could precede the loss, perhaps because the gain caused the loss through some type of suppression (Uttal & Perlmutter, 1989). Another possibility is that the gain occurred concurrent with the loss, but that the gains and losses are independent and unrelated phenomena and not involved in a causal relationship with one another (Uttal & Perlmutter, 1989). Finally, it is conceivable that some type of selective deterioration could have occurred such that the criterion competence and the efficiency of all components might previously have been at a high level, but a greater loss occurred in the critical or deficient component. In this case, it might be more accurate to refer to small and large losses rather than gains and losses (Salthouse, 1984).

Each of the cases mentioned previously could result in a configuration in which weaknesses or deficits in one or more behavioral components appear to be offset by strengths or gains in other behavioral components. However, in none of these situations does the balancing or counteracting component of behavior develop in response to, or as a consequence of, the behavioral deficiencies. The question therefore arises as to whether a temporal and causal linkage must be established between the onset of the deficit and the emergence of compensatory behavior.

Although it may be preferable to reserve the term *compensation* for situations in which, by means of longitudinal research or other types of evidence, one is confident that the losses preceded, and likely contributed to, the gains, the possibility of functional compensation should also be considered

(Salthouse, 1990a). That is, if a high level of proficiency in one behavioral component allows for the maintenance of competency in a criterion activity despite a low level of proficiency in another component, would this not be considered effective or functional compensation regardless of the origin or temporal ordering of the strength relative to the weakness? Adoption of a functional definition of *compensation* such as this would greatly broaden the applicability of the concept, but in the process the implied causal ordering of a loss producing a gain would be abandoned. Further consideration of this issue is needed to determine whether it is meaningful to refer to compensation when the compensatory behavior has no causal relationship to the deficient behavior for which it is purportedly compensating.

#### **Awareness of the Deficit**

Must the individual be aware of the deficit and take deliberate action to compensate? In other words, is compensation a conscious and deliberate process, or could it occur relatively automatically and without the individual's awareness? Although the distinction between automatic and deliberate processes can be quite subtle, the question of whether compensation necessarily involves an awareness of a deficit and a choice to engage in potentially compensatory behavior is important for determining the nature of compensation.

Bäckman and Dixon (1992) suggested that compensation may be unlikely if the individual is not aware of the deficit and thus does not make a deliberate attempt to compensate. However, the justification for claiming that compensation could not occur unconsciously is not clear, and adoption of this criterion may severely limit application of the concept of compensation. As a rather mundane example, several years ago I was walking with a taller person who had a much longer stride than me. After several minutes of walking I realized that I was becoming tired because I had been taking many more steps than him in an attempt to keep up with his pace. Changing the manner in which the criterion behavior—in this case, walking at a given speed—is achieved seems to meet most of the criteria associated with compensation. However, in this case I was not immediately aware that I had altered my walking pattern, and therefore this example would presumably not qualify as compensation if a criterion of awareness and deliberate decision were to be employed.

#### **Locus of the Compensatory Mechanism**

Must the compensatory mechanisms be internal to the individual, or could reliance on external aids or prosthetics be considered compensation? Dixon and Bäckman (1992–1993) suggested that the use of external memory aids, such as notes or even other people, could be considered compensatory

mechanisms. However, two questions immediately arise if an interpretation of this type is adopted: will the criterion behavior remain the same when an external aid or device is used? If so, is it the individual or the external aid that is doing the compensating?

As an example, consider a situation in which a business executive with a poor memory relies on a secretary to remember all of the former's appointments. The desired criterion behavior of not forgetting the appointments may be achieved by this strategy, but is it accurate to refer to this as compensation? It could be argued that the delegation of behavior to another person is not compensating for a deficit within the individual, but instead is an instance of accommodating to the deficit by shifting responsibility and essentially altering the nature of the criterion activity. That is, in this example, the behavioral deficit within the individual is not offset by an increase in some other aspect of her behavior. Instead, the goal of attempting to remember appointments herself is effectively abandoned, and thus responsibility for that particular type of competence is assigned to another individual.

One possibility is that the term *compensation* should be limited to situations in which the individual takes an active role in the compensatory process, and not to those in which a barrier is removed, such as providing eyeglasses to correct a visual deficiency (Salthouse, 1990a). The difficulty with this suggestion is that it is not always clear when an individual is taking an active role, nor what constitutes a barrier. Provision of corrective lenses may not require any action on the part of a mildly visually impaired individual, but the use of a visual-tactile substitution device almost certainly requires special action on the part of a blind individual. In both cases, individuals with deficits in a relevant component of reading behavior can accomplish the global activity of reading written materials because a sensory barrier is removed, but it is not obvious that compensation is involved in each instance.

### **Uniqueness of Mechanisms**

Must the compensatory mechanisms be restricted, or unique, to individuals with a deficit, or can they also be evident in normal individuals? If they can occur in people without a deficit, what is the basis for identifying them as compensatory? Would the exact same behavior in a person without a deficit be considered compensation? If so, what deficiencies are being compensated? A key issue in this context is whether the behavior of the compensating person must be qualitatively or quantitatively distinct from that of a normal person.

Uniqueness of the compensatory mechanisms is clearly a complex issue. However, it is also a critical one for the concept of compensation because it concerns a fundamental aspect of what is meant by compensation. That



is, if the compensatory mechanisms are effective, why are they not used by normal individuals who do not have a deficit? Are there substantial costs in the acquisition or utilization of the compensatory mechanisms that reduce their value to individuals without a deficit? Or are these mechanisms only possible when a deficit is present? If the latter is the case, what is there about the presence of a deficit that enables the use of mechanisms that apparently facilitate competence in a particular domain?

### Composition of Competence

Is the same level of criterion competence achieved by an altered importance of the components, or by different levels of the components (Salthouse, 1989, 1993)? This distinction can be clarified by expressing the relationship between the criterion behavior and the components in the form of a regression equation.

$$(1) Y = b_1X_1 + b_2X_2 + c$$

Assume that of the two components relevant to the criterion behavior  $Y$ , one group of individuals has a deficit in component  $X_1$ . It is logically possible for the same criterion level of functioning ( $Y$ ) to be achieved with a deficit in  $X_1$  either by altering the regression weights for the two components (i.e., decreasing  $b_1$  and increasing  $b_2$ ) or by increasing the level of  $X_2$ .

One characteristic often mentioned in connection with the concept of compensation is that the behavioral profile (Bäckman & Dixon, 1992) or the composition of the competence (Salthouse, 1990a) differs between normal and compensating individuals. The question of interest in this context is whether both of the alternatives mentioned earlier fit this criterion and should be considered instances of compensation. That is, is it compensation if the same mechanisms—in the sense of relative importance of the components—are used? Or should the term *compensation* be reserved for situations in which individuals with and without the critical deficit achieve similar levels of functioning with different mechanisms, perhaps as reflected by different coefficients in a regression equation?

### TWO CASE STUDIES

The relevance of the preceding issues to research on compensation can be illustrated by considering their applicability to two research projects from my laboratory. Both projects involved adults of different ages as the research participants, and in each the primary behavioral deficit of interest was processing speed as measured by tests such as finger-tapping rate, choice reaction

time, digit-symbol substitution time, or perceptual comparison time. Previous research has revealed that increased age is associated with lower levels of performance in a wide variety of speeded tasks (see Salthouse, 1985, for a review). It also was assumed that for many older adults, slower speed functioned as a behavioral deficit in certain criterion activities.

In the first project (Salthouse, 1984), the criterion activity was transcription typing. Processing speed was presumed to be relevant to this activity because the rate of typing is dependent on the speed with which the typist can execute appropriate keystrokes. Research participants in this project were deliberately selected so that there was no relationship between age and proficiency in the criterion behavior (i.e., speed of typing). This was an important feature of the design because it allowed a determination of how typists of different ages were able to achieve the same level of molar or criterion functioning, despite a deficit in a relevant component on the part of older typists. Obtaining a sample in which there was no relationship between age and typing speed typically requires a positive relationship between age and experience. However, this is not a problem in this type of design because the interest is not in the source of the compensatory mechanisms (e.g., experience or other factors related to age), but rather in their identity or nature.

The goal of the Salthouse project was to identify how older typists could perform at the same level as young typists despite a slower processing speed, as reflected by measures such as finger-tapping rate and choice reaction time. Several possible compensatory mechanisms were investigated in this project, including dependency on sequential constraints in language and efficiency of different types of keystrokes (e.g., those on the same hand vs. those on different hands). The only measure in which age-related increases were found was the eye-hand span, which represented how far ahead of the current keystroke the subject was processing the to-be-typed text. This span was measured by varying the amount of to-be-typed text while the individual was typing, and then determining the amount of visible text needed to maintain one's normal rate of typing. In both of the studies reported in Salthouse (1984), older typists were found to have larger eye-hand spans than younger typists. These results were recently replicated by Bosman (1993).

One of the interpretations originally proposed to account for the observed pattern of results was that the older typists might have been compensating for their slower perceptual-motor speed by expanding their span of anticipation. That is, older typists appear to begin their processing of to-be-typed characters farther in advance of younger typists, thereby minimizing the consequences of their slower processing speed.

Let us now reexamine this phenomenon in terms of the issues discussed in the preceding sections. It is convenient to begin by considering the issues portrayed in the flowchart in Fig. 2.1. Because the design of the study

ensured that the average level of competence in the criterion activity was equivalent across the age range, we can rule out the possibility of accommodation as an interpretation of this phenomenon. Furthermore, because the age-related difference in the speed measures was present even among the most skilled typists, we can rule out that the deficit was remediated through extensive experience or some other means. Although no pertinent data were reported, it seems likely that measures of perceptual-motor speed were still relevant to typing performance even at high levels of typing proficiency, and thus the interpretation of elimination or compilation also seems improbable in this situation.

What about the other issues relating to the identification of a phenomenon as compensation? In the Salthouse (1984) project, the anticipation or eye-hand span was identified as a possible compensatory mechanism because it was found to be larger among older typists than younger typists of the same skill level. However, the causal ordering of the increased eye-hand span and slower perceptual-motor speed is not known because no longitudinal data were available. Therefore, it is possible that the increased span and decreased speed were independent and unrelated phenomena, or that selective deterioration occurred because of a decrease with increased age in perceptual-motor speed, but not in eye-hand span. No data were collected with regard to whether the older typists were aware of their deficit in perceptual-motor speed, and there was no evidence that any of the typists deliberately decided to expand their eye-hand span as a compensatory mechanism.

Because the increased eye-hand span is a mechanism within the individual, the presumed compensation is not attributable to a reliance on external aids. The hypothesized compensatory mechanism is not unique to individuals with a speed deficit because several fast younger typists in the studies also exhibited large eye-hand spans. Finally, no direct statistical tests were conducted to compare the regression equations of younger and older typists, but the pattern of an age-related decrease in perceptual-motor speed and an age-related increase in eye-hand span is consistent with the interpretation of a different composition of the competence for adults of different ages.

Does this phenomenon qualify as compensation on the basis of the information presented earlier? Although it does not appear to be accommodation, remediation, or elimination/compilation, there are several respects in which the phenomenon appears inconsistent with potential criteria for compensation. That is, the causal linkage between the deficit and the presumed compensatory behavior is unknown, as is the awareness of the individual of his or her deficit and of the compensatory behavior. Furthermore, similar levels of the hypothesized compensatory mechanism were observed in normal individuals, and hence it was not unique to those with a deficit.

In a second project (Salthouse, 1993), the criterion behavior consisted of performance in timed verbal activities, such as anagrams, creating words by

placement of letters in specified spatial locations, switching from one word to another by altering one letter at a time, and various fluency tasks. The presumed deficient component was processing speed as measured by perceptual comparison tasks, and the component expected to play a compensatory role was word knowledge as measured by performance on two vocabulary tests. Samples of younger and older adults were therefore administered two perceptual comparison speed tests and two vocabulary tests, in addition to several timed verbal tasks.

Of primary interest in this project were the regression equations which related the speed and vocabulary measures to prediction of performance in the criterion verbal tasks in the younger and older age groups. The key question was whether younger and older adults differed with respect to the weightings of speed and knowledge, or only in terms of the average levels of each variable.

Similar results were obtained across eight criterion tasks and two independent samples. In each case younger and older adults were found to differ primarily in terms of the average levels of the components, and not with respect to the regression coefficients. That is, on the average, older adults were slower and had greater knowledge of word meanings than younger adults, but the two groups did not differ significantly in the coefficients relating either speed or knowledge to criterion performance.

Now consider the application of the issues discussed earlier to these results. Because younger and older adults were fairly similar in their average performance on most of the criterion tasks, there is no evidence that the older adults accommodated to their speed deficit by shifting the nature of the activity performed, or by altering the level of performance in that activity. The speed deficit was always present, and therefore the possibility of remediation can be ruled out. There was no direct examination of the relevance of speed to performance on the criterion tasks among the highest performing individuals, but there seems little reason to suspect that the critical components were no longer relevant because they had been eliminated or compiled. In terms of the flowchart in Fig. 2.1, therefore, it appears that this phenomenon would be classified as *possible compensation*.

The remaining issues can be examined to determine whether the phenomenon qualifies as true compensation. A greater quantity of relevant knowledge was identified as the probable compensatory component in this project, but no information was available about the causal ordering of the increase in knowledge and the decrease in speed. However, it seems highly improbable that the decrease in speed caused or contributed to the increase in word knowledge. Furthermore, although no information was available about the older adults' awareness of their slower perceptual comparison speed, it is unlikely that they would have decided to increase their vocabulary to be prepared to perform well in future tests requiring both speed and

word knowledge. The locus of the hypothesized compensatory mechanism was internal because it is assumed to be increased knowledge of word meanings. Possession of high levels of knowledge about word meanings was not limited to older adults with a deficit in speed, however, and thus the hypothesized compensatory mechanism is not unique to individuals with a deficit. Finally, direct statistical comparisons revealed that younger and older adults did not differ in the coefficients or weightings of speed and knowledge in the prediction of performance in the criterion tasks, but instead differed in the average levels of those variables.

Again it is ambiguous whether the phenomenon should be considered an example of compensation. The small to nonexistent age differences in the criterion verbal tasks, despite large age-related differences in the measures of processing speed, do not seem attributable to related concepts such as accommodation, remediation, or elimination/compilation. However, there is no evidence of a causal connection between the deficit and the presumed compensatory behavior, nor of any awareness of the deficit or possible compensatory actions. The hypothesized compensatory mechanism was not restricted to individuals with a deficit in the critical component, and direct evaluation revealed that groups with and without the deficit did not differ in the relative importance, or weightings, of the relevant behavioral components.

The purpose of examining these two phenomena in terms of the issues discussed herein was to illustrate that classification of a phenomenon as involving compensation is neither straightforward nor unequivocal. In each of the cases described, arguments could be made both for and against invoking the concept of compensation. Until this ambiguity is eliminated by resolution of the issues mentioned, *compensation* may be a term with more popular appeal than scientific value.

### CONCLUSION

It should be apparent by now, if it was not already, that compensation is a complex concept. Although it represents an intriguing and appealing idea, the term *compensation* has been used in an inconsistent, and often confusing, manner. I have suggested that a number of issues need to be carefully examined and resolved for the concept of compensation to be meaningful and useful in scientific discourse. This chapter does not exhaust the list of relevant issues, nor was any attempt made to provide a definitive resolution of any of the issues that were discussed. Nevertheless, my hope is that the process of raising some of these issues will eventually lead to the refinement of one of the most interesting, and potentially important, concepts in the field of psychology.

## REFERENCES

- Ackerman, P. L. (1989). Individual differences in skill acquisition. In P. L. Ackerman, R. J. Sternberg, & R. Glaser (Eds.), *Learning and individual differences: Advances in theory and research* (pp. 165-217). New York: Freeman.
- American Heritage Dictionary of the English Language* (3rd ed.). (1992). Boston: Houghton Mifflin.
- Anderson, J. R. (1982). Acquisition of cognitive skill. *Psychological Review*, 89, 369-403.
- Bäckman, L. (1989). Varieties of memory compensation by older adults in episodic remembering. In L. W. Poon, D. C. Rubin, & B. A. Wilson (Eds.), *Everyday cognition in adulthood and late life* (pp. 509-544). Cambridge, England: Cambridge University Press.
- Bäckman, L., & Dixon, R. A. (1992). Psychological compensation: A theoretical framework. *Psychological Bulletin*, 112, 259-283.
- Bosman, E. A. (1993). Age-related differences in the motoric aspects of transcription typing skill. *Psychology and Aging*, 8, 87-102.
- Dixon, R. A., & Bäckman, L. (1992-1993). The concept of compensation in cognitive aging: The case of prose processing in adulthood. *International Journal of Aging and Human Development*, 36, 199-217.
- Salthouse, T. A. (1984). Effects of age and skill in typing. *Journal of Experimental Psychology: General*, 113, 345-371.
- Salthouse, T. A. (1985). Speed of behavior and its implications for cognition. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (2nd ed., pp. 400-426). New York: Van Nostrand Reinhold.
- Salthouse, T. A. (1987). Age, experience, and compensation. In C. Schooler & K. W. Schaie (Eds.), *Cognitive functioning and social structure across the life course* (pp. 142-150). Norwood, N.J.: Ablex.
- Salthouse, T. A. (1989). Aging and skilled performance. In A. Colley & J. Beech (Eds.), *The acquisition and performance of cognitive skills* (pp. 247-264). Chichester, England: Wiley.
- Salthouse, T. A. (1990a). Cognitive competence and expertise in aging. In J. E. Birren & K. W. Schaie (Eds.), *Handbook of the psychology of aging* (3rd ed., pp. 310-319). San Diego, CA: Academic Press.
- Salthouse, T. A. (1990b). Influence of experience on age differences in cognitive functioning. *Human Factors*, 32, 551-569.
- Salthouse, T. A. (1993). Speed and knowledge as determinants of adult age differences in verbal tasks. *Journal of Gerontology: Psychological Sciences*, 48, P29-P36.
- Uttal, D. H., & Perlmutter, M. (1989). Toward a broader conceptualization of development: The role of gains and losses across the life span. *Developmental Review*, 9, 101-132.