

An Apparent Order of Sensory Ability Changes in Human Beings

Introduction

This research report will present the isolation of an order in human beings. The presentation of an observed order of sensory ability changes may or may not be important. The order of sensory ability changes will be called an apparent order because it was isolated when records and personal documents of 154 human beings were examined. The examination will be described later.

Two groups of readers are the primary targets of this presentation. The first is young members of the affected disciplines who might perform research that either replicates the research done in the isolation of the apparent order or perform other research strategies on a broad sample. The second group of readers that is targeted is educators and others engaged in fields relating to education who might describe the changes in education that will be recommended if the apparent order is found to be significant and supportable or if it leads to work that does isolate an order that is supportable and significant.

A third group of readers is, of course, anyone who is interested, but there are so many ifs and ands that this group of readers—anyone who happens to read the report—should be cautioned about waiting for someone to support the apparent order before he believes that the apparent order exists in the lives of human beings. The apparent order exists in the lives of the members of the sample that was examined, but it may not be the only order of sensory ability changes that human beings experience. It appears to be the only order that the members of the sample experience, but it is called an apparent order because others have not yet had an opportunity to see if it is experienced by members of other samples.

This apparent order of sensory ability changes has not been presented. There was a time in psychology, when John Dewey was lavishing his blessings on the broadest group of researchers, when a great many such orders were presented. Those presentations, which were often elaborate and frequently tied to some prediction that they made evolutionary sense, gave all such orders that might be proposed a bad name. Since then psychologists have avoided anything that hinted of any such order, and in the face of the failure of those early orders, the discipline probably chose the right tack.

The sample that was examined will be described later. Considering the number of human beings there are, a few hundred is a very small sample. Furthermore, the sample has other limitations which will be touched upon later in the section about the sample.

If the apparent order is indeed an order through which human beings move and fail to move, it will open new opportunities for research in the human sciences. A reader may ask how anyone could believe that any such order could exist and not have been described. The answer is that two qualities that distinguish the apparent order might have kept it from being described: the first of these is that the changes in the apparent order while they appear to be experienced in the one order may be truncated and the second is that one of the changes may apparently be skipped. Truncation will be discussed later, and when the apparent order is presented, the change that may be skipped will be described. The nature of the investigation in which the apparent order was isolated may

allow an investigator to see an apparent order where none was identified. The investigation will be described later.

The presentation of new work in science is almost always the presentation of observations that have not previously been made. Such presentations are, upon first presentation, almost always wrong. It is the business of science to select the new work that holds promise of the advancement of knowledge and through examination and experimentation correct the new work so that it provides new understanding.

The apparent order is presented as if it were one order through which human beings move or fail to move. It is so presented because those members of the sample who did not appear to experience the one order are very small in number. It is also presented in that way because a wide variety of human beings—members of many language groups—appear to move through the one order or fail to move through it. The apparent order may not be the only order that human beings move through although it appears to be the order that almost all of the members of the sample that was examined moved through or failed to move through. The apparent order may be wrong.

If the apparent order is supportable and significant, every researcher who examines the lives of the members of a large and diverse sample will find the same changes in the same progressions.

The apparent order is presented with the knowledge that if it is supportable and significant it will open the way to new work in the human sciences.

Abstract

Examination of records and personal documents of 1309 human beings isolated an apparent order of sensory ability changes, for 154 members of the sample both records and personal documents were available. The five changes in the apparent order are (a) an improvement in auditory perception that always includes an increase in complexity of speech, (b) an improvement in ability to taste or to smell or both and comparative myopia in which the developing human being becomes more near-sighted than he or she has been, (c) an increase in ability to discern and separate aural or visual or aural and visual stimuli simultaneously received, (d) comparative hyperopia, and (e) a marked increase in ability in one or more up to all five of the sensory abilities considered in the research: audition, vision, gustation, olfaction, and touch. Truncation of movement through the order is a salient feature, and the fourth change, comparative hyperopia, may be skipped. If the apparent order is significant and supportable, it may lead to new, productive research in many affected disciplines.

Sensory ability changes are the subject of many disciplines. In child development (Dapretto and Bjork, 2000), physiology (Tortora and Anagnostakos, 1991), neurology (Pujol et al., 2006), and the auditory and visual sciences, sensory ability changes are treated often or occasionally. However, no linear order of sensory ability changes has been proposed.

In the research reported here a linear order of sensory ability changes was observed. The isolation of an order of sensory ability changes may provide an opening for new and productive research in many affected disciplines. If the apparent order of sensory ability changes is supportable and significant, new opportunities for both description and hypotheses will be available.

Wohlwill (1973) considered the importance of description when he wrote, "... the descriptive phase of the research program ... represents the lowest level of the research pyramid ... If description is important for science generally, it is doubly so in the case of a field whose basic phenomena involve change, as is true of any developmental discipline or any field involving the analysis of change over time."

"Observation and comparison, of course, have always been of paramount importance in biology," wrote Mayr (1985), and he listed other areas of science where observation and comparison and the resulting description have provided a way to promising further inquiry. Description is necessary to the formulation of "if-then" statements (Rudner, 1966) and testable statements (Hempel, 1966).

Some commentators insist that there are too many variables for any progress to be made toward isolation of such an order (Magnusson and Casaer, 1993). The assurance that research in the human sciences need not be any more difficult than research in other areas of inquiry was offered by Magnusson when he wrote, "There is nothing more mysterious or incomprehensible about the dynamic processes of individual development than there is about the subject matters of other scientific disciplines concerned with dynamic processes."

Method

Examination of records has long been a valid and productive method in the medical sciences (Allport, 1961). The guidelines for the use of personal documents to augment records were presented first in psychology by Allport (1942) and then in other social science disciplines—history, anthropology and sociology—by Gottschalk, Kluckhohn, and Angell (1945).

Examination of records poses unsolved methodological problems, but methods generally deemed methodologically superior such as longitudinal research have proven less effective than forecast. For instance, two longitudinal studies long maintained in the United States by Block (1971) and Thomas and Chess (1980) kept no records on sensory ability changes in the populations of the studies.

The use of personal documents to supplement records compounds the methodological problems. Both archival methods and informal sources have limitations. Legibility and comprehensibility are problems, for much of the source material is in longhand and meanings change over time and distance. Moot points and contradictions can never be resolved. The investigator cannot measure; he or she can only tabulate, and few relevant measurements are given. An example of this is the diopters of correction figures that were often supplied for members of the sample to whom lenses were prescribed. Of the 135 members of the sample who reportedly became more myopic than they had been approximately 82 were reported to have worn eyeglasses. Single or multiple diopter of correction numbers were given for 29 or 31 of those for whom spectacles were prescribed. The two groups, those to whom lenses were prescribed and those who wore glasses, were not congruent; some to whom lenses were prescribed never wore them and some wore eyeglasses that were not prescribed for them.

Strengths of the method balance the limitations. “The great advantage of archival research is that it is truly nonreactive,” wrote Bernard (1994), and he described several successful studies that used archival resources.

Strong reinforcement for examination of records and personal documents was given when Hindley (1982) wrote, “The last issue on which I wish to comment is that of the importance of paying attention to what happens to individuals in the course of development. It is only individuals who develop, and processes taking place can only be in individuals. Therefore, in my view, the first aim of developmental studies is not to obtain population norms, but to reveal processes.”

When extensive records and useful augmenting materials are available, effective examination is possible. There are no time constraints, translators and other support personnel can be engaged, and an international sample is available.

The papers that were examined were obtained from libraries and other institutions or from the sample member’s family. The most useful sources were family records, medical records, letters, especially family letters (Dyadic series were rarely available.); biographies, especially those for which the subject’s papers were made available to the author; school records, journals, diaries, and ships logs. Financial records, armed services records, autobiographies, memoirs, and whatever else was preserved were also examined.

The materials for one member of the sample or for a group of members of the sample were collected. Then a list of events in each life was compiled. An event was defined as

what the sample member did or what was done to him or her; this limiting definition was necessary to prevent the inclusion of events from the lives of others.

These events from the lives of the members of the sample were listed in as near chronological order as could be ascertained from the materials. Contradictions in time were started and entered in both places in the lists. Ordinary meals, unremarkable nights sleep and bowel and urinary information were not listed.

Records were assumed to be reliable unless proven unreliable. When the meaning of a word or expression that appeared to be important was not known nor found in standard or specialized reference materials, someone from the sample member's geographical area was often consulted. The contact often consulted an older person or historians of the area. Local physicians were used as consultants for interpretations of regional and archaic descriptions of medical conditions. Records that were too slight or too extensive were avoided.

When a widely varied sample is the goal, when early childhood records and supplementary materials are sought, and when family group records are prized, the researcher often works from partial records, and the important activity is to process the partial and the more complete records exactly alike toward a goal of "empirical, that is, based on careful and systematic observation." (Wade and Tavis, 1993)

Sample

The members of the sample were normal human beings, defined as human beings capable of learning human language, spoken or signed. Those whose records were examined numbered 154: 54 female, 100 male. They came from 11 of the 13 language families enumerated in the "Oxford Atlas of the World." Their birth dates ranged from 1742 to 1948 with the great majority born in the 19th century.

The sample is a purposive (Arkin and Colton, 1956; Bernard, 1994) sample for whom records and personal documents were available for examination. The sample members in the beginning of the research project were chosen because they were mathematically able.

The members of the sample spoke 24 native languages. The sample is heavily weighted with those whose native languages were English or German. The 10 native languages that were represented in the sample with more than two members were English 87, German 14, French 8, Russian and Chinese each 5, and Spanish, Italian, Japanese, Hindi, and Dutch each 3. All shapes of the head, all major skin colors, and all Landsteiner blood groups (Montagu, 1961; Jurmain, et al., 1999) were represented in the sample along with two blind and three deaf. The sample members were from all the inhabited continents and several islands.

This core sample of 154 members includes those whose records and personal documents were available for examination. Hundreds more papers from human beings' lives were examined, but those were either too extensive to be used because it would have taken years to examine the whole record or too brief to be considered. There is no such thing as a complete record of the life of a human being. Among the hundreds of papers that were examined and were not included in the core sample were many for whom there were medical records but no personal documents and those for whom there were personal documents but no medical or school records. Also in the big group that might be called the flimsy sample were numerous accounts of sensory ability changes. This flimsy sample also included one large group of human beings for whom the only source was a set of ophthalmologists' records. For this group neither other records nor any personal documents were available. This flimsy sample numbered 1155.

Results

Of the 154 members of the sample 152 appeared to move or fail to move through the order of sensory ability changes. This order is a macro-order, overriding sensory ability changes that occur in small increments (Mueller, 1965).

Two elements that may have made the observation of the apparent order possible were, first, truncation, and, second, the possibility that a sensory ability change may be skipped. Both were part of the observations. Truncation is a salient feature of the movement through the order. Movement through the order can apparently be truncated before any of the changes have been experienced or after any one of the changes. Also movement through the order may be arrested for years over the average time between changes.

The apparent order of sensory ability changes is in contrast to the usual order in human development. According to Salkind (1985), an order in human development is traditionally defined as a straight-line list with no skips or variations in the series. However, in the apparent order the fourth change may apparently be skipped with some members of the sample moving directly from the third change to the fifth change. The truncation is also in contrast to the traditional order in human development. Further, according to Shepard (1987), there is no background belief in any such order.

The Apparent Order

The five changes in the apparent order are (a) an improvement in auditory perception that is always accompanied by a marked increase in complexity of speech, (b) comparative myopia in which the sample member became more myopic than he or she had been and an improvement in ability to taste or in ability to smell or in both, (c) an increase in ability to discern and separate aural or visual or aural and visual stimuli simultaneously received, (d) comparative hyperopia in which the sample member became more far-sighted than he or she had been, and (e) a marked increase in ability in one or more, up to all five, of the sensory abilities considered in the research: audition, vision, gustation, olfaction, and tactile perception (touch) (Cholewiak and Collins, 1991).

This sequence of five changes has been called an order after Von Wright (1960), for all those in the sample who appeared to experience the second change had apparently experienced the first change, and all the members of the sample except two who appeared to experience the third change had apparently experienced the second change, and all those who appeared to experience the fourth and fifth changes had apparently experienced the third change.

Six members of the sample appeared to experience none of the sensory ability changes in the apparent order. Because life records of these members of the sample, excepting medical and school records, appear to be recorded and preserved only rarely, five members of this group were siblings or childhood associates of other members of the sample, and the other was a male sports figure of the early 20th century. There is no evidence that any of the six who appeared to experience none of the changes became functionally literate. This observation must be tempered with a statement that learning to read where and when they lived was often deemed not very important, but the sibling or childhood associate of the five learned to read.

An additional 44 who appeared to experience none of the sensory ability changes were observed in the flimsy sample.

The First Change

The first sensory ability change in the apparent order appears to be an improvement in auditory perception. The increase in ability to hear is always accompanied by a marked increase in complexity of speech. This spurt in articulation is well-known among child development researchers and has been much discussed in the past 25 years (Dapretto and Bjork, 2000). The increase in complexity of speech was indicated by the sample member's beginning to use polysyllabic words or combinations of monosyllabic words. The improvement in the sample member's ability to hear was most often noted in vocal interchanges or in his or her hearing animal or transportation sounds not heard before.

Although the spurt in articulation is an accepted reality among child development researchers, theorists, and editors, there are some investigators, among them Bloom (2000), who insist that there is no such thing as a word spurt. However it was reported in the records or personal documents of 88 of the 148 members of the sample who appeared to experience the first change.

The range of ages at the time of this first change was from 13 months to 39 years; median: 1 year 7 months. A further statistical description of the ages at the times of the first change and the ages at the times of the subsequent changes also shows a positively skewed distribution. When an adaptation of the standard deviation (Wike, 1971) is applied to the range of ages at the time of the first change, the positive skew is illustrated: one standard deviation: 1 year 4 months to 2 years 7 months; two standard deviations: 1 year 2½ months to 3 years 2 months.

In the flimsy sample an additional 800 examples of this change were observed.

The Second Change

The second sensory ability change in the apparent order is an improvement in ability to taste or in ability to smell or both and comparative myopia (Swanston and Wade, 1991) in which the sample member became more near-sighted than he or she had been. In informal sources gustatory and olfactory perception are difficult to separate. Wolsk (1967) explains, "Taste and smell are, of course, closely related."

Max (2008) writes, "Taste is the orphaned sense. Even among those interested in the field, it plays sidekick to smell. 'Taste is a waste, the action's in olfaction' goes the quip. Few researchers study it, and when they do it is usually for the food industry. But such efforts are built on very little basic science. The bodily processes behind taste—how information begins in the taste buds and then is sent via nerves to the brain, to be merged with input from the eyes and the nose and formed into a conceptual whole—remains unclear. 'With taste, believe it or not, we're still not actually sure how salty works,' Marcia Pelchat, a researcher on food at the Monell Chemical Senses Center in Philadelphia, says, 'That just amazes me.'"

Myopia, of course, has been studied for a long time, but opinions about its cause and whether or not it can be treated have been widely varied over the course of its long reign as a subject of interest.

The range of ages for the beginning of the second change is from 4 years 3 months to 56 years; one standard deviation: 6 years 7 months to 13 years 2 months; two standard

deviations: 5 years 8 months to 20 years 8 months; median: 10 years 11 months. While many of the figures for the age at the time of the onset of each of the sensory ability changes in the order are approximate, the age figures for the onset of myopia are particularly inexact, but in a uniform way. The recordings of the visual part of this change were usually made at the time of or shortly after situations where near-sightedness was noticed—the opening of school terms, the beginning of planting, sports or hunting seasons, and at the resumption of outdoor activities in climates with extreme winter or summer temperatures.

For the 135 members of the sample who became more myopic than they had been neither congenital myopia (Francois, 1961) nor the night myopia that frequently occurs under conditions of low illumination (Curtin, 1985) was considered important. In the flimsy sample another 160 examples of this change were observed.

The Third Change

The third change in the observed order is an increase in ability to perceive and separate aural or visual or aural and visual stimuli simultaneously received. The number of members of the sample who appeared to experience this change is 94. The age range for this third change was 6 years 1 1/2 months to 42 years 11 months; one standard deviation: 11 years 9 months to 14 years 9 months; two standard deviations: 10 years to 21 years 1 month; median: 12 years 9 months.

The evidence for this change when it was visual was most often in the sample member's seeing irregularities of many kinds or in observation of the night sky or in observation of weather. The auditory change was usually indicated in the sample member's ability to hear one certain sound in the din of a machine shop or in the cacophony of an urban setting or in outdoor observation or in music with better identification of specific sounds in combination with other sounds. In the flimsy sample another 50 examples of this change were observed.

The Fourth Change

The fourth change in the apparent order of sensory ability changes is comparative hyperopia (Swanston and Wade, 1991) (Southall, 1937), hypermetropia. The members of the sample who appeared to experience the change became more far-sighted than they had been. In the upper ages the age range may be distorted by the onset of presbyopia, but this would, if an age of 35 years were applied to the onset of presbyopia, affect fewer than 10 of the 50 members of the sample who appeared to experience the fourth change. The lower end of the age range for the fourth change is 10 years 11 months.

In the flimsy sample another 180 examples of the fourth change were examined.

The Fifth Change

The fifth change is a marked increase in ability in one or more, up to all five, of the sensory abilities considered in the research: vision, audition, olfaction, gustation, and touch (Heller and Schiff, 1991). In three members of the sample improvement in all five considered sensory abilities was described. In most of those whose records and personal documents were examined the increase in ability was noted in vision, in auditory perception, or in both.

The number of members of the sample who appeared to experience this fifth change is 58. The range of ages for the fifth change is 9 years 3 months to 48 years 8 months; one standard deviation: 14 years 3 months to 24 years 4 months; two standard deviations: 12 years 10 months to 33 years 7 months; median: 15 years 1 month. In the flimsy sample another 232 examples of the fifth change were observed.

The members of the sample appeared to experience the changes in the apparent order in two progressions: (a) one through five in numerical order and (b) one, two, three, five and then four. Six members of the sample appeared to experience none of the changes. The first change only was apparently experienced by 11 members of the sample. The first and second changes only were apparently experienced by 43 members of the sample, and 14 sample members appeared to experience only the first, second, and third changes. Nine members of the sample appeared to experience only the first, second, third and fourth changes, and the first, second, third and fifth changes only were apparently experienced by 17 sample members. The whole order was apparently experienced by 41 members of the sample: 28 in numerical order and 13 with the fourth change after the fifth.

Neither gender nor ability to see nor native language nor skin color nor Landsteiner blood group nor shape of the head nor geographical area of origin appeared to assure passage through the apparent order or to deny possible movement through the order.

Discussion

The number of members of the sample who appeared to experience each of the changes in sensory abilities indicates only how many examples were seen in the research. Because the research employed purposive sampling and also because some sample members were selected because they were mathematically able, no generalizations can be made either from the number of those whose records and personal documents were examined who appeared to experience a change or from the number who appeared to have their movement through the order truncated. The valid comparison is between one sample member at one time and that same sample member at another time.

The fifth change may be an increase in ability in all five of the considered sensory abilities and the limitations of the materials examined make the change appear to affect only one or two of the sensory abilities in most members of the sample.

Myopia and Other Visual Changes

Standard references such as McDowell's (2004) mostly agree that "most vision problems, such as nearsightedness and farsightedness, are hereditary."

According to Holt (2007), "All that is common sense. But common sense has not always proved to be such a good guide to understanding the world." Overcoming what appears to be evident is the first task of anyone providing an alternate view of how the world works.

The extent of myopia may be hereditary. In families where myopia appears to be hereditary patterns may be repeated.

In the apparent order no one who had not experienced the first change appeared to experience the second change, a part of which is usually myopia.

Whether the two members of the sample who appeared to move from the first change to the third change without appearing to have experienced the comparative myopia part of the second change are the results of limitations of the materials examined cannot be known from so little evidence. The two who appeared to experience this move without any recording of the comparative myopia is certainly an insignificant number in comparison to the 30 members of the sample who appeared to skip the fourth change.

The cause of myopia is a moot point in ophthalmology (Fledelius, Asbirk and Goldschmidt, 1981). Some ophthalmologists argue that myopia is hereditary; others believe that myopia is developmental. Most psychologists choose one view or the other, but some psychologists present arguments that myopia is caused by the close work required of pupils and students in the developed countries.

The second change may provide a base for the argument that myopia is generally developmental. The question is of some importance for a survey (National, 1989) gives the estimate that 25 percent of adults in the United States is myopic, and surgical correction of myopia has become commonplace.

Mathematics and Arithmetic

No one talks about arithmetic. The mathematics education journals do not talk about arithmetic. They call it all math, and they are not alone. Arithmetic seems to have left the language of ordinary people—elementary students and their parents, both active and retired teachers, and the general public—as well as the math ed journals.

Arithmetic and mathematics are not the same thing. The dictionary definition of arithmetic is “the mathematics of integers, rational numbers, real numbers, or complex numbers under addition, subtraction, multiplication and division.” The dictionary definition of mathematics is “the study of the measurement, properties, and relationships of quantities using numbers and symbols.” The base “to count” applies to arithmetic, and the base “to learn” applies to mathematics.

Practically arithmetic is dealing with numbers in the way that elementary school children, accountants, and most of the general public do. Mathematics is dealing with concepts that are not involved in arithmetic.

Part of the loss of the word arithmetic stems from the movement to incorporate math concepts into the teaching of arithmetic that began in the 1960s in the courses on arithmetic teaching and was called “the new math.”

None of this would matter here were there not a place in the apparent order where the learning of mathematics appears to become much easier for some whose papers were examined in the research project. But there is such a place in the apparent order, and arithmetic learning does not appear to be affected by the third change.

Cognitive changes, defined as changes in the way a person learns or thinks, appear to accompany the physiological sensory ability changes in the apparent order. Those members of the sample who appeared to experience the first change became better able to memorize and learned more easily what was presented to them orally. They appeared also to have gained some component of the ability to become functionally literate. The cognitive change that appeared to accompany the second change allowed those who experienced it to become better able to learn what was presented to them visually and what they wrote or drew. The cognitive change that appeared to accompany the third change was the ability better to extract component parts from systems. If these sample

members were, after the third change, members of a cultural unit where mathematics (not arithmetics) were taught, they were better able to learn them. The cognitive change that appeared to accompany the fourth change was an increase in ability to communicate with other human beings and some other animals, almost always called an increase in ability to teach. The fifth change was accompanied by an increase in invention and by an increase in ability to recall past sensory experience.

The wide age ranges at the times of the changes, the truncation of movement through the apparent order, and the long arrests that are possible before changes may indicate that activities in the human environment cause the changes.

If this apparent order is supportable, every research person who looks at records of the lives of a large and diverse sample or who applies another research strategy to the problem will find the same changes in the same progressions.

If this apparent order is supportable, it will allow some interesting questions to be asked. One of these is whether the apparent order may be an overt and visible system that indicates an underlying succession of changes in the human brain; the sensory organs are the instruments of perception, but it is the brain that processes perceptual information (Tortora and Anagnostakos, 1991). Another question is whether myopia and some other features of the changes are generally developmental.

The first question—Is it supportable?—is the most important, and until it is answered by other investigators, all the other questions must wait. Among these questions are whether the apparent order is a common denominator among human beings (Eisenberg, 1972), whether the apparent order describes one aspect of human development, and whether the order is significant (Eisenberg, 1972) and thus will lead to applications beyond itself. If the apparent order is supportable or leads to description that is supportable, new avenues of productive research will be opened not only in psychology and physiology, and in the visual and auditory sciences, but also in cognitive and behavioral neurology and in other affected disciplines.

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