A Test of the Generalizability of Uznadze's Set Typologies to Mathematical Performance with Grade Six Children

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Curriculum Studiorum

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Abstract of

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The generalizability of Uznadze's set typologies to mathematical performance was tested using 99 grade six subjects (average age, 12 years and 1 month). Uznadze maintains that individuals are characterized by a specific type of set, i.e. a predisposition to act in a certain way. Using a chi-square statistic, it was found that there is no significant relationship between the set typologies determined by the Uznadze Visual Test and the Order of Operations Test. The latter test was constructed by the researcher to detect the presence of set in a mathematical context. It is difficult to account for the lack of a significant relationship between the set typologies determined by the two tests. The Order of Operations Test was examined with reference to the type of questions, the time allowed to answer them, the reliability, and the classification of this test as a qualitative experiment or as an experiment based on equality. All of the above observations could account for

the lack of a significant relationship. Yet, Uznadze's statement that an individual is characterized by a specific type of set was made with reference to quantitative experiments. It is possible that an individual's set typology differs depending on whether the classification is based on quantitative experiments, qualitative experiments, or experiments based on equality. Further research is needed to compare set typologies determined by different kinds of experiments. Some progress was made towards the development of measurement instruments to detect the presence of set in non-quantitative experiments. It was suggested that consideration should be given both to the number of setting trials required to fix a set in different kinds of experiments, and to the optimum range of setting trials, which should be determined on an individual basis. Further research is also needed in the designing of a mathematical measurement instrument to detect the presence of set.

Introduction

In 1966, Uznadze's book, The Psychology of Set, was translated from the Georgian dialect of the Soviet Union into English, and thereby catalyzed interest in set theory among Western researchers. Investigators of the conception of set have debated the degree to which set, a predisposition to act in a certain way, determines behavior. Soviet researchers, basing their work primarily on Uznadze's theory, have given set a primary role in the determination of behavior. Uznadze (1886-1950) maintains that behavior is activated by sets reflecting not only individual mental functions but the state of the subject as a whole. Set is considered to be an underlying determinant of behavior, an integral part of the personality. Western researchers, on the other hand, have tended to regard set as a secondary factor.

Uznadze's theory of set is an outgrowth of tests conducted mainly in the haptic (sense of touch) and visual modalities with adults. This led to a classification of individuals into categories referred to as set typologies. The present study is intended to test the generalizability

of Uznadze's set typologies in the visual modality, to an analogous classification in relation to the mathematical performance of grade six children. It is hoped that this study will contribute specifically to the development of procedures for the study of sets with children.

The philosophical and psychological background of Uznadze's theory, its place in set research, and the definition of the research problem, are introduced in Chapter I. The subjects and the testing procedures are described in Chapter II, while in Chapter III, a presentation and discussion of the results is given. Instructions for the administration of the tests and the resulting data are included in the appendixes.

Chapter I

Review of the Literature

The researcher will present the historical background of set theory leading to the definition of set according to Uznadze. This will be followed by a description of set typologies, a discussion of the research contributions, and a statement of the research problem.

1. The Evolution and Meaning of Set

In this first section, the conception of set will be defined with reference to Western and Soviet psychology. The evolution of Uznadze's conception of set as well as its properties will be discussed.

Set was generally regarded by Western researchers as a secondary aspect of an individual's behavior. Some Western researchers considered set to be a biological phenomenon. Hritzuk (1968, p. 47-48) quoted Freeman (1939) and Dashiell (1949) who explained set with reference to skeletal muscles. Other Western researchers emphasized the psychological aspects of set: set as inflexible behavior (Werner, 1946); set as the product of the closeness of the psychological

regions of man (Kounin, 1948); or set as an organized belief system (Rokeach, 1960). The majority of Western researchers classified set as a biological/psychological phenomenon. For example, Hritzuk (1968) reported Woodworth's (1937) description of set as motive (p. 45), and Hebb's (1949) statement that voluntary acts are conditioned by earlier stimulation (set), and involuntary ones are determined by general physiological conditions (p. 50). Hritzuk (1968) further quoted Luchins' (1942) definition of set as Einstellung or habituation, a biological/psychological tendency to do things in the same way (p. 59); and Allport's (1955) description of set as a specific and selective readiness for action, activated consciously or unconsciously, and resulting from bodily needs, emotions, or from a long-standing personality characteristic (p. 51).

On the other hand, set has a universally accepted definition, that of Uznadze, in the Soviet psychology of Georgia, S.S.R. Of the Western researchers mentioned above, Uznadze's definition of set most closely resembles that of Allport (1955). According to Uznadze (1966, p. 10) set is an underlying, primary determinant of behavior involving the total subject, both mental and physical. It is a

predisposition to act in a certain way. Set is a preparatory stage which is responsible for the specific action of an individual in a specific situation.

Uznadze developed his theory of set by reacting against traditional psychology at a philosophical and experimental level. At a philosophical level, he had three main points of contention. Uznadze (1966, p. vii) disputed the idea that the three basic traditional categories of mental activity: sensation, cognition, and volition, were entirely conscious phenomena. According to him, set is a basic form of mental activity which precedes consciousness. Secondly, Uznadze (1966, p. ix) disagreed with Freud's psychology of the unconscious because in this theory, unconscious phenomena are considered to be essentially the same as conscious phenomena. Thirdly, Uznadze challenged the theories of psychophysical parallelism and interactionism by stating that set is a mediating process between mind and matter. According to the theory of psychophysical parallelism, a physical reaction is the result of a physical cause, and a mental reaction is the result of a mental cause. On the other hand, interactionists maintained that the physical acts on the mental and vice versa, but here too, the

connection is a direct one (Uznadze, 1966, p. 20).

At an experimental level, Uznadze reacted against two viewpoints: Muller's "illusion of heaviness," the most widespread theory explaining Fechner's phenomenon in the early 1920's, and the theory of "disappointed expectations." In 1860, Fechner had simultaneously given his subjects two objects of different weights and found that upon presentation of equal weights, the subjects experienced an illusion, i.e. an incorrect perception. One object was perceived as being heavier than the other. Muller tried to explain this result by stating that upon presentation of the equal weights, the hand that had previously lifted the heavier object used a greater motor impulse causing the hand to "fly upwards." The subject perceived the object in the other hand as being heavier because it had previously lifted the lighter object and now it seemed to "stick" to the table (Natadze, 1969, p. 604). Muller gave the same motor explanation for the "illusion of Charpentier" in which two wooden cylinders of the same weight but of different sizes were raised by means of a cord. The subject perceived the larger cylinder as being lighter because a greater heaviness was expected (Natadze, 1969, p. 605).

Uznadze doubted Muller's explanations because he considered set to be an integral condition of the subject rather than a muscular phenomenon. He devised an experiment involving a non-motor illusion in which the subject was to compare the weight of a pair of boxes equal in weight but different in size. The comparison was to be made via pressure exerted by these boxes on the subject's hands by means of a Wundt balance. The hand did not "fly upwards" but the illusion occurred (Natadze, 1969, p. 605).

Uznadze also studied the work of Khmaladze (1938) who conducted haptic tests using wooden balls. The subject who had experienced a number of trials with wooden balls equal in weight but different in size experienced an illusion upon the presentation of equally-sized balls. Uznadze perfected these haptic experiments and then devised experiments which involved neither motor impulses nor tactile sensations to measure the phenomenon of illusion. With the aid of a tachistoscope, the sweeping motion of the eye was eliminated since the objects completely fitted into the centre of the field of vision. Although a kinesthetic base for the perception of size was considered to be excluded, the subject experienced an illusion (Natadze, 1969, p. 607).

Uznadze found further support for his refutation of Muller's theory in the work of Adamshvili (1941) and Khachapuridze (unpublished). Adamshvili worked with sound and color intensity while Khachapuridze experimented with the perception of the number of dots in a circle (Natadze, 1969, p. 608). Once again, illusions took place in the absence of muscular impulses or tactile sensations.

Yet, the theory of "disappointed expectations" could account for all of the above illusions. According to this traditional theory, a subject's expectations triggered illusions. In order to disprove this theory, Uznadze conducted experiments in which he gave setting trials with unequally-sized objects, to his subjects in a hypnotic state. He then instructed his subjects to forget whatever had occurred during their hypnotic state. The subjects in an alert state still experienced illusions when presented with equally-sized objects. Uznadze (1966, p. 37) concluded that set is "extra-conscious," and that expectations are not necessary for set illusions.

Uznadze not only emphasized the "extra-conscious" nature of sets but stated that all behavior is determined by sets. He named two conditions for set activation, i.e. an

emergence of set, and consequently human behavior: a need and a situation. He defined need as a state in man which necessitates a change and initiates activity to bring this change about (Uznadze, 1966, p. 24). He also differentiated need into two categories: substantive needs, such as hunger; and functional needs, such as the desire for some type of activity. Uznadze (1966, p. 26) further stated that the need must be combined with a suitable environment, that is, a situation capable of satisfying the need in order for the set to be activated.

The combination of a need and a situation may also occur through the intermediary action of others. For example, schooling involves the transfer of sets from the teacher to the pupil. As the pupil becomes more educated, he becomes more capable of formulating his own sets. Yet, man never ceases to acquire sets from others because it is in his nature to be social, and the ever-increasing limits of knowledge makes sharing a practical necessity.

Whether man relates to the outside world with a new set or a former one, depends on whether the set is activated on the plane of impulsive behavior or on the second plane of behavior called objectivization (see Figure 1 depicting the

activation of set). Impulsive behavior is automatic behavior triggered by a familiar environment in which no problem is detected (Uznadze, 1966, p. 114). Alternately, objectivization occurs when a problem is detected since the situation is not appropriate for the satisfaction of the particular need. Objectivization is a mechanism which "confirms nothing and rejects nothing; it is nothing more than a fact of halting or checking a set created in a subject" (Uznadze, 1966, p. 241). Uznadze further differentiated objectivization from attention. Objectivization is a halting of activity while attention implies a focussing on some aspect of the environment as a result of the halting procedure. Attention is impossible without objectivization (Uznadze, 1966, p. 238).

Objectivization was also distinguished from the two stages of perception: one taking place before and the other following set activation (Uznadze, 1966, p. 206). The first stage is a physical response to stimuli. True perception, the second stage, takes place after a set has been activated with the intervention of the whole subject or personality on the plane of impulsive behavior or on the plane of objectivization.

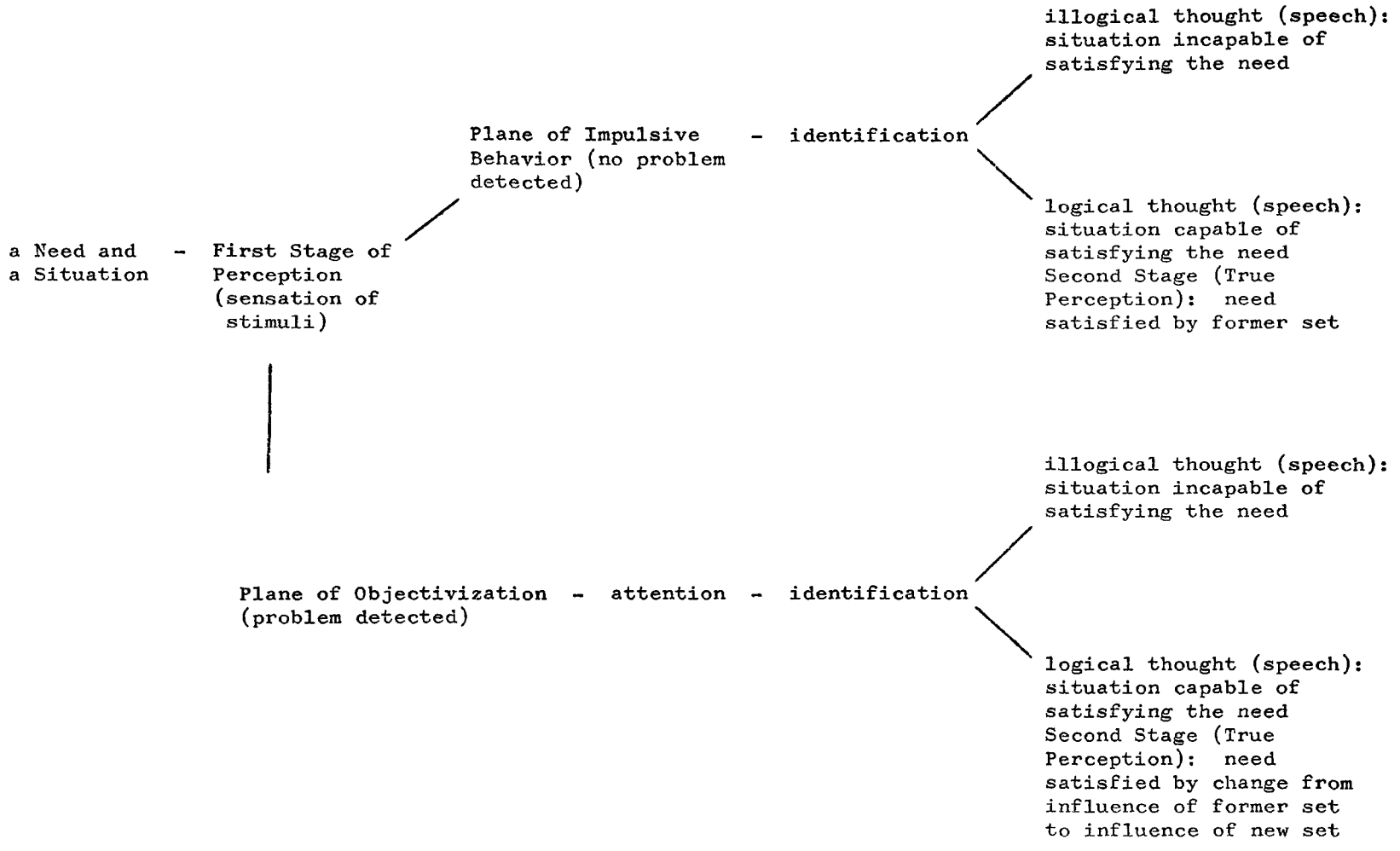

Figure 1. The Activation of Set

Logical thought, based on speech, takes place between the first and second stages of perception. Implicit in the process of thought is the principle of identity in which it is stated that everything is equal to itself: A = A (Uznadze, 1966, p. 221). A specific thought can only occur once a particular object is identified as being itself. Once identification has taken place in a situation capable of satisfying the need, true perception is possible. Illogical thought is a product of a situation incapable of satisfying the need (Uznadze, 1966, p. 240).

The context of a real-life situation will be used to illustrate the above terms concerning set activation. The description will follow the sequence identified in Figure 1. Imagine an individual named Jack walking down a street and meeting another person named Bill. Bill is at first noticed or perceived by Jack. If Jack immediately recognizes Bill (identification), he may automatically say "hello" as a result of the activation of a former set meeting no problem (impulsive plane of behavior). This reaction is correct (true perception) if Bill is indeed an acquaintance (situation capable of satisfying the need). If Bill is not an acquaintance (situation incapable of satisfying the

need), then Jack has made an error (illogical thought).

On the other hand, Jack may realize that he knows Bill but cannot remember his name. Jack has a problem: "Who is he?" (plane of objectivization). Jack looks at Bill carefully and tries to recognize him (attention). Jack then proceeds to remember Bill's name. He may be successful (true perception) if Bill is an acquaintance (situation capable of satisfying the need) or unsuccessful (illogical thought) if Bill is not an acquaintance (situation incapable of satisfying the need).

Thus far, the evolution of set theory, the conditions for set formation, and the process of set activation have been discussed. This is now followed by a description of the three properties of set as defined by Uznadze: illusion (contrast and assimilation), irradiation, and generalization.

Illusion, i.e. an incorrect perception, may be detected in a subject after he has been exposed to a number of fixing or setting trials. For example, if a subject is tachistoscopically presented with two unequally-sized circles 10 to 15 times, he may experience illusion upon the presentation of two equally-sized circles. The latter trials are called critical trials because it is possible at this point, to

determine if the subject is under the influence of set. If the subject continues to see two unequally-sized circles in the critical trials, he is exhibiting set. If the larger circle was presented on the left, and the smaller one on the right during the setting trials, and the subject continues to see the left circle as being larger, the illusion is one of assimilation. If the left circle looks smaller, the illusion is one of contrast (Uznadze, 1966, p. 1-2). These two types of illusion are also evident in experiments testing the haptic and muscular modalities.

The transfer of a set within one modality or between modalities is defined as the irradiation of a set. For example, two unequally-sized wooden balls are placed in the right hand of a subject. After a number of setting trials, two equally-sized wooden balls are placed in the subject's left hand. The subject may perceive the equal wooden balls as being unequal if set has spread from the right hand to the left hand (Uznadze, 1966, p. 30). Irradiation may also be noted from the haptic to the visual mode, from the muscular to the haptic mode, from the visual to the muscular mode, and vice versa (Uznadze, 1966, p. 34). For instance, a subject with a set fixed in the haptic mode using wooden

balls may exhibit a visual illusion in the critical trials. This transfer of set lends support to Uznadze's argument that set is a central underlying determinant of behavior. Regardless of the way set is formed, it may express itself in different ways.

Generalization, the third property of set, refers to the response an individual makes to objects other than those used in fixing the set within the same modality. (It should be noted that "generalization," as used here, does not have the same connotation as "generalizability" in the title of this thesis.) For example, circles may be used in the setting trials, and squares, cubes, or other polygons may be used in the critical trials to indicate the presence of set (Uznadze, 1966, p. 35). Once again the integral nature of set is supported.

In summary, the first step in set activation is the initial perception, the sensation of stimuli at the impulsive plane of behavior (no problem detected) or at the plane of objectivization (problem present). Objectivization is the moment of halting following the detection of a problem, and attention is the focussing on some aspect of the problem as a result of the halting action.

Objectivization and attention are followed by identification, the process of realizing something as being equal to itself. Once something is identified, logical thought, based on speech, is possible which leads to true perception, the solving of the problem. Illogical thought results if the situation is incapable of satisfying the need.

Uznadze's theory of set evolved from a reaction against traditional psychology at a philosophical and experimental level. According to Uznadze, set is a primary not a secondary determinant of behavior. It is a preconscious interaction between man as a complete subject, both mental and physical, and his environment. Experimentally, Uznadze discovered that set is not a result of greater or lesser motor impulses, nor does it originate from a subject's expectations. It arises from the combination of a particular need and a particular situation.

A need and a situation capable of satisfying this need are necessary for all individuals to form a set, but the type of set formed varies from individual to individual. In the following section, a classification together with an explanation of these individual differences will be presented.

2. Set Differentiation

The phases of set formation in quantitative and qualitative experiments, as well as in experiments based on equality, will be discussed. Following this, set typologies in adults and children will be described.

There are four phases in set formation: the diffuse phase, the phase of differentiation, the fixed phase, and the perception of reality. A person confronting some problem in his environment for the first time has a vague reaction. This is the diffuse phase because at this time, the subject is incapable of accurately satisfying his particular need (Uznadze, 1966, p. 209). With the repeated combination of a need and a situation, the set becomes more differentiated and finally fixed (Uznadze, 1966, p. 210). The number of setting trials needed to fix set is called the excitability of the set. If an individual finds himself with a similar need in a similar situation, the previously formed set arises more quickly than a new set (Uznadze, 1966, p. 40).

The fixed phase of set formation differs in quantitative and qualitative experiments, and in experiments based on

equality. Contrast illusions are the most stable, persistent, and predominant in quantitative experiments (Uznadze, 1966, p. 45). As these sets begin to weaken, assimilation illusions then become more common in some individuals, followed by the perception of reality. Only assimilation illusions are found in experiments based on equality (Uznadze, 1966, p. 62), and in qualitative experiments, e.g. a quality difference such as the difference between Latin and Russian letters (Uznadze, 1966, p. 67). Furthermore, it is more difficult to fix set, and the fixing takes place at a later time in experiments based on equality as opposed to quantitative experiments (Uznadze, 1966, p. 63).

The final phase of set formation, the perception of reality, may also be described as the first phase of the next set. If a situation is slightly changed, then a new set is necessary in order to satisfy the subject's need. Man's behavior is the result of the activation of former sets and the formation of new ones when a need is combined with a situation capable of satisfying this need. For example, using unequally-sized circles in the setting trials, the subject notes from time to time that the circles are equal in size in the critical trials. The subject is

beginning to perceive reality. The inappropriate set is broken once the subject recognizes the equality of the circles five times in succession in the critical trials (Uznadze, 1966, p. 44).

Although the phases of set formation are universal, the number of critical trials needed to extinguish set is not the same in all individuals. The number of trials needed determines what is known as the extinction of the set. Uznadze examined the extinction patterns of his subjects and then categorized these individuals into three set typologies: dynamic, static, and variable. Uznadze (1966, p. 90) also stipulated that each subject is characterized by a particular type of set which remains unchanged regardless of the sensory modality. In some cases it may be experimentally impossible to fix a set within a certain time period. Nevertheless, given an unlimited amount of time, one may fix a set even in these difficult and rare cases (Uznadze, 1966, p. 75).

Before describing the three main types of set, it is useful to be acquainted with some of Uznadze's terms, such as: dynamic/static, plastic/coarse, constant/variable, and stable/labile. A dynamic set is one which is

extinguished within 30 critical trials. A static set remains fixed. These two types of set may be further characterized by their plasticity or coarseness. A plastic set is one which undergoes a series of gradual changes. The subject vacillates between accurate perceptions and illusions. A coarse set is one in which the critical trials have no effect on the character of the set (Uznadze, 1966, p. 81). In a coarse dynamic set, the individual no longer experiences illusions once he has an accurate perception in the critical trials. In a coarse static set, the individual never experiences an accurate perception in the critical trials. Constant/variable refers to the type of set extinction. A set is a constant set if, when it is fixed at two different times without changing the experimental conditions, it does not exhibit a variation of the type of extinction (Uznadze, 1966, p. 85). A variable set is characterized by a change in the type of extinction. Stable/labile refers to how long a set remains in action. Some sets remain active for weeks while others lose their force within minutes or hours (Uznadze, 1966, p. 86).

The above terms are used to classify individuals into dynamic, static, and variable groups. Uznadze (1966, p. 140)

found that the majority of the adults of the first group, are plastic dynamic individuals, who have well-developed powers of objectivization accounting for their flexibility. A smaller number is coarse dynamic. Uznadze also described dynamic individuals as being "fairly" constant, "highly" stable, and exhibiting comparatively weak irradiation. Normally, contrast illusions are more common than assimilation illusions. But in the presence of weak irradiation resulting from weak fixation, assimilation illusions are more predominant (Uznadze, 1966, p. 141).

Uznadze noted that set excitability is very high in the second type of individual, the static subject. With this type of individual, the predominant form of set (89% to 100%) is the coarse static set (Uznadze, 1966, p. 143). Furthermore, constancy and stability were found in almost 100% of the cases and irradiation was very extensive and strong (Uznadze, 1966, p. 143). Static individuals may also be described as individuals using more fully their powers of objectivization in order to overcome the inflexibility of their sets. Because of their energy and willingness to work, the static nature of their sets need not interfere with their achievements in life.

The third group, made up of variable individuals, accounts for only a small portion of the total population (Uznadze, 1966, p. 147). This classification includes two subgroups, namely, the variable-stable individuals who are variable within strictly defined limits (Uznadze, 1966 p. 145), and the variable-labile individuals whose sets sometimes remain in force not more than one hour (Uznadze, 1966, p. 146). Similar to static individuals, these people are also capable of being very productive because of their hard-working nature.

The three above-mentioned classifications pertain to adults. In the adult population, the dynamic group is the largest followed by a much smaller static group, and a rarer representation of the variable group. Among children, the proportion of the three set typologies is almost reversed.

Early school children (ages 6-11) are characterized by plastic static sets. As the children become older, the sets are mainly dynamic, ranging from coarse dynamic in middle school children (ages 12-14), to plastic dynamic in adults (Uznadze, 1966, p. 82). High excitability is one of the main features of set in children. A single exposure was sufficient to fix a set in 80% of the early school children,

60% having assimilation illusions and 20% having contrast illusions (Uznadze, 1966, p. 76). When the number of fixing exposures was increased to 4, the assimilation illusions fell to 25%. With 15 exposures, the contrast illusions increased to approximately 79% (Uznadze, 1966, p. 77). Furthermore, middle school children have lower excitability than early school children, excitability increases in the 15 to 17 year old group, and then it stabilizes in the adult (Uznadze, 1966, p. 77). The proportion of contrast illusions rises as the children become older, indicating that set is a developmental phenomenon.

In summary, Uznadze stated that there are four stages of set formation. The subject's first reaction is diffuse followed by a less vague response with the repetition of the setting trials. When the subject exhibits illusions in the critical trials, the set is fixed. As soon as the subject is able to give 5 correct responses in succession within 30 critical trials, he has entered the last stage, the perception of reality. The type of illusion which arises depends on the type of experiment. Quantitative experiments yield a majority of contrast illusions, while qualitative studies and experiments based on equality,

result only in assimilation illusions.

Uznadze further classified his subjects into three set typologies: individuals of the dynamic group, capable of extinguishing set within 30 critical trials; individuals of the static group, not capable of extinguishing set within 30 critical trials; and individuals of the variable group, exhibiting different types of set extinction at different times. These set typologies were used to classify children as well as adults. Uznadze found that the majority of early school children are plastic static. Middle school children have mainly coarse dynamic sets, while adults are mainly characterized by plastic dynamic sets.

Uznadze's investigation of sets has been continued in his homeland and in Western countries. The following is a description of some of the studies by Western researchers who have experimented with the Soviet conception of set.

3. Related Studies

The works of Hritzuk (1968), Sodhi (1968), Stewin (1969), Janzen (1971), and Janzen, Maguire, and Boersma (Note 1) have contributed to an understanding of Uznadze's theoretical position.

Hritzuk (1968), using a sample of 122 first-year student nurses, showed that a relationship exists between personality traits as defined by the Eysenck Personality Inventory and performance on Uznadze set tasks. Hritzuk's main contribution is the support given to Uznadze's contention that set is an integral part of personality.

Sodhi (1968) hypothesized that good and poor second language learners differ on the measures of set fixation and extinction. His hypotheses were based on the work of Hertzog (1967). Hertzog stipulated that individuals requiring fewer setting and critical trials in the haptic and visual modalities would possess a more elaborated language code than individuals requiring a greater number of setting and critical trials. Sodhi (1968, p. 33) reported that Hertzog's work supported the hypothesis that an individual capable of extinguishing set within 30 critical trials could process more information and thus acquire a second language more easily.

After studying Hertzog's work, Sodhi stated that good second language learners, at a first-year level, would fix and extinguish set more easily in the haptic modality. He considered a sample of 40 good second language learners,

and a sample of 40 poor second language learners, as determined by the Modern Language Association Cooperative Foreign Language Test. A significant difference was found between the two groups on the number of critical trials necessary for set extinction. Poor second language learners exhibited the properties of a static set. On the other hand, no significant difference was found between good and poor second language learners on the number of setting trials required to establish set. Sodhi's results indicate that, perhaps, set extinction is the crucial factor to distinguish between good and poor second language learners. A further contribution is the fact that Sodhi's work illustrates the generalizability of Uznadze's set typologies to a language learning situation, emphasizing the role of set as a central determinant of behavior.

Stewin (1969) included Uznadze's set tasks in his study of the conceptual systems of 207 grade eleven students. His hypothesis that individuals of a higher integrative index of conceptual functioning, being more flexible, should require fewer trials to fix and extinguish set in the haptic modality was not supported. Stewin attributed the low relationship between conceptual systems and set to the type of set task

administered. Stewin (1969, p. 117) quoted Natadze (1969) who summarized Uznadze's work and stated that the emergence of set in situations not dealing with tactile perceptions are on the second plane of activity, the plane of objectivization. On the other hand, the haptic modality set task may be largely restricted to the first or impulsive plane of behavior. Thus, the low relationship between conceptual systems and set typologies may be partly attributable to the fact that Stewin gave his subjects a haptic set task. A visual set task, relying more on imagination rather than sensation, is based on the second plane of activity (Natadze, 1969, p. 621). A closer relationship may have been achieved if Stewin had used a visual set task instead of a haptic set task. Stewin's main contribution to this study lies in his emphasis that caution must be exercised when choosing an appropriate set task.

Uznadze (1966) suggested a link between language and objectivization (p. 229-230), and further linked objectivization with personality, by stating that human mental activities may be described as definitions of the individual's integral personality (p. 200). Janzen (1971) wished to extend Uznadze's theory by proposing a link between

language and personality.

Using 186 first-year university subjects, Janzen (1971) discovered that there is a relationship between language, set typologies, and personality traits. Set characteristics were found to be represented across and within all the factors used in the study. Janzen's (1971, p. 62) main contribution is the support given to Uznadze's contention that set is an underlying determinant of behavior.

Janzen et al. (Note 1) examined the set characteristics of children at various age levels. Since Uznadze did not test children extensively, this research was basically a normative study designed to test ease of excitability and extinction in the haptic and visual modalities. Samples of 25 boys and samples of 25 girls, at each of the eight different age levels, 5 to 12 years of age were tested. The most important findings were:

1. Using the same number of setting trials, excitation occurred more readily in the haptic modality (91%) than in the visual modality (58%). Specifically, at age 12, 96% fixed haptically while 66% fixed visually. At age 11, 90% fixed haptically while 60% fixed visually. Janzen et al. (Note 1) explained the greater success in fixing set in the

haptic modality by referring to Uznadze's emphasis on grasping in the evolution of the species, suggesting that it is easier to fix a set based on the sense of touch rather than to fix a set at a more abstract level. With reference to the visual modality, Janzen et al. (Note 1, p. 25) stated that it involves less active participation with the environment as compared with motor manipulation.

2. According to Uznadze, set excitability gradually decreases in the 5 to 12 year old range. Contrary to these findings, Janzen et al. (Note 1) observed approximately the same levels of set excitability in the haptic modality with 5 to 12 year old children. A similar pattern with lower excitability levels was observed in the visual modality.

3. There was no sex difference in set excitability within the haptic or visual modalities.

4. Most subjects fixed set after 2 trials in the haptic modality (85%). In the visual modality, a number of subjects required 5 (38%) and 10 (20%) trials to fix set.

5. Younger children had more assimilation illusions than did the older children. There were more contrast illusions than assimilation illusions in both modalities. There was no clear age trend for the contrast illusions.

6. There was no significant correlation (Kendall's Tau) between the number of trials necessary to fix set in the haptic and visual modalities. Janzen et al. (Note 1) observed that children who fixed set in the haptic modality with a few setting trials, did not necessarily fix set in the visual modality. A possible explanation for this result is that 10 setting trials may be sufficient to fix set in the haptic modality, but may not be sufficient to fix set in these same children in the visual modality.

A trend was noticeable in trials to extinction. Children at ages 5, 8, and 11, who did not extinguish in the haptic modality tended not to extinguish in the visual modality. At age 12, the trend was the same but not at a significant level.

7. Finally, Janzen et al. (Note 1) examined differences in the age groups with relation to set extinction. The results in the haptic modality supported Uznadze. In the groups of children ages 5 to 7, 72% did not extinguish, while in the groups of children ages 10 to 12, 39% did not extinguish. Thus, as Uznadze (1966, p. 82) stated, the static set is predominant in younger children.

The developmental trend in the visual modality was not clear. The proportion of static individuals was approximately the same in the 5 to 6 year old children (33%) as in the 11 to 12 year old children (37%). Furthermore, the 9 year old children were the least static (10%).

Perhaps, if the number of setting trials in the visual modality had been increased, then there could have been a greater number of dynamic older children who could be included in the extinction analysis (extinction is impossible without excitation). Uznadze (1966, p. 77) stated that only one setting trial is needed to fix set in the majority of early school children. One setting trial resulted only in 20% of the subjects having contrast illusions. Quantitative experiments are usually characterized by a predominance of contrast illusions. Further testing, using 15 setting trials, resulted in 79% of the subjects having contrast illusions. Janzen et al. (Note 1) used only 10 setting trials. An increase in the number of setting trials with the children at the lower end of the age range would probably not alter the excitability pattern since these younger children generally have static sets requiring only two setting trials. Therefore, an increased number of setting

trials would not necessarily increase the number of younger children who fixed set. The results could have then supported Uznadze's statement that static sets are also predominant in younger children in the visual modality.

The above study is very valuable because it is the only one conducted in Western countries using children as subjects, and because Uznadze, himself, did not conduct a great deal of research with children. It adds support to Uznadze's theory with reference to set extinction. It was found that children who did not extinguish in the haptic modality, had a tendency not to extinguish in the visual modality. This supported Uznadze's statement that each individual has a particular type of set.

The contributions of the above-mentioned studies, with reference to Uznadze's theory of set, could be summarized as follows: Hritzuk (1968) showed that set is not only linked to perception but to personality; Sodhi (1968) illustrated the generalizability of Uznadze's set typologies to a language learning situation; Stewin (1969) suggested that there are some relationships between conceptual systems and set, and that caution must be exercized in choosing the appropriate set task; Janzen (1971) extended Uznadze's

theory by showing a relationship between language and personality, and supported Uznadze's statement that set is an underlying determinant of behavior; and Janzen et al. (Note 1) supported Uznadze's assertion that each individual is characterized by a certain type of set.

3. Statement of the Problem

In the above review of the literature, it was identified that the basic debate in set theory is whether set plays a primary or secondary role in the determination of behavior. Generally, Western researchers consider set as a secondary factor, while Soviet researchers, adopting Uznadze's definition are more inclined to consider set as a primary factor. Yet, this split between Western and Soviet set psychology is not a total one. An examination of Western set psychology indicated that the definition of set according to some researchers closely agrees to Uznadze's definition (e.g. Luchins, 1942 and Allport, 1955). Furthermore, some Western researchers such as Hritzuk (1968), Sodhi (1968), Stewin (1969), Janzen (1971), and Janzen et al. (Note 1) have conducted experiments using Uznadze's definition of set.

Janzen et al. (Note 1) showed that those children who are not able to extinguish set in one modality tend not to extinguish set in the other modality. Uznadze (1966, p. 90) stated that "as a rule each normal subject has his own particular type of fixed set, which generally remains unchanged regardless of the sensory spheres involved in the process of its origin." Sodhi's (1968) work supported the generalizability of set typologies to a language learning situation. This study is intended to offer further support for Uznadze's statement quoted above, and to extend the work of Janzen et al. (Note 1) by testing set typologies in the field of mathematics. More precisely, according to Uznadze, the set typology of an individual can be determined by the type of extinction in the visual modality, and each individual is characterized by a specific set typology. Hence, a similar type of extinction should be observable in the performance of a mathematical task capable of detecting the presence of set. It is then hypothesized that:

> Grade six children characterized by one type of set in the visual modality will be characterized by the same type of set in a test involving mathematical questions.

Chapter II

Experimental Design

In this section procedures for testing the research hypothesis will be discussed. These include the selection of the research subjects, the selection and construction of the measurement instruments, the collection of the data, and the plan of the statistical analysis.

1. The Subjects

Uznadze (1966, p. 82) stated that the majority of early school children (ages 6-11) manifest static sets while the majority of middle school children (ages 12-14) exhibit dynamic sets. The researcher chose to conduct the experiment with grade six children because at this age (11-12), both types of sets were expected to be observed. It was further established that by grade six, the children would have mastered the operations on which the mathematical performance tests are based.

Accordingly, 105 grade six children from one public elementary school and one separate elementary school near a large metropolitan area were tested. Of this sample,

61 were boys and 44 were girls. The mean age was 12 years and 1 month. The urban and rural social-economic environments of these children ranged from working class to middle class living.

2. The Measurement Instruments

The researcher will explain the reason why Uznadze's Visual Test was chosen to detect the presence of set, and will then discuss the steps taken to design a measurement instrument to detect the presence of set within a mathematical context.

Uznadze's work was mainly done in the haptic and visual modalities. The visual modality was chosen for this study because a set developed by means of a visual representation of circles of different sizes is on the second plane of activity (Natadze, 1969, p. 621). The haptic modality, on the first plane of activity, involves more "concrete" participation of the subject. The subject is to grasp wooden balls rather than to perceive circles through a tachistoscope. Since the researcher's objective is to examine set extinction types within a mathematical context which are on the second plane of activity, tests using the

visual modality are expected to bear a closer relationship to mathematical performance than tests using the haptic modality.

The visual modality tests, administered individually, were carried out with a two-channel tachistoscope scientific prototype 800F, using three different slides: the setting trial slide, the blank slide, and the critical trial slide. The setting trial slide shows the outline of two black circles on a white background. Uznadze did not give precise instructions for the dimensions of the circles. He described his work using circles which ranged in size from 22 mm to 26 mm (Uznadze, 1966, p. 13). The size specifications of the circles used in this study are taken from Hritzuk's (1968, p. 92) work: The circle on the left has a diameter of 30 mm while the circle on the right has a diameter of 15 mm. Between each exposure the subject is presented with a blank white slide. The critical trial slide contains two circles, each 22.5 mm in diameter.

Hritzuk (1968, p. 96-97) quoted Uznadze's (1958) statement that if a set is not fixed within 25 setting trials or if it is not extinguished within 30 critical trials, one assumes that an unlimited number of trials are

required to either fix or extinguish set. These cut-off points were thus used since the researcher wished to have as many subjects as possible fixing set in order to test set extinction. Furthermore, the researcher decided to use Uznadze's Visual Test because this test has been successfully used in research to detect the presence of set for over thirty years. In addition, Hritzuk (1968, p. 101) applied Uznadze's procedures in his study and upon retesting 25 of his 122 subjects one week later was able to report a reliability of .98 using the Spearman rank coefficient.

With reference to the development of mathematical measurement instruments, the researcher conducted tests in a pilot study with three groups of students:

1. Grade 5A: Out of a class of 24, this group of 10 grade five students consisted of the 5 top achievers and the lowest 5 achievers of the class, with respect to general mathematical ability as determined by the classroom teacher. They were involved in the designing stages using flash cards and in the testing of the finalized forms using slides.

2. Grade 7: This group consisted of 11 grade seven students involved in the designing stages using flash cards and in the testing of the finalized forms using slides.

3. Grade 5B: This group consisted of 14 grade five students. They were given only the finalized forms of the tests using slides to provide data from subjects confronting the tests for the first time. They accounted for the remaining portion of the grade five class used in the selection of the Grade 5A group.

Keeping two factors in mind, three different types of measurement instruments were investigated. The test questions had to be simple enough so that the subjects could easily fix the procedure. Secondly, the test questions had to be easily modifiable so that the critical trials could be constructed. The difference between the questions in the setting and critical trials had to be a slight one so that the subjects did not immediately objectivate.

The procedure used in the first mathematical measurement instrument closely resembles Uznadze's Visual Test. The subjects had to identify the position (right or left) of the larger of two numerical values. The larger value was always on the left side in the setting trials (e.g. 10, 3 + 6 ; 11 - 3, 4 + 2). In the critical trials, the larger value was always on the right side. There was no evidence of set formation in all of the subjects when this test was

administered to Grade 5A. A closer examination revealed that the procedure was not being fixed since the different mathematical operations encouraged all of the subjects to objectivate each time. Consequently, this test was omitted without further investigation.

The second measurement instrument, the Order of Operations Test (see Appendix C), was based on the operations of multiplication and addition, as well as their order within an arithmetic expression. The subjects were given questions in which multiplication was to be done first. For example, 3 + (2 x 4) would be presented to the subjects in the setting trials. Only the numerals 1 to 4 were used and the parentheses were always placed on the right-hand side. In the critical trials, the operations of multiplication and addition were interchanged so that 3 x (2 + 4) would be presented to the subjects. It was predicted that this test would be more successful than the first mathematical measurement instrument because it does not lend itself as easily to objectivization.

It was further assumed that the subjects had to answer 20 or more questions correctly out of the 25 setting trials in order to be included in the data analysis. Five errors

or less could be attributed to careless mistakes, but a number of errors greater than 5 raised doubt on the ability of the subjects to answer the questions correctly.

Approximately 2 seconds were given in the setting trials using flash cards. In this case, it was found that 3 of the 9 Grade 5A subjects, and 1 of the 11 Grade 7 subjects made 5 or more errors in the 25 setting trials. Because of the composition of the Grade 5A group, it was not surprising that 3 subjects were not able to meet the minimum requirement of 5 errors or less.

In the finalized form of the Order of Operations Test, a Layfette Model 1810 timer was used to electronically control the exposure time which was set at 2 seconds. A total of 56 slides were projected: 1 example, 25 setting trial slides, and 30 critical trial slides. Few children made 5 or more errors in the setting trials: 2 of the 10 Grade 5A subjects, none of the 11 Grade 7 subjects, and 2 of the 14 Grade 5B subjects. From these observations, an exposure time of 2 seconds was considered appropriate for testing with the grade six subjects.

In the third measurement instrument, the Sequence Test (see Appendix D), the subjects were presented with a

sequence of five numbers and they had to supply the sixth number. In the setting trials, the pattern was obtained by alternatively adding 1 and 2 to the preceding number (e.g. 3 4 6 7 9, the next number being 10). In the critical trials, the pattern was obtained by alternatively adding 2 and 1 to the preceding number (e.g. 3 5 6 8 9, the next number being 11).

In the designing stage of the instrument, each sequence of five numbers was written on a flash card. The Grade 5A's were given approximately 4 seconds while the Grade 7's were given approximately 3 seconds to provide the sixth number in 25 setting trials and 30 critical trials. The children were not as able to provide correct answers to the Sequence Test as to the Order of Operations Test: 4 of the 9 Grade 5A subjects, and 4 of the 8 Grade 7 subjects, made more than 5 errors in the setting trials using flash cards.

Using the slides with a timed exposure of 6 seconds, 3 of the 10 Grade 5A subjects, 4 of the 11 Grade 7 subjects, and 13 of the 14 Grade 5B subjects, made 5 or more errors in the setting trials. The above results indicated that the Sequence Test was too difficult, so the researcher decided to further increase the exposure time to 12 seconds

for testing with the grade six subjects.

Prior to testing with the grade six students, an effort was made to compare the results of the testing done in the designing stages with the results of the finalized forms of the Order of Operations Test and the Sequence Test. It was discovered that previous exposure to the tests improved the scores (i.e. the subjects took less trials to break set). The time interval between the two exposures to the tests was approximately two weeks. In the Order of Operations Test, 8 of the 9 Grade 5A's and 9 of the 11 Grade 7's improved their scores. In the Sequence Test, 2 of the 9 Grade 5A's and 6 of the 8 Grade 7's improved their scores. This indicated that once subjects have been given a mathematical test examining set fixation, readministration of the same test to the same subjects generally results in improved scores. It is difficult to measure the test-retest reliability of the designing stages and the finalized forms of the Order of Operations Test and the Sequence Test because the exposure times were different, and the questions themselves were changed in the process of designing the instruments.

3. The Procedure Used to Collect the Data

In this section, the researcher will describe the collection of the data compiled on an individual basis for the Uznadze Visual Test, and on a group basis for the Order of Operations Test and the Sequence Test. This will be followed by an explanation of the scoring of the results and a plan of the statistical design.

A card for each subject indicating his name, birthdate, and sex was prepared. The subject was asked to come to a small room containing two chairs and a table with the tachistoscope set at an intensity to ensure equal brightness in the stimulus field and in the blank field. Assured that the testing would not interfere with school grades, the subject was told that he was participating in a research project designed to find out "how people see different things." It was verified that the subject could differentiate left from right. Then he was positioned comfortably in front of the face guard of the tachistoscope and instructed to keep that position throughout the testing period (see Appendix A for the verbal instructions and administration procedures for the Uznadze Visual Test).

All the tachistoscopic exposures were given for .1 second (Janzen, Note 2). The experimenter recorded the subject's answer (see Appendix B for the scoring sheet for the Uznadze Visual Test), took the slide out of the tachistoscope, placed it on the table, and put it back into the tachistoscope after each exposure to prevent the subject from detecting any procedural differences upon the critical slide presentations. While the slide was being changed, the subject was presented with a blank white slide. Before showing the subject the next slide, the experimenter said "ready." All 25 setting trials and all 30 critical trials were presented in succession. The time lapse between exposures was just long enough for the subject to answer and for the experimenter to record the answer.

The Order of Operations Test (see Appendix C) was administered on a group basis to each of the three grade six classes. The Sequence Test (see Appendix D) was administered on a group basis the following week (see Appendix E for the verbal instructions and administration procedures for the Order of Operations Test and the Sequence Test). The experimenter made sure that the classroom had a screen, that it was dark enough to see the slides easily, and that

the subjects could see the screen from where they were seated. The subjects were then assured that the testing would not interfere with their school grades. The answer sheets were then distributed (see Appendix F for the answer sheet for the Order of Operations Test and the Sequence Test).

A scoring method which adhered as much as possible to Uznadze's definition of set extinction was devised to examine the subject's responses. Uznadze (1966, p. 44) stated that 5 correct successive responses within 30 critical trials indicated that set was extinct. If the subject correctly perceived the first 5 critical trials, then no set was present. This criterion was also used in the scoring of the Order of Operations Test and the Sequence Test.

In the critical trials of the Order of Operations Test, five types of responses are possible: a correct response (C); an assimilation (A); a partial assimilation (PA); a computational error (E); or an omission (O). For example, suppose a subject is given 4 + (3 x 2) as a setting trial question and 4 x (3 + 2) as a critical trial question. If he answers "20" in the critical trial section of the test,

he would be correct. If he answers "10," his response would indicate assimilation since he is continuing to multiply first and then add as he did in the setting trials. If he answers "24," his response would indicate partial assimilation since he correctly perceived only part of the operation, namely, 4 x (3 x 2). If he answers "9," his response would once again indicate partial assimilation since he perceived 4 + (3 + 2). Since the computational errors are not based on an incorrect order of operations, in this study, a set will be considered to be extinct if the subject gives 5 correct successive responses including computational mistakes. Omissions will simply be ignored.

As mentioned previously, Uznadze's criterion for set extinction was also used in the scoring of the Sequence Test. The coding system is the same as in the Order of Operations Test except for the PA type of response, because partial assimilations are not identifiable in the Sequence Test. For example, suppose a subject is given the sequence 3 4 6 7 9 as a setting trial question, and 3 5 6 8 9 as a critical trial question. If he answers "11," he would be correct. If he answers "10," his response would indicate an assimilation of the pattern used in the setting trial

section of the test.

With reference to the statistical analysis, the subjects will be cross-classified according to their set typologies as determined independently by the Uznadze Visual Test and the Order of Operations Test. This classification will be repeated with the Uznadze Visual Test and the Sequence Test. In each case, a chi-square statistic will be used to test the independence between these classification criteria.

Chapter III

Presentation and Discussion of the Results

In this chapter, the researcher will first discuss the relationship between unfixable, dynamic, and static set typologies with respect to the Uznadze Visual Test and the Order of Operations Test. Secondly, this will be followed by an analysis of the relationship between the set typologies as determined by the Uznadze Visual Test and the Sequence Test.

1. Analysis of the Relationship between the Uznadze Visual Test and the Order of Operations Test Data

As mentioned previously, the purpose of this study is to test the hypothesis that grade six children characterized by one type of set in the visual modality will be characterized by the same type of set in a test involving mathematical questions. The sample consists of 58 males and 41 females. The results of six children were eliminated since these subjects were not able to answer 20 out of 25 setting trials correctly in the Order of Operations Test.

The grade six children tested in this study have an average age of 12 years and 1 month, spanning a period of transition with reference to set type. Although Uznadze (1966, p. 82) did not regard his findings as final, he stated that early school children (ages 6-11) are characterized by plastic static sets. The sets are mainly coarse dynamic in middle school children (ages 12-14), developing into plastic dynamic sets in the adult. Therefore, both static and dynamic sets should be represented among the grade six children of this study.

The results indicate that 27.27% of the subjects are coarse dynamic, 41.41% are plastic dynamic, 4.04% are plastic static, and 0% are coarse static on the Uznadze Visual Test (see Appendix J for set classification on the Uznadze Visual Test and the Order of Operations Test). The remaining classification consisting of unfixable individuals is also strongly represented (27.27%). Uznadze (1966, p. 75) stated that unfixable subjects are extremely rare and that given an unlimited amount of time, it would be also possible to fix a set in these individuals. Hritzuk (1968, p. 96-97) quoted Uznadze's (1958) statement that for experimental purposes, if a set is not fixed within 25 setting trials,

one assumes that an unlimited number of trials are required to fix a set. The researcher thus gave the subjects of this study 25 setting trials to experimentally define unfixable individuals.

The resulting large percentage of unfixables may be explained in three ways. Uznadze (1966, p. 77) stated that it is more difficult to fix a set in middle school children but did not indicate whether this difficulty results in a large number of unfixables. Secondly, Uznadze relied mainly on exhaustive assessments of a few adult subjects to formulate his theory of set. Most of the time he did not indicate how many subjects were being tested and on one occasion measuring set stability, only 13 subjects were tested (Uznadze, 1966, p. 64). Thirdly, the results of the study by Janzen et al. (Note 1) also indicated a strong representation of unfixables in the visual modality. At age 12, 34% of the subjects were classified as unfixable, and at age 11, 40% of the subjects were classified as unfixable. As mentioned previously, Janzen et al. (Note 1, p. 25) attributed this result to the fact that it is more difficult to fix a visual set because it is at a more abstract level than a haptic set. The percentage of unfixables in the

present study is lower than that in the Janzen et al. (Note 1) study because only a maximum of 10 setting trials were used in the latter study.

The results of the Order of Operations Test indicate a similar proportion of set types in the coarse dynamic (29.29% as opposed to 27.27% in the Uznadze Visual Test) and the plastic dynamic (44.44% as opposed to 41.41% in the Uznadze Visual Test) groups (see Appendix J for set classification on the Uznadze Visual Test and the Order of Operations Test). The unfixable group is smaller (13.13% as opposed to 27.27%), the plastic static group is larger (13.13% as opposed to 4.04%), and the coarse static group is represented (1.01% as opposed to 0%). Furthermore, there is no appreciable sex difference with reference to set typologies in the Uznadze Visual Test and the Order of Operations Test. Yet, there is a trend indicating more females in the plastic dynamic cells while there are more males in the coarse dynamic cells. This may be due to the fact that females mature earlier than males. Since the plastic dynamic set is higher developmentally, more females were found in this category than males.

Uznadze found that the set type distributions were different in adults and children. Since Uznadze (1966, p. 82) stated that his findings were tentative, an investigation was made into the sub-classifications of the set typologies. The above results on both the Uznadze Visual Test and the Order of Operations Test, are not generally in keeping with the set type distribution found by Uznadze. This is due to a majority of plastic dynamic subjects rather than a majority of coarse dynamic subjects, and to a strong representation of unfixable individuals.

Uznadze classified his subjects into dynamic, static, and variable groups, referring respectively to those who extinguish set within 30 critical trials; to those who do not extinguish set within 30 critical trials; and to those who exhibit a change in the type of extinction when tested on different occasions. For the purpose of this study, the three main set typologies are: unfixable, dynamic, and static (see Table 1 for set classifications on the Uznadze Visual Test and the Order of Operations Test). The unfixable classification is included because it is strongly represented. The variable classification has been excluded because variable subjects are difficult to identify. Their

Table 1

Set Classification on the Uznadze Visual Test and the Order of Operations Test

Uznadze Visual Test	Order of Operations Test			
	UF	D	S	Total
UF[a]	3	21	3	27
D	9	49	10	68
S	1	3	0	4
Total	13	73	13	99

[a]These abbreviations represent the set typologies: UF (unfixable), D (dynamic), and S (static).

identification would require testing on several occasions, and moreover, Uznadze stated (1966, p. 147) that they represent a very small portion of the population.

Due to the fact that the set classifications of the Uznadze Visual Test and the Order of Operations Test include too many cells with few observations, a chi-square test will be used with caution. Referring to Table 1, if the 4 static subjects of the Uznadze Visual Test are considered as outliers, a chi-square test may be tentatively conducted on the remaining 95 subjects classified in a 2 x 3 contingency table. With expected frequencies less than 5 in two cells, the calculated chi-square is .34 indicating that there is no significant relationship between the two classification criteria, and thereby not supporting the hypothesis of this study. The chi-square value is so low that this conclusion is expected to be equally applicable to the complete data. It is interesting to note that the dynamic group is the largest group in both tests. This is observed in the data: 68.68% of the subjects are dynamic on the Uznadze Visual Test, 73.73% of the subjects are dynamic on the Order of Operations Test, and 49.49% of the subjects are dynamic on both tests.

A descriptive analysis will now be used to offer explanations for the lack of relationship between the set typologies as determined by the Uznadze Visual Test and the Order of Operations Test. The discussion will begin with an examination of four aspects of the Order of Operations Test, namely, the type of questions, the administration procedures, the reliability, and the identification of the type of experiment. This will be followed by an investigation of the testing procedures of both the Uznadze Visual Test, and the Order of Operations Test.

With reference to the type of questions, Uznadze (1966, p. 12) stated that set is more easily identified if the setting and critical trials are similar. Most of his experiments were quantitative ones testing different size proportions. In the Order of Operations Test, the subjects were not required to make a quantitative comparison. Furthermore, all the questions in the setting and critical trials were dissimilar in the sense that each question was formulated by using different numbers. The only invariant was the order of mathematical operations within the setting trials and within the critical trials. Perhaps more success would have been achieved by using the same question for all

the setting trials, e.g. 1 + (2 x 3), and the same question for all the critical trials, e.g. 1 x (2 + 3). In addition, the following three-step procedure had to be used in order to solve the question: remember to do what is in parentheses first; compute the expression inside the parentheses next; and then compute the final answer. This procedure is more complex than the one-step procedure the subjects followed in the Uznadze Visual Test in which the subjects had to compare the sizes of two circles.

Secondly, with reference to the administration procedures of the Order of Operations Test, it is possible that the exposure time was adequate but the time given to answer the question was too long. From the results of the designing stages of the instrument with grade five and seven students, the researcher determined that a timed exposure of 2 seconds would be adequate in order to answer each question. In the administration of the test to grade six subjects, 94.28% of the subjects were able to answer at least 20 out of 25 setting trials correctly. The time allotted between questions was not electronically controlled because the test was administered on a group basis. The researcher made sure that each subject had finished

answering the question and that each subject had his eyes focussed on the screen before presenting the next question. Thus, the interval between exposures may have been long enough to allow some of the subjects to break set. This may partially explain the relatively high number of subjects who were classified as unfixable by the Uznadze Visual Test and dynamic by the Order of Operations Test (see Table 1). The time allotted between the questions seems to have been short enough to detect the presence of set, but long enough for these subjects to correct their perceptual errors.

Thirdly, the test-retest reliability of the Order of Operations Test computed from a Spearman rank correlation coefficient was .18. The test was readministered to one of the three grade six classes (N = 35), one week after the first administration of the test. A low reliability was expected because the test is not based on computational skills, but rather on a change in the order of operations which occurs once in the whole testing procedure. Thus, a subject who may have been aware of this single change prior to the second administration of the test, could quickly identify this change in the critical trials. Furthermore, the reliability was also affected by the large number of

tied scores, especially in the second administration of the test (see Appendix K for the set extinction scores on the first and second administration of the Order of Operations Test).

Fourthly, regarding the type of experiment, the Order of Operations Test may be described both as a qualitative experiment or as one based on equality. An important point to consider, is that an attempt is being made in this study to compare the set typologies resulting from Uznadze's Visual Test, a quantitative experiment, and the Order of Operations Test, a non-quantitative experiment. Uznadze (1966, p. 90) stated that an individual is characterized by a particular type of set which remains unchanged with reference to any sensory modalities. Yet, Uznadze's comparisons were all based on quantitative experiments. Perhaps an individual may be characterized by a particular set type in a quantitative experiment, yet by a different one in a non-quantitative experiment.

The Order of Operations Test may be classified as a qualitative experiment in the sense that there is a different answer for each trial. There are two main differences between quantitative and qualitative experiments.

One is that quantitative experiments result in a majority of contrast illusions while qualitative experiments yield only assimilation illusions. In the Order of Operations Test, the majority of the errors which the subjects made were the result of an assimilation of the mathematical procedure fixed in the setting trials. Very few "real" mistakes, that is, computational errors were made (see Appendix H for the raw data of the Order of Operations Test). The other difference is that qualitative experiments require more setting trials than quantitative experiments in order to detect the presence of set. Uznadze (1966) used 30 setting trials in his experiments testing the recognition of Latin and Russian letters (p. 66), while he recognized that fixation is best achieved in 10 to 15 setting trials in quantitative experiments with dynamic subjects, comprising the majority proportion of the population (p. 141).

The Order of Operations Test may also be described as an experiment based on equality. Uznadze (1966, p. 63) presented his subjects with equally-sized circles in the setting trials. In the Order of Operations Test the same mathematical procedure is required of the subjects in the setting trials. Classifying the Order of Operations Test

as an experiment based on equality has three important implications. Similar to qualitative experiments, only illusions of assimilation may be obtained in experiments based on equality (Uznadze, 1966, p. 62).

The second implication is that sets based on equality yield a comparatively high number of static subjects. Uznadze (1966) reported that in experiments based on equality, 20% of the subjects were static (p. 64), while he further stated that only very few subjects may be classified as static (p. 147). This observation seems to add support to the idea that different set typologies may be obtained from different kinds of experiments. It may also explain the relatively high number of static subjects which accounted for 13.13% of the subjects in the Order of Operations Test.

The third implication, similar to the one made with reference to qualitative experiments, involves the number of setting trials needed to fix a set. Uznadze (1966, p. 63) stated that a set based on equality is more difficult to fix and is fixed later than one based on quantitative experiments. In some cases, 25 to 30 setting trials may be required to detect the presence of set. The number of

setting trials required depends on the type of set that one is trying to fix. Qualitative experiments and experiments based on equality both require a greater number of setting trials than sets based on quantitative studies.

Having examined four aspects of the Order of Operations Test, the testing procedures of both the Uznadze Visual Test and the Order of Operations Test will now be analyzed. As mentioned above, the type of experiment should be considered in determining the required number of setting trials. In order to examine the set extinction phase in as many subjects as possible, the researcher gave the same number of setting trials in the Uznadze Visual Test and in the Order of Operations Test.

Not only does the number of required setting trials depend on the type of set being fixed, it also depends on the individual being tested. This facet of set investigation was not taken into account in the administration of both tests. In the literature, the number of setting trials used in the Uznadze Visual Test differed from study to study. This made it difficult to select a specific number of setting trials for the purpose of this study. It was decided to administer the Order of Operations Test on a

group basis since this would minimize the chances of a subject being aware of the fact that the test is based on a single change in the order of operations. The researcher gave all the subjects 25 setting trials on both tests to make sure that the unfixable subjects were indeed experimentally unfixable. This procedure did not take the individual differences into account.

The number of setting trials suitable for a particular person should be determined by examining both the maximum and minimum number of setting trials to determine the presence of set. The testing should be done on an individual basis to determine the individual range for optimal fixation by gradually increasing the number of setting trials until the subject experiences illusion during the critical trials.

With reference to dynamic subjects, Uznadze explained what happens if an inappropriate number of setting trials is used. If a number of setting trials outside the optimum range (either decreased or increased) is used, then the number of illusions decreases (Uznadze, 1966, p. 139). An increase of setting trials within the optimum range makes the set more firm and strong (Uznadze, 1966, p. 40-41). It

seems that it is not only necessary to establish the optimum range of setting trials, but to test the individuals with a number of trials represented by the median of their optimum range.

Considering the optimum range of setting trials, the results of Table 1 will be further analyzed. Since the number of setting trials was 25 for all the subjects, it is possible that the subjects of a high optimum range would be affected differently from the subjects of a low optimum range. For example, if it is assumed that the subjects, classified as dynamics on the Uznadze Visual Test and as unfixables on the Order of Operations Test (see Table 1), are characterized by a high optimum range of setting trials, then, these resulting different set typologies may be explained in the light of an inappropriate number of setting trials. Individuals who have a high optimum range need a large number of setting trials. Therefore, they may have received too low a number of setting trials outside the optimum range in the Order of Operations Test (25 to 30 setting trials needed for most subjects, 25 given) resulting in a weaker set. They may have received too many setting trials within the optimum range in the Uznadze Visual Test

(15 setting trials needed for most subjects, 25 given) resulting in a stronger set.

As a second example, the subjects who are classified as unfixables on the Uznadze Visual Test, and as dynamics on the Order of Operations Test will now be considered (see Table 1). If these individuals are characterized by a low optimum range, meaning that they need a small number of setting trials, then it may be suggested that these subjects received too many setting trials on both the Uznadze Visual Test and the Order of Operations Test. This resulted in a stronger set in the Order of Operations Test because the number of setting trials was within the optimum range (25 to 30 setting trials needed for most subjects, 25 given). In the Uznadze Visual Test, the set was weaker because the number of setting trials was not within the optimum range (15 setting trials needed for most subjects, 25 given).

Another explanation for the lack of a significant relationship between the set typologies as determined by the Uznadze Visual Test and the Order of Operations Test, is that some of these subjects may be classified as variable set types. Variable subjects exhibit different types of sets at different times. To establish that a subject is

indeed a variable type, retesting should be conducted on the Uznadze Visual Test on several occasions. Because of the nature of the Order of Operations Test being based on a single change in the order of operations, this test is not as easily amenable to the identification of variable set types.

It must also be remembered that the above discussion is based on Uznadze's work with adults. Further research with children is required. Nevertheless, the children of this study are mainly characterized by plastic dynamic sets which also constitute the majority group in adults. Therefore, the statements made with reference to adults regarding the required number of setting trials, may also apply to children of the age group of this study.

In summary, the relationship between the unfixable, dynamic, and static set typologies was examined with reference to the Uznadze Visual Test and the Order of Operations Test. Three reasons were given for the strong representation of unfixables in this study. Uznadze stated that it is more difficult to fix set in middle school children but he did not indicate whether this difficulty results in unfixable set types. Secondly, his remarks

concerning unfixables were made with reference to adult subjects; and thirdly, it is more difficult to fix a visual set which is on a more abstract level, than a haptic set.

The Order of Operations Test was next examined with reference to four aspects resulting in the following observations: The setting trial questions and the critical trial questions were perhaps too dissimilar; the time allotted to answer the questions may have been too long; the reliability was low; and the Order of Operations Test could be classified both as a qualitative experiment or as an experiment based on equality.

It was further observed that both the Uznadze Visual Test and the Order of Operations Test should be administered on an individual basis in order to determine the optimum range of the setting trials. If too many setting trials are given within the optimum range, the set becomes stronger. If too many setting trials or not enough setting trials are given outside the optimum range, the set becomes weaker. All the above observations could account for the lack of a significant relationship between the set typologies as determined by the Uznadze Visual Test and the Order of Operations Test. It was also mentioned that variable

subjects may have been partially responsible for this lack of relationship.

Having analyzed the results of the Uznadze Visual Test and the Order of Operations Test, an examination of the Sequence Test will now follow.

2. Analysis of the Relationship between the Uznadze Visual Test and the Sequence Test Data

The pre-testing with grade five and seven students indicated that the subjects would most likely find the questions of the Sequence Test difficult. With a timed exposure of 6 seconds, it was found in the pilot study, that too few subjects were able to meet the minimum requirement of correctly answering at least 20 out of 25 setting trials. In this study with a timed exposure of 12 seconds, approximately one third of the grade six subjects were not able to meet the minimum requirement.

The increased time allotment may have allowed some of the subjects to objectivate. The minimum requirement was met by 68 subjects (N = 104). Of these, 41 were classified as unfixable, 23 were classified as dynamic, and 4 were classified as static. The majority of the subjects who were

able to identify the pattern in the setting trials, were also able to immediately identify the new pattern in the critical trials.

Of the 36 subjects who were not able to meet the minimum requirement, 12 were classified as unfixable, 13 were classified as dynamic, and 11 were classified as static. Although these subjects were not able to meet the minimum requirement, approximately one third were classified as dynamic. On close examination, it is possible that these subjects did not form the set from the setting trials, but were finally able to identify the pattern in the critical trials. Other subjects made up entirely different patterns of their own. In some cases, no pattern at all was evident. Some subjects eventually managed to identify the pattern in the setting trials and then continued to use it in the critical trials.

The results of the Sequence Test may indicate that it was too difficult for some subjects and that the time allotment was too long for those subjects capable of identifying the pattern in the setting trials. Perhaps more success could be achieved with this test if it were administered on an individual basis to adjust the timing

for each subject.

A summary of the Order of Operations Test and the Sequence Test results and their implications, as well as suggestions for further study, will be presented in the next section.

Summary and Conclusions

Uznadze maintains that set is a primary determinant of behavior and that each individual is characterized by a specific type of set. The purpose of this study is to offer support for this statement by testing set typologies in the field of mathematics. The researcher used the Uznadze Visual Test to determine the set typologies of 99 grade six subjects. Two mathematical measurement instruments, constructed by the researcher, were used: the Order of Operations Test and the Sequence Test. The latter instrument was not successful in detecting the presence of set because the majority of the subjects either found the questions too difficult, or were given too much time to answer the questions allowing them to objectivate. Thus, the Order of Operations Test was used to test the hypothesis that subjects characterized by one type of set in the visual modality, will be characterized by the same type of set in a test involving mathematical questions.

A chi-square statistic was used to test the independence between set typologies determined by the Uznadze Visual Test and the Order of Operations Test. It was found

that there is no significant relationship between the set typologies determined by these two measurement instruments. The following observations on the Order of Operations Test could account for the lack of a significant relationship: the dissimilarity between the setting and critical trial questions, the time allotment to answer the questions, the low reliability, and the classification of the test as a qualitative experiment or as an experiment based on equality.

Uznadze's statement that an individual is characterized by a specific type of set was based on quantitative experiments. Uznadze also reported that the formation of set is basically the same in different kinds of experiments. The formation of set may be the same, but an individual's set typology may be different depending on whether the classification is based on quantitative experiments, qualitative experiments, or experiments based on equality. An important point to consider is that a comparison is being made in this study between a quantitative experiment, the Uznadze Visual Test, and a non-quantitative experiment, the Order of Operations Test. Further research is needed to compare set typologies determined by different kinds of experiments.

Another contribution is that some progress has been made towards the development of measurement instruments to detect the presence of set in non-quantitative experiments within a mathematical context. In future research, consideration should be given to the number of setting trials required with reference to different kinds of experiments. Quantitative experiments generally need less setting trials than qualitative experiments or experiments based on equality. Secondly, the individual optimum range of setting trials should be taken into account. If too many setting trials are given within the optimum range, the set becomes stronger. If too many setting trials, or not enough setting trials are given outside the optimum range, the set becomes weaker. Further research is needed in the designing of a mathematical measurement instrument to detect the presence of set. Such a test should be administered on an individual basis to determine the optimum range of setting trials, but a test which can be administered on a group basis, would be advantageous.

A further contribution is that unfixable subjects are strongly represented among grade six children. Uznadze stated that unfixable subjects are very rare in the adult

population, but he did not specify the proportion of unfixables among children. Since Uznadze conducted very little research with children, further research with children of different age levels is needed.

Another area of research may involve the examination of set stability which may be measured by the required number of critical trials (the method used in this study), or by the amount of time needed to extinguish set. Do these two methods yield the same results? Is one better than the other in experiments testing irradiation and generalization? Is one more suited than the other in quantitative or qualitative experiments? Are Uznadze's set typologies generalizable to performance in other subject areas?

The conclusions made in this study are tentative. It is difficult to account for the lack of a significant relationship between the Uznadze Visual Test and the Order of Operations Test. Further research is needed in the designing of mathematical measurement instruments, but it is also possible that an individual is characterized by a specific type of set only in quantitative experiments.

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Appendix A

Verbal Instructions and Administration Procedures for the Uznadze Visual Test

Appendix A

Verbal Instructions and Administration Procedures for the Uznadze Visual Test

The Uznadze Visual Test was administered on an individual basis during the last two weeks of March, 1977. The testing times ranged from nine o'clock in the morning to half past four in the afternoon. The subject was asked to come into a small room containing a table with a two-channel tachistoscope scientific prototype 800F, and two chairs. The verbal instructions were as follows:

1. "I am here to test you to find out how different people see things. The results of this test will not affect your school grades in any way. Just relax and do the best you can."

2. "I am going to flash two circles on a screen at the back of this box. I would like you to tell me which circle is bigger, the one on your left, or the one on your right. Just say 'equal' if they are the same size."

3. "If the bigger circle is on this side (experimenter pointed to the left side of the tachistoscope), what would you say? (Pause.) All right. If the bigger circle is on

this side (experimenter pointed to the right side of the tachistoscope), what would you say? (Pause.) Good. If they are the same size, just say 'equal.' Just before I flash the circles on the screen, I will say 'ready.' You don't have to answer me. Just be ready. Any questions?" (The experimenter answered any questions posed.)

4. "Sit comfortably in your chair and put your eyes right against the face guard. Keep that position until all of the testing is complete."

The subject was given 25 successive setting trials in which the bigger circle was presented on the subject's left side. The setting trials were immediately followed by the critical trials. The testing was continued until the subject gave 5 correct responses in a row or until a maximum of 30 critical trials were given.

Appendix B

Scoring Sheet for the Uznadze Visual Test

Appendix B

Scoring Sheet for the Uznadze Visual Test

L (left) R (right) E (equal)

Excitation				Extinction			
1.	L	R	E	1.	L	R	E
2.	L	R	E	2.	L	R	E
3.	L	R	E	3.	L	R	E
4.	L	R	E	4.	L	R	E
5.	L	R	E	5.	L	R	E
6.	L	R	E	6.	L	R	E
7.	L	R	E	7.	L	R	E
8.	L	R	E	8.	L	R	E
9.	L	R	E	9.	L	R	E
10.	L	R	E	10.	L	R	E
11.	L	R	E	11.	L	R	E
12.	L	R	E	12.	L	R	E
13.	L	R	E	13.	L	R	E
14.	L	R	E	14.	L	R	E
15.	L	R	E	15.	L	R	E
16.	L	R	E	16.	L	R	E
17.	L	R	E	17.	L	R	E
18.	L	R	E	18.	L	R	E
19.	L	R	E	19.	L	R	E
20.	L	R	E	20.	L	R	E
21.	L	R	E	21.	L	R	E
22.	L	R	E	22.	L	R	E
23.	L	R	E	23.	L	R	E
24.	L	R	E	24.	L	R	E
25.	L	R	E	25.	L	R	E
				26.	L	R	E
				27.	L	R	E
				28.	L	R	E
				29.	L	R	E
				30.	L	R	E

Appendix C

The Order of Operations Test

Appendix C

The Order of Operations Test[a]

Example $12 \div (5 - 1)$[b]

Setting Trials

1. 1 + (2 x 3)	2. 2 + (3 x 1)
3. 3 + (3 x 3)	4. 1 + (3 x 3)
5. 3 + (1 x 2)	6. 4 + (3 x 1)
7. 3 + (1 x 3)	8. 1 + (2 x 2)
9. 3 + (2 x 1)	10. 2 + (1 x 3)
11. 1 + (2 x 4)	12. 2 + (2 x 2)
13. 4 + (2 x 1)	14. 2 + (1 x 2)
15. 4 + (3 x 2)	16. 3 + (2 x 2)
17. 2 + (2 x 1)	18. 3 + (3 x 1)
19. 4 + (1 x 2)	20. 1 + (3 x 2)
21. 3 + (3 x 2)	22. 4 + (1 x 3)
23. 3 + (2 x 3)	24. 2 + (3 x 3)
25. 3 + (4 x 1)	

[a]Each item appears on an individual slide.

[b]This item was presented as an example and discussed with the subjects.

Critical Trials

26. 1 x (2 + 3)	27. 2 x (4 + 1)
28. 1 x (3 + 2)	29. 2 x (1 + 3)
30. 2 x (3 + 1)	31. 3 x (1 + 2)
32. 3 x (2 + 1)	33. 2 x (1 + 2)
34. 3 x (3 + 2)	35. 4 x (3 + 2)
36. 2 x (2 + 1)	37. 3 x (2 + 3)
38. 2 x (3 + 3)	39. 1 x (3 + 3)
40. 3 x (1 + 3)	41. 4 x (2 + 3)
42. 3 x (3 + 1)	43. 1 x (2 + 4)
44. 2 x (4 + 4)	45. 1 x (4 + 2)
46. 4 x (2 + 1)	47. 1 x (3 + 4)
48. 4 x (1 + 2)	49. 3 x (1 + 4)
50. 1 x (4 + 3)	51. 4 x (3 + 1)
52. 3 x (4 + 1)	53. 4 x (1 + 3)
54. 2 x (2 + 2)	55. 3 x (3 + 3)

Appendix D

The Sequence Test

Appendix D

The Sequence Test[a]

Example 2 4 6 8 10[b]

Setting Trials[c]

1.	4	5	7	8	10	2.	1	2	4	5	7
3.	5	6	8	9	11	4.	9	10	12	13	15
5.	2	3	5	6	8	6.	15	16	18	19	21
7.	3	4	6	7	9	8.	6	7	9	10	12
9.	21	22	24	25	27	10.	16	17	19	20	22
11.	7	8	10	11	13	12.	17	18	20	21	23
13.	25	26	28	29	31	14.	8	9	11	12	14
15.	13	14	16	17	19	16.	10	11	13	14	16
17.	24	25	27	28	30	18.	11	12	14	15	17
19.	22	23	25	26	28	20.	12	13	15	16	18
21.	18	19	21	22	24	22.	14	15	17	18	20
23.	20	21	23	24	26	24.	23	24	26	27	29
25.	19	20	22	23	25						

[a]Each item appears on an individual slide.

[b]This item was presented as an example and discussed with the subjects.

[c]The answers in the setting trials are obtained by adding one to the last number of the sequence.

Critical Trials[a]

26.	24	26	27	29	30
27.	15	17	18	20	21
28.	30	32	33	35	36
29.	2	4	5	7	8
30.	27	29	30	32	33
31.	1	3	4	6	7
32.	14	16	17	19	20
33.	3	5	6	8	9
34.	28	30	31	33	34
35.	16	18	19	21	22
36.	46	48	49	51	52
37.	39	41	42	44	45
38.	6	8	9	11	12
39.	29	31	32	34	35
40.	26	28	29	31	32
41.	4	6	7	9	10
42.	31	33	34	36	37
43.	45	47	48	50	51
44.	19	21	22	24	25
45.	5	7	8	10	11
46.	10	12	13	15	16
47.	36	38	39	41	42
48.	25	27	28	30	31
49.	43	45	46	48	49
50.	7	9	10	12	13
51.	44	46	47	49	50
52.	23	25	26	28	29
53.	8	10	11	13	14
54.	40	42	43	45	46
55.	21	23	24	26	27

[a]The answers in the critical trials are obtained by adding two to the last number of the sequence.

Appendix E

Verbal Instructions and Administration Procedures for the Order of Operations Test and the Sequence Test

Appendix E

Verbal Instructions and Administration Procedures for the Order of Operations Test and the Sequence Test

The Order of Operations Test and the Sequence Test were administered on a group basis during the first three weeks of April, 1977. The Order of Operations Test was given to each of the three grade six classes in the morning of three separate days. The following week the same procedure was repeated for the administration of the Sequence Test. A screen, a Layfette Model 1810 timer, and a slide projector were used in the testing. Precautions were taken so that all the subjects could see the questions clearly from their desks, and that the lighting was appropriate for the viewing of the slides. The experimenter stood at the front of the classroom to make sure that all of the subjects were ready for each question. The experimenter operated the electronic timer which controlled the exposure time of the slides. The classroom teacher changed the slides at the request of the experimenter. The verbal instructions and administration procedures for the Order of Operations Test were as follows:

1. The answer sheets were distributed.

2. "The results of this test will not affect your school grades at all. The results will not be given to you. Just do the best you possibly can."

3. "At the top of the page, next to the word 'test,' write the letter 'A.' Write your full name and the date at the bottom of the page. Is everyone ready? (Pause.)"

4. "I am going to flash questions on this screen and I would like you to write your answer on the sheet you have on your desk. You must pay very close attention because each question is timed and will not appear on the screen again. Please pay very close attention. If you do not know the answer to a question, draw a line through its answer space so that you will not lose your spot." (The experimenter demonstrated this on the blackboard.)

5. "Before each question I will say 'ready' and when you are all looking at the screen, I will flash the next question." (The experimenter stood next to the screen.)

6. "Now I will show you an example of the type of questions you will be asked." (The classroom teacher flashed the example question on the screen.) "Look at this question and write your answer in the answer space for the

example on your sheet. (Pause.) What is the answer?" (The experimenter accepted a student response.) "Good. As you probably already know, you must do what is in the parentheses first at all times. Five minus one is four, and twelve divided by four is three. Any questions?" (The experimenter answered any questions posed.)

7. "Now we will begin. Do not ask any further questions. Be ready to write your answer for number one."

The questions were flashed on the screen for 2 seconds each. The experimenter said 'ready for number ___' once in a while to make sure that all the subjects were writing their answers in the appropriate space. At the conclusion of the test, the papers were collected.

The instructions and procedures for the administration of the Sequence Test may be described by the steps 1, 2, 3, 4, and 5 above, followed by 6a and 7a below. In step 2, the subjects were asked to write the letter 'B' instead of 'A' to identify the test.

6a. "Now I will show you an example of the type of questions you will be asked." (The classroom teacher flashed on the screen: '2 4 6 8 10.') "Look at this question and write down what number you think comes next in

the series. Write your answer in the answer space for the example on your sheet. What is the answer?" (The experimenter accepted a student response.) "Good. As you correctly said, the next number would be twelve because each number is two larger than the number before it. The patterns of the questions I am going to be giving you will be different from this example. Look at the numbers carefully and do your best. Any questions?" (The experimenter answered any questions posed.)

7a. "Now we will begin. Do not ask any further questions. Be ready to write your answer for number one."

The questions were flashed on the screen for 12 seconds each. The experimenter said 'ready for number ___' once in a while to make sure that all the subjects were writing their answers in the appropriate space. At the conclusion of the test, the papers were collected.

Appendix F

Answer Sheet for the Order of Operations Test and the Sequence Test

Appendix F

Answer Sheet for the Order of Operations Test and the Sequence Test

Test _____

Example _____

1._____	2._____	3._____	4._____	5._____
6._____	7._____	8._____	9._____	10._____
11._____	12._____	13._____	14._____	15._____
16._____	17._____	18._____	19._____	20._____
21._____	22._____	23._____	24._____	25._____
26._____	27._____	28._____	29._____	30._____
31._____	32._____	33._____	34._____	35._____
36._____	37._____	38._____	39._____	40._____
41._____	42._____	43._____	44._____	45._____
46._____	47._____	48._____	49._____	50._____
51._____	52._____	53._____	54._____	55._____

Name_____

Date_____

Appendix G

Raw Data of the Uznadze Visual Test

Appendix G

Table A

Raw Data of the Uznadze Visual Test

Subject	1	2	3	4	5	6	7	8	9	10	11	12
Trial												
1	E[a]	R	E	R	R	R	R	E	R	R	E	R
2	E	E	E	E	R	R	E	E	R	R	E	R
3	E	E	E	E	R	E	R	E	R	R	E	E
4	E	E	E	R	R	R	R	E	E	R	E	R
5	E	E	E	R	R	E	R	E	E	E	E	E
6		E		E	R	R	R		E	E		E
7				E	R	E	R		E	E		E
8				E	R	E	E		E	E		E
9				E	R	E	R			E		E
10				E	R	E	R					
11					R	E	R					
12					R		E					
13					E		E					
14					E		E					
15					E		E					
16					R		E					
17					R							
18					R							
19					R							
20					R							
21					E							
22					R							
23					R							
24					R							
25					R							
26					R							
27					R							
28					R							
29					R							
30					R							

[a] L (left) R (right) E (equal)

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	13	14	15	16	17	18	19	20	21	22	23	24
Trial												
1	E	R	R	E	R	E	R	E	R	E	R	R
2	E	E	R	E	E	E	E	E	E	R	E	R
3	E	E	L	E	E	E	R	E	E	R	E	R
4	E	E	E	E	E	E	E	E	R	R	E	E
5	E	E	E	E	E	E	E	E	E	R	R	E
6		E	E		E		E		E	R	E	E
7			E				E		R	E	E	E
8			E				E		E	E	E	E
9									E	E	E	
10									R	E	E	
11									E	E		
12									E			
13									E			
14									E			
15									R			
16									E			
17									E			
18									E			
19									E			
20									E			
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	25	26	27	28	29	30	31	32	33	34	35	36
Trial												
1	R	R	R	E	R	E	E	R	R	E	E	E
2	E	R	R	E	E	E	E	R	E	E	E	R
3	E	R	R	E	E	E	E	R	E	E	E	R
4	E	E	R	R	E	R	E	R	E	E	E	E
5	E	E	R	E	E	E	E	R	E	E	E	E
6	E	E	R	R	R	E		R	E			E
7		E	R	R	E	E		R				R
8		E	R	E	E	E		E				R
9			R	E	E	E		E				E
10			E	E	E			E				R
11			R	E	E			R				E
12			R	R				E				E
13			E	R				L				E
14			R	R				E				E
15			R	R				R				E
16			E	E				R				
17			R	E				E				
18			E	R				E				
19			R	E				E				
20			R	E				E				
21			E	R				E				
22			E	E								
23			E	E								
24			E	E								
25			E	E								
26				E								
27												
28												
29												
30												

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	37	38	39	40	41	42	43	44	45	46	47	48
Trial												
1	R	E	R	R	R	E	E	R	E	R	E	E
2	E	R	R	E	R	E	R	R	E	E	E	R
3	E	E	R	R	R	E	E	R	E	E	R	E
4	E	R	E	E	E	E	R	R	R	E	E	E
5	E	E	E	R	E	E	E	R	E	E	E	R
6	E	E	E	E	E		L	R	E	E	E	E
7		R	E	R	E		E	R	E		E	E
8		E	E	E	E		L	R	E		E	E
9		E		E			E	R	E			E
10		E		R			E	R				E
11		E		E			E	R				
12		E		R			E	E				
13				R			E	E				
14				E				E				
15				E				E				
16				E				E				
17				E								
18				E								
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	49	50	51	52	53	54	55	56	57	58	59	60
Trial												
1	R	R	R	R	R	R	E	E	R	R	R	E
2	E	E	E	R	R	E	E	E	E	E	E	E
3	E	R	E	R	R	R	E	E	E	R	R	E
4	E	E	E	R	R	E	E	E	E	E	E	E
5	E	R	E	R	E	E	E	E	E	E	R	E
6	E	E	E	E	E	E			E	R	E	
7		R		E	E	E				R	E	
8		R		E	E	E				E	R	
9		R		E	E					R	R	
10		R		E						E	E	
11		R								R	E	
12		E								E	E	
13		E								R	E	
14		E								E	E	
15		R								E		
16		E								R		
17		L								R		
18		E								R		
19		E								E		
20		E								E		
21		E								E		
22		E								E		
23										E		
24												
25												
26												
27												
28												
29												
30												

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	61	62	63	64	65	66	67	68	69	70	71	72
Trial												
1	E	E	E	E	E	E	R	R	R	R	R	R
2	E	E	E	E	E	E	R	R	R	E	E	E
3	R	E	E	E	E	E	R	R	R	R	R	R
4	E	R	E	E	E	E	E	R	R	R	R	R
5	E	R	E	E	E	E	R	R	R	R	E	R
6	E	E					R	E	E	R	E	R
7	E	E					E	R	L	E	E	R
8	E	E					R	R	E	E	R	R
9		E					R	R	L	E	E	R
10		E					E	R	E	R	E	R
11							E	E	E	E	E	R
12							E	E	E	L	E	E
13							E	E	E	E	E	R
14							E	E	E	E		R
15								R		R		E
16								R		R		E
17								E		R		E
18								R		R		E
19								R		R		E
20								E		L		
21								E		R		
22								E		E		
23								E		R		
24								E		R		
25										L		
26										R		
27										R		
28										E		
29										R		
30										L		

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	73	74	75	76	77	78	79	80	81	82	83	84
Trial												
1	R	E	R	R	R	R	E	R	R	E	E	R
2	E	E	R	R	R	E	R	R	R	E	E	R
3	R	E	R	R	R	E	E	E	R	E	E	E
4	E	R	R	E	E	E	R	E	R	E	E	R
5	E	R	R	R	R	E	R	E	E	E	E	E
6	R	R	R	R	R	E	E	R	E			E
7	E	R	R	R	R		E	E	R			E
8	E	E	R	E	R		E	R	E			E
9	R	E	R	E	E		E	E	E			E
10	E	E	R	E	R		E	R	E			
11	R	E	E	E	R			E	E			
12	R	E	R	E	R			E	E			
13	E		R		R			R				
14	E		E		R			R				
15	E		E		E			R				
16	R		E		E			R				
17	E		R		E			R				
18	R		E		R			E				
19	R		E		R			E				
20	E		E		E			R				
21	R		E		R			E				
22	E		E		R			E				
23	E				E			R				
24	E				E			R				
25	E				E			R				
26	R				E			R				
27	R				E			E				
28	E							E				
29	E							R				
30	R							E				

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	85	86	87	88	89	90	91	92	93	94	95	96
Trial												
1	R	R	E	R	E	E	E	R	E	R	R	E
2	E	E	E	R	E	E	E	E	E	R	E	E
3	E	E	E	E	E	E	R	E	E	E	E	E
4	E	E	E	E	R	E	R	E	E	E	E	E
5	E	E	E	R	E	E	E	E	E	E	E	E
6	E	E		R	E		E	E		E	E	
7				E	E		E			E		
8				E	E		E					
9				E	E		R					
10				E			E					
11				E			R					
12							E					
13							E					
14							E					
15							E					
16							E					
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Table A Continued

Raw Data of the Uznadze Visual Test

Subject	97	98	99
Trial			
1	R	E	E
2	E	E	E
3	E	E	E
4	E	E	E
5	E	E	E
6	E		
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
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Appendix H

Raw Data of the Order of Operations Test

Appendix H

Raw Data of the Order of Operations Test

It was determined that there are five possible types of responses to each question in the Order of Operations Test. These responses were described in Chapter II, and are repeated here for reference.

Five types of responses are possible: a correct response (C); an assimilation (A); a partial assimilation (PA); a computational error (E); or an omission (O). For example, suppose a subject is given 4 + (3 x 2) as a setting trial question, and 4 x (3 + 2) as a critical trial question. If he answers "20" in the critical trial section of the test, he would be correct. If he answers "10," his response would indicate assimilation since he is continuing to multiply first and then add as he did in the setting trials. If he answers "24," his response would indicate partial assimilation since he correctly perceived only part of the operation, namely, 4 x (3 x 2). If he answers "9," his response would once again indicate partial assimilation since he perceived 4 + (3 + 2). Since computational errors are not based on an incorrect order of operations, in this

study, a set will be considered to be extinct if the subject gives five correct successive responses including computational mistakes. Omissions will simply be ignored.

Uznadze sub-classified his three main set typologies to further describe his subjects' responses. Therefore, the sub-classifications of the subjects of this study are included here, in order that the reader may compare a specific classification of an individual on the Uznadze Visual Test, with a specific classification on the Order of Operations Test. The following set sub-classifications are used in Table B. The definition of each term is included for reference:

1. UF (unfixable) It is experimentally impossible to fix a set within 25 setting trials.

2. CD (coarse dynamic) The subject is able to extinguish set within 30 critical trials. Once the subject has an accurate perception in the critical trials, he no longer experiences illusions.

3. PD (plastic dynamic) The subject is able to extinguish set within 30 critical trials. This is accomplished gradually. The subject vacillates between accurate perceptions and illusions.

4. CS (coarse static) The subject never experiences an accurate perception in the critical trials, and is therefore unable to extinguish set within 30 critical trials.

5. PS (plastic static) The subject experiences some accurate perceptions in the critical trials, but is unable to extinguish set within 30 critical trials.

The raw data of the Order of Operations Test is presented with the set sub-classifications on the Uznadze Visual Test (UVT) and the Order of Operations Test (OOT). The number of trials needed to extinguish set on the Uznadze Visual Test (UEX) is also included, along with the subject's sex, and age as of April, 1977. For example, in Table B, the first subject is a male, 15 years and 2 months old. He is classified as unfixable on the Uznadze Visual Test, and as plastic dynamic on the Order of Operations Test. He extinguished set on the fifth trial on the Uznadze Visual Test (in this case, the subject did not actually form a set in the setting trials), and displayed the following pattern of responses: E PA C C PA PA C C C C C, until set extinction on the Order of Operations Test.

Table B

Raw Data of the Order of Operations Test[a]

Subj.	1	2	3	4	5	6	7	8	9
Sex	M	M	M	F	F	F	F	F	M
Age	15-02	11-01	11-02	12-02	11-09	11-10	12-02	13-05	11-11
UVT	UF	CD	UF	PD	PS	PD	PD	UF	CD
OOT	PD	UF	CD	UF	PD	CD	CD	PD	CD
UEX	5	6	5	10	30	11	16	5	8
Trial									
1	E	C	A	C	PA	PA	PA	A	PA
2	PA	C	A	C	C	PA	C	PA	C
3	C	C	A	C	PA	C	C	PA	C
4	C	C	A	C	C	C	C	PA	C
5	PA	C	A	C	C	C	C	PA	C
6	PA		C		C	C	C	PA	C
7	C		C		C	C		PA	
8	C		C		C			A	
9	C		C					C	
10	C		C					C	
11	C							A	
12								C	
13								C	
14								C	
15								PA	
16								C	
17								C	
18								C	
19								C	
20								C	
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

[a]See the discussion preceding this table for an explanation of the symbols used.

Table B Continued

Raw Data of the Order of Operations Test

Subj.	10	11	12	13	14	15	16	17	18
Sex	F	M	M	M	F	F	M	F	M
Age	11-09	10-09	12-11	10-11	12-00	12-06	11-06	13-10	11-09
UVT	CD	UF	PD	UF	CD	CD	UF	CD	UF
OOT	CD	UF	PD	PD	CD	PD	PD	PS	UF
UEX	9	5	9	5	6	8	5	6	5
Trial									
1	A	C	A	PA	PA	A	PA	A	C
2	A	C	E	PA	PA	A	C	A	C
3	A	C	PA	PA	C	A	PA	E	C
4	A	C	PA	PA	C	A	PA	A	C
5	C	C	PA	C	C	A	C	A	C
6	C		PA	PA	C	A	C	A	
7	C		PA	E	C	A	C	A	
8	C		A	C		A	C	A	
9	C		C	O		A	C	A	
10			C	C		PA		A	
11			A	C		E		A	
12			PA	C		A		A	
13			C			C		A	
14			C			C		A	
15			PA			C		A	
16			E			E		A	
17			C			A		A	
18			C			C		A	
19			C			C		A	
20			C			C		A	
21						C		A	
22						C		A	
23								A	
24								A	
25								A	
26								A	
27								A	
28								A	
29								A	
30								A	

Table B Continued

Raw Data of the Order of Operations Test

Subj.	19	20	21	22	23	24	25	26	27
Sex	F	M	M	M	F	M	M	M	M
Age	11-04	12-00	11-07	12-01	11-10	12-09	13-11	12-05	11-04
UVT	PD	UF	PD	PD	PD	CD	CD	CD	PD
OOT ·	PD	CD	PD	CD	PD	CD	PD	PS	PD
UEX	8	5	20	11	10	8	6	8	25
Trial									
1	PA	PA	A	A	A	A	PA	A	A
2	C	C	A	O	A	A	PA	A	A
3	PA	C	A	C	A	A	PA	A	C
4	PA	C	A	C	A	A	PA	A	C
5	C	C	A	C	A	A	C	A	C
6	C	C	PA	C	C	A	E	A	PA
7	C		PA	C	C	PA	PA	E	C
8	C		C		C	E	E	A	A
9	C		PA		PA	C	C	PA	C
10			PA		PA	O	C	A	C
11			C		C	C	C	A	A
12			PA		E	C	C	A	C
13			PA		PA	C		E	C
14			PA		C			A	C
15			C		C			A	E
16			C		C			A	C
17			O		C			A	
18			C		C			A	
19			C					A	
20			C					A	
21								A	
22								A	
23								A	
24								A	
25								A	
26								E	
27								PA	
28								A	
29								E	
30								PA	

Table B Continued

Raw Data of the Order of Operations Test

Subj.	28	29	30	31	32	33	34	35	36
Sex	F	M	M	F	M	M	M	M	F
Age	13-02	11-08	11-07	12-03	12-01	11-10	11-11	13-02	11-09
UVT	PD	PD	PD	UF	PD	CD	UF	UF	PD
OOT	UF	CD	PS	UF	CD	PD	CS	PS	PD
UEX	26	11	9	5	21	6	5	5	15
Trial									
1	C	PA	PA	C	PA	C	A	A	A
2	C	C	C	C	PA	C	A	A	PA
3	C	C	C	C	C	PA	A	A	A
4	C	C	PA	C	C	C	A	A	A
5	C	C	PA	C	C	C	A	A	C
6		C	PA		C	C	A	A	C
7			C		C	C	A	A	A
8			A			C	A	A	C
9			C				A	A	A
10			C				A	A	A
11			A				A	PA	A
12			C				A	E	PA
13			PA				A	PA	PA
14			PA				A	PA	C
15			PA				A	PA	C
16			C				A	PA	C
17			PA				A	PA	C
18			E				A	PA	C
19			C				A	PA	
20			C				A	PA	
21			PA				A	PA	
22			C				A	C	
23			PA				A	PA	
24			PA				A	PA	
25			C				A	C	
26			PA				A	C	
27			PA				A	PA	
28			PA				A	C	
29			C				A	C	
30			PA				PA	C	

Table B Continued

Raw Data of the Order of Operations Test

Subj.	37	38	39	40	41	42	43	44	45
Sex	F	F	F	M	M	F	F	M	F
Age	11-05	11-10	10-11	11-10	12-05	11-07	11-10	11-07	12-04
UVT	CD	PD	CD	PD	CD	UF	PD	CD	PD
OOT	PD	PD	CD	PD	PD	PD	PD	CD	PD
UEX	6	12	8	18	8	5	13	16	9
Trial									
1	PA	A	PA	C	PA	PA	PA	A	C
2	C	A	C	E	PA	E	PA	A	C
3	PA	PA	C	PA	C	C	C	C	C
4	C	PA	C	C	PA	PA	PA	C	PA
5	C	PA	C	C	C	C	PA	C	C
6	C	E	C	PA	C	C	C	C	C
7	C	PA		C	C	C	C	C	C
8	C	A		A	C	C	C		C
9		C		C	C	C	C		A
10		C		C			C		C
11		C		C					C
12		C		C					C
13		PA		C					C
14		C							C
15		C							
16		C							
17		C							
18		C							
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Table B Continued

Raw Data of the Order of Operations Test

Subj.	46	47	48	49	50	51	52	53	54
Sex	M	M	F	M	F	F	M	M	M
Age	12-02	11-09	12-02	13-02	11-07	12-07	11-08	13-01	11-06
UVT	CD	PD	PD	CD	PD	CD	CD	CD	PD
OOT	PD	PD	UF	PS	PD	UF	CD	UF	CD
UEX	6	8	10	6	22	6	10	9	8
Trial									
1	PA	C	C	A	A	C	A	C	PA
2	C	C	C	A	A	C	C	E	C
3	PA	PA	C	A	A	C	C	C	C
4	C	C	C	A	PA	C	C	O	O
5	C	C	C	A	C	C	C	C	C
6	C	C		O	PA		C	C	C
7	C	C		E	PA				C
8	C	C		A	A				
9				PA	PA				
10				PA	PA				
11				A	C				
12				PA	PA				
13				PA	E				
14				PA	C				
15				PA	C				
16				PA	C				
17				PA	C				
18				PA					
19				E					
20				PA					
21				PA					
22				O					
23				PA					
24				PA					
25				PA					
26				PA					
27				PA					
28				PA					
29				PA					
30				PA					

Table B Continued

Raw Data of the Order of Operations Test

Subj.	55	56	57	58	59	60	61	62	63
Sex	F	F	M	M	M	F	F	F	M
Age	11-06	12-01	11-04	12-04	11-11	11-11	12-11	11-11	12-10
UVT	UF	UF	CD	PD	PD	UF	PD	PD	UF
OOT	PD	PD	CD	CD	PS	PD	PS	CD	CD
UEX	5	5	6	23	14	5	8	10	5
Trial									
1	PA	PA	PA	PA	PA	C	A	PA	A
2	C	C	PA	PA	PA	PA	PA	C	PA
3	C	PA	PA	PA	PA	C	PA	C	PA
4	PA	PA	C	PA	PA	C	PA	C	PA
5	C	C	C	PA	PA	PA	PA	C	PA
6	C	C	C	PA	PA	C	PA	C	C
7	C	C	C	PA	PA	C	PA		C
8	C	C	C	C	PA	C	A		E
9	C	PA		E	PA	C	PA		E
10		A		C	PA	C	PA		C
11		C		C	PA		A		
12		PA		C	PA		C		
13		C			PA		C		
14		C			PA		C		
15		C			A		PA		
16		C			PA		C		
17		C			A		PA		
18					PA		C		
19					PA		C		
20					PA		C		
21					PA		PA		
22					PA		C		
23					PA		PA		
24					PA		PA		
25					PA		C		
26					C		PA		
27					C		PA		
28					PA		PA		
29					C		C		
30					C		C		

Table B Continued

Raw Data of the Order of Operations Test

Subj.	64	65	66	67	68	69	70	71	72
Sex	M	M	M	F	F	M	F	F	F
Age	12-02	12-02	11-09	12-07	11-04	11-08	11-11	12-02	12-01
UVT	UF	UF	UF	PD	PD	PD	PS	PD	PD
OOT	CD	PD	PD	PS	CD	CD	UF	PS	UF
UEX	5	5	5	14	24	14	30	13	19
Trial									
1	PA	C	PA	A	PA	PA	C	A	C
2	O	C	E	PA	C	PA	C	PA	E
3	PA	PA	C	C	C	O	C	A	C
4	PA	O	PA	PA	C	C	C	PA	C
5	PA	PA	PA	PA	E	C	C	PA	C
6	PA	C	C	PA	C	C		PA	
7	C	C	C	PA		C		A	
8	C	C	C	A		C		A	
9	C	C	C	C				A	
10	C	C	C	C				A	
11	C			A				C	
12				C				E	
13				C				C	
14				C				C	
15				PA				PA	
16				C				E	
17				PA				PA	
18				C				A	
19				C				C	
20				PA				PA	
21				PA				PA	
22				C				PA	
23				PA				C	
24				PA				A	
25				C				A	
26				PA				PA	
27				PA				PA	
28				PA				PA	
29				C				C	
30				C				A	

Table B Continued

Raw Data of the Order of Operations Test

Subj.	73	74	75	76	77	78	79	80	81
Sex	M	M	F	M	M	F	M	M	F
Age	11-06	12-05	12-03	12-01	12-01	11-09	11-06	12-00	11-10
UVT	PS	PD	PD	PD	PD	CD	PD	PS	PD
OOT	CD	CD	PD	UF	CD	PD	PD	PD	PD
UEX	30	12	22	12	27	6	10	30	12
Trial									
1	A	PA	C	C	PA	C	C	A	A
2	C	A	A	C	C	C	C	E	C
3	C	C	C	C	C	C	PA	PA	PA
4	C	C	PA	C	C	C	C	C	PA
5	C	C	PA	C	C	PA	C	C	PA
6	C	C	C		C	C	C	C	C
7		C	C			C	C	C	C
8			A			C	C	C	C
9			C			C			C
10			C			C			C
11			E						
12			C						
13			C						
14									
15									
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30									

Table B Continued

Raw Data of the Order of Operations Test

Subj.	82	83	84	85	86	87	88	89	90
Sex	F	F	M	M	F	F	M	M	M
Age	13-01	11-11	11-11	12-00	11-06	11-11	11-07	11-08	11-10
UVT	UF	UF	PD	CD	CD	UF	PD	PD	UF
OOT	PD	PD	CD	PD	PD	CD	UF	PD	PD
UEX	5	5	9	6	6	5	11	9	5
Trial									
1	PA	C	A	C	C	PA	C	PA	C
2	C	PA	A	C	PA	PA	C	PA	PA
3	C	C	A	C	C	PA	C	PA	C
4	C	PA	PA	A	PA	PA	C	C	C
5	PA	PA	C	C	C	C	E	PA	C
6	C	PA	C	C	C	C		C	C
7	C	C	C	C	C	E		C	C
8	C	C	C	A	C	C		C	
9	C	C	C	C	C	C		C	
10	C	C		C				C	
11		C		A					
12				C					
13				C					
14				C					
15				C					
16				C					
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Table B Continued

Raw Data of the Order of Operations Test

Subj.	91	92	93	94	95	96	97	98	99
Sex	M	M	F	M	M	M	M	M	M
Age	11-11	12-10	11-07	11-09	13-02	12-03	11-09	12-09	11-11
UVT	PD	CD	UF	CD	CD	UF	CD	UF	UF
OOT	CD	PD	PD	CD	PS	PS	PS	PD	PD
UEX	16	6	5	7	6	5	6	5	5
Trial									
1	A	C	PA	PA	E	A	A	A	E
2	E	PA	C	C	PA	A	A	PA	PA
3	A	C	C	C	PA	A	PA	PA	C
4	A	C	PA	C	PA	A	PA	PA	PA
5	A	C	PA	C	A	A	PA	PA	PA
6	A	C	C	C	A	A	C	PA	C
7	PA	C	C		PA	A	PA	C	C
8	A		C		A	A	C	A	C
9	C		C		A	A	PA	PA	C
10	C		C		PA	A	PA	PA	C
11	C				PA	A	A	A	
12	C				E	A	PA	PA	
13	C				PA	A	PA	C	
14					PA	A	C	C	
15					PA	A	PA	PA	
16					PA	A	PA	PA	
17					PA	PA	PA	PA	
18					A	A	C	C	
19					PA	A	C	C	
20					PA	A	C	C	
21					PA	A	PA	C	
22					PA	A	C	C	
23					PA	A	PA		
24					PA	A	PA		
25					PA	A	C		
26					PA	A	PA		
27					PA	PA	PA		
28					A	PA	PA		
29					PA	C	C		
30					PA	C	C		

Appendix I

Summary of the Number of Trials Needed to Break Set on the Uznadze Visual Test and on the Order of Operations Test extracted from the Raw Data of Appendix G and H ($\underline{n}$ = 99)

Appendix I

Table C

Summary of the Number of Trials Needed to Break Set on the Uznadze Visual Test and on the Order of Operations Test extracted from the Raw Data of Appendix G and H ($\underline{n}$ = 99)

Uznadze Visual Test	Order of Operations Test					
Trials	5-9	10-14	15-19	20-24	25-30	Total
5-9	28	16	3	5	9	61
10-14	12	2	2	0	3	19
15-19	3	2	1	0	0	6
20-24	2	2	1	1	0	6
25-30	6	0	1	0	0	7
Total	51	22	8	6	12	99

Appendix J

Set Classification and Sub-classification on the

Uznadze Visual Test and the Order of Operations Test

($\underline{n}$ = 99: 58 males, 41 females)

Appendix J

Table D

Set Classification and Sub-classification on the Uznadze Visual Test and the Order of Operations Test

($\underline{n}$ = 99: 58 males, 41 females)

Uznadze Visual Test	Order of Operations Test				
	UF	CD	PD	PS	Total
UF[a]	3.44[b]	6.89	13.79	5.17[c]	
	2.44	2.44	19.51	0	
	3	5	16	3	27
CD	3.44	10.34	10.34	6.89	
	2.44	7.31	9.75	2.44	
	3	9	10	5	27
PD	3.44	17.24	12.06	3.44	
	9.75	9.75	21.95	7.31	
	6	14	16	5	41
PS	0	1.72	1.72	0	
	2.44	0	2.44	0	
	1	1	2	0	4
Total	13	29	44	13	99

[a]UF (unfixable), CD (coarse dynamic), PD (plastic dynamic), and PS (plastic static). For a more detailed description of these set typologies, see Appendix H.

[b]The first number indicates the percentage of males in each cell; the second number indicates the percentage of females in each cell; and the third number indicates the number of subjects in each cell.

[c]This cell includes one male coarse static subject.

Appendix K

Set Extinction Scores on the First and Second Administration of the Order of Operations Test

Appendix K

Table E

Set Extinction Scores on the First and Second Administration of the Order of Operations Test

Subject	First Administration	Second Administration
1	11	5
2	5	6
3	10	9
4	5	6
5	8	5
6	7	5
7	6	5
8	20	9
9	6	6
10	9	7
11	5	5
12	20	22
13	12	8
14	7	7
15	22	12
16	9	5
17	30	9
18	5	9
19	9	6
20	6	9
21	19	6
22	6	5
23	18	5
24	12	5
25	12	5
26	30	7
27	16	8
28	5	5
29	6	10
30	30	20
31	5	5
32	7	19
33	8	6
34	30	30
35	18	8