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The relationship between consistency of hand use, stamina, energy and fatigue

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THE RELATIONSHIP BETWEEN CONSISTENCY OF HAND USE, STAMINA,
ENERGY AND FATIGUE

A Thesis

Presented to

The Faculty of the Department of Psychology

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Masters of Arts

By

Genevieve M. Inman

December 2000

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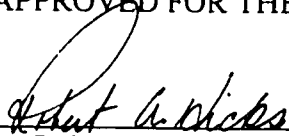
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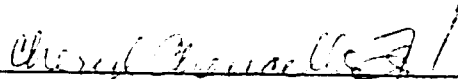
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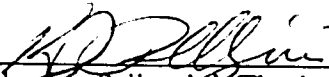
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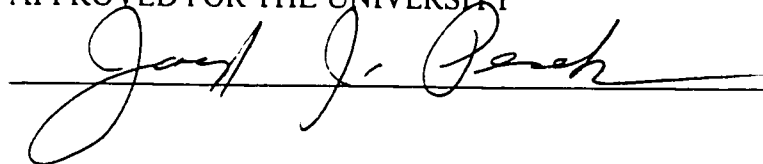


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The Relationship Between Consistency of Hand Use and Stamina, Energy and Fatigue

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Running head: CONSISTENCY OF HAND USE

Footnotes

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Abstract

The relationship observed between consistent and inconsistent hand use, sleep, and other health related items has consistently been significant. Furthermore, the relationship between sleep and stamina has been established. Therefore, the goal of this study was to test for a correlation between consistency and inconsistency of hand use and levels of stamina, energy and fatigue. To do this, the Briggs-Nebes Handedness Scale was used to classify individuals as either consistent or inconsistent in the use of their hands. An equal number of consistent (n=49) and inconsistent (n=49) university students were assigned to each group. Then, for these groups, the Stamina Scale for Students, the Visual Analog Scale and the Fatigue Impact Scale were used to measure levels of stamina, energy and fatigue. The consistent hand-use group was found to have significantly higher levels of stamina and energy and significantly lower levels of fatigue.

The Relationships of Consistency of Hand Use to Stamina and Fatigue

Overall, research on handedness has promoted a set of methodological problems which have promoted confusing and perhaps misleading results. To elaborate, research on handedness has long focused primarily on the differences between left and right handed individuals. In the process, mixed handers have often been excluded from consideration or combined with left-handers to form a non-right-handed classification. In this regard, a limited body of literature has been developed that questions the validity of excluding mixed-handers from handedness research. Satz and his colleagues (Satz, Soper & Orsin, 1988) have drawn a distinction between people who are ambidextrous or ambiguous. Satz defined ambidextrous as those who are inconsistent between items, but consistent within items. In our research, these individuals are most likely to be classified as consistent hand users. According to Satz, ambiguous hand users are those who are inconsistent within items in the use of their hands, and these individuals are most likely to be classified as inconsistent hand users in our research. However, this limited research on handedness consistency was based entirely on “non-normal” populations.¹

However, recently, using consistency and inconsistency as variables of hand use in designs that controlled for hand preference, we have established that consistency of hand use may be of greater importance than hand preference in determining relationships between handedness and certain health related factors. This study was designed to

¹ In this case, “non-normal” refers to individuals who have various disorders, such as dyslexia, mental deficiencies, birth defects, mental retardation, autism and tardive dyskinesia.

broaden the scope of the relationships between hand use consistency and health-related factors by measuring the relationship between consistency of hand use and stamina, energy and fatigue.

Hand Preference and Sleep

The problem of mixed handers, i.e., a group that seems more likely to exhibit inconsistencies in hand use, being excluded or combined with left-handed classification is apparent in a study by Coren and Searleman (1987). In this study they examined the relationship between sleep difficulty and left- and right-handedness. They hypothesized that "if sleep difficulty and sinistrality [left handedness] are both 'soft signs' of the alinormal pattern...one ought to be able to predict an elevated incidence of sleep difficulties in left-sided individuals." (p.186). The alinormal pattern is a term adopted by Coren and Searleman to describe individuals who experienced birth stressors or an unusual intrauterine environment and might suffer from "some covert trauma which does not render them manifestly abnormal, but rather alinormal (where the Latin suffix ali conveys the meaning of elsewhere or otherwise)." (p.186). To test this hypothesis 668 female and 606 male university students were evaluated for laterality using the Lateral Preference Inventory. This allowed them to ascertain eye, hand, foot and ear lateral preference. Self-report measures were used to rate sleep difficulty. These questions focused on whether the individual had difficulty falling asleep and frequent awakenings at night and were rated on a 5-point scale. Results state, "We are left with a pattern of data which clearly indicate that, as a group, left sided individuals suffer from a greater

incidence of sleep disturbance than do their right sided counterparts.” (Coren and Searleman, 1987; p.189). Specifically, non-right handed individuals were more than twice as likely to report difficulty falling asleep and significantly more likely to report frequent night awakenings. In forming the design of this study, they ignored an earlier study by Hicks, Pellegrini and Hawkins (1979) that had reported that mixed-handers tend to sleep less, and as a result, as a group, exhibited significantly greater deviations in sleep duration than either left- or right-handers.

In a subsequent study, Bautista, Barry & Hicks (1994) compared quality of sleep among left-, right-, and mixed-handers in an attempt to gain a better understanding of the relationship between sleep and laterality. University students (n=645) completed the Arousal Predisposition Scale and the 11-item Coren Insomnia Scale (Coren, 1988). The Briggs-Nebes Handedness Scale (Briggs & Nebes, 1975) was used to classify students as left-, right-, or mixed-handed. The analysis used all eleven items from the Coren Insomnia Scale, as opposed the two that Coren and Searleman (1987) used in their study. By using the full 11-item assessment of sleep difficulty, an increase in sleep difficulty for left-handed individuals was not supported. These data may question the validity of Coren and Searleman’s results because they raise the concern that Coren and Searleman may have selected only those items that produced a significant difference, and therefore, may have capitalized on chance.

As was mentioned, in Coren and Searleman's study (1987), the system used for classifying handedness did not identify mixed-handers as a separate group, but rather they were viewed as "non-right handed" and thus were assigned to their left-handed group. Therefore, it may be the case that inconsistent hand users were over represented in their left-handed group. In this regard, it has been noted that "Their demonstration that left-handers have more trouble falling asleep and awakened more frequently during sleep may, in part, reflect a relationship between these specific sleep problems and the consistency of hand use." (Hicks, DeHaro, Inman & Hicks, 1999; p. 53).

Consistency of Hand Use and Hand Preference

The issue of classification of handedness was considered by Annett (1990). As a part of this seminal paper on this topic, she conducted an association analysis using the 12 tasks of the handedness scale that served as the basis for the Briggs-Nebes Handedness Scale. As a result of this analysis she concluded that handedness could be viewed a continuous variable rather than a set of discrete categories. In her analysis of these data, she recognized the need to pay attention to persons who scored in the mixed-handed range on this scale. However, because research on handedness classification has, for the most part, ignored this advice, confusion has developed in the literature regarding hand preference relationships. For instance, Dusek and Hicks (1980) reported the relationships between "the handedness distribution of large groups of elementary school children with either birth complications or multiple birth risks with large groups of children who had no history of these birth-related variables. In both cases, the distribution

of handedness scores for the children with possible birth-related problems was shifted significantly in the direction of mixed handedness, in a direction that suggests the presence of greater inconsistency of hand use within these groups.” (Hicks, DeHaro, Inman & Hicks; 1999, p. 54) However, when scores for gifted children (IQ>132) and non-gifted children (IQ<132) were computed for the children’s version of the Briggs-Nebes Handedness Scale, Hicks and Dusek (1980) reported the handedness of the gifted group was also skewed towards mixed-handedness relative to the distribution of the non-gifted group. These data suggest that gifted students in the study were more likely to be inconsistent in their hand-use than their non-gifted peers.

In the past, research on handedness has focused almost exclusively on right- or left-hand preference. However, as has been noted, a body of literature has been developed that questions the validity of right-, left-handed classification as the primary dimension of handedness that relates to health. When analyzing attributes of normal consistent and inconsistent hand users, a variety of health related factors, such as frequency of accidents with injury, frequency of falls, symptoms of insomnia, and frequency of exercise and sports related injuries, have been found to be at significantly higher levels among inconsistent hand users. Thus, using consistency and inconsistency as variables of hand use, as opposed to right- and left- hand use, may be of importance in understanding relationships between handedness and health related factors.

In the studies that have been done regarding consistency and inconsistency of hand use, there seems to be a relationship to health in general. Currently, it can not fully be speculated why this relationship exists.

Consistency of Hand use and Health-related Variables

In the first study that examined consistency of hand use and health-related factors in normal populations, Hicks, Inman, Ching, Bautista and DeHaro (1998) measured the relationship between frequency of accidents with injury that required medical care and consistency of hand use. To do this, a scoring procedure for the 12 item Briggs-Nebes Handedness Scale was developed to define consistent and inconsistent hand use. In responding to the item Briggs-Nebes Handedness Scale, individuals were asked to indicate hand preference on the following 5-point scale: Always left, Usually left, No preference, Usually right, Always right. Consistent hand use was defined as a score of Always right or Always left to all 12 items. Inconsistent hand use was defined as ≤ 6 items marked as Always right or Always left. Undergraduate university students were rated on the scale and groups of inconsistent and consistent hand users were formed (n=23 in each group). Groups were matched as closely as possible for age, gender, ethnicity and handedness classification. Participants then completed a questionnaire with accident items used in a previous study (Hicks, Pass, Freeman, Bautista & Johnson, 1993). Results showed that inconsistent hand-users were 6.12 times more likely to experience an accident with injury that required medical care than their consistent hand-use peers. To explain the results, it was hypothesized that inconsistent hand users may

experience more serious accidents because they are “less practiced and thus less proficient with their hands than their peers with consistent hand use.” (Hicks, Inman, Ching, Bautista & DeHaro; 1998, p. 853).

In a subsequent study, Hicks, Inman, DeHaro and Hicks (1999a) showed similar results for inconsistent hand users and frequency of falls. The same method was used to establish hand-use groups as was used in the first study. A questionnaire was administered which assessed frequency of falls in the past 12-months and proneness to falling. Inconsistent hand-users were 2.81 times more likely to experience frequent falls in the past 12-months, and 1.64 times more likely to rate themselves higher in proneness to falling. These data suggested that the hypothesis used to explain the data of the first study needed alteration. Thus, collective results of both of these studies might “be a sign of a developmental inconsistency in motor coordination which could account for both the results we reported in our earlier study (Hicks, Inman, Ching, Bautista & DeHaro, 1998) and here.” (Hicks, Inman, DeHaro & Hicks; 1999a, p. 1110). Consistent with this hypothesis, in a recent study Hicks, Inman, DeHaro & Hicks (1999b) reported that the frequency of exercise and sports related injuries between consistent and inconsistent hand use groups (n=23 in each group). The consistent hand use group reported exercising more than twice as many hours per week than the inconsistent hand use group. “In response to the question, “Do you follow a regular exercise schedule?” 65% (n=15) of the consistent hand use group and 35 % (n=8) of the inconsistent hand use group answered yes.” (p.1360). Thus, this study suggests that consistency of hand use is associated with amount

of exercise and these data are consistent with the hypothesis that inconsistency of hand use may be a sign of general lack of motor control.

In a more recent study by Hicks, DeHaro, Inman & Hicks (1999) the relationship between consistency of hand use and three symptoms of insomnia were measured; i.e., the two symptoms of insomnia used by Coren and Searlman (1987): delayed sleep onset, frequent awakenings, and a third variable, trouble returning to sleep after an awakening. For each of these insomnia-related items, we reported that university students who were classified as inconsistent in the use of their hands (n=30) were significantly more likely to report problems than their consistent hand-use peers (n=30). This study holds ramifications for previous studies mentioned above. First, because sleep difficulties have been correlated with the incidence of accidents (Leger, 1994) it is logical to think that individuals who experience sleep problems will experience a higher incidence of accidents. The hypothesis was then changed to suggest that inconsistency of hand use might be a sign of general lack of motor coordination. These results “suggest that attention should be paid to the general issue of hand use consistency and health-related variables.” (Hicks, DeHaro, Inman & Hicks, 1999; p. 53).

Recently, the general issue of hand use consistency and health-related variables was emphasized by the results of a study by McNamee-Cole and Hicks (2000). Using the system for classifying the consistency of hand use, they reported a significant relationship between the consistency of hand use and the self-reported frequency of colds. They concluded that while they did not have a clear rationale for this relationship, they noted

that the relationship between consistency of hand use and health studies may be more pervasive than we had thought it to be. The purpose of this research is to elaborate further the relationship which may exist between the consistency of hand use and health status by measuring for the first time, the relationship between hand-use consistency and stamina, fatigue and energy.

Sleep, Stamina and Fatigue

A study by Inman, Rutherford, Hicks & Pellegrini (1999) demonstrated a relationship between levels of stamina and fatigue and quality of sleep in two groups of undergraduate university students (n=30 in each group) who were matched as closely as possible for age and gender. Individuals who scored low in stamina were 2.6 times more likely to rate themselves as poor sleepers, yet averaged 27 minutes more sleep per night than the high stamina group. To understand the underlying aspects of these problems, it was observed that the low stamina group scored significantly lower in measures used to assess sleep knowledge and practices. The low stamina group scored significantly lower on the Sleep Hygiene Knowledge Scale (Lacks, 1987), a scale which measures an individuals knowledge of beneficial sleep practices, i.e., if it is best to have a routine regarding going to bed. They scored lower on the Caffeine Knowledge Scale (Lacks, 1987), a scale which measures an individuals knowledge of the effects of caffeine on sleep. They also scored significantly lower on the Sleep Hygiene Practices Scale (Lacks, 1987), a scale which measures an individuals behavior concerning proper sleep habits, i.e., going to bed at around the same time each night. The high stamina group was also

significantly more likely to rate themselves as “Morning Types.” than the low-stamina group.

The observed relationships between inconsistency of hand use, accidents, sleep, and health problems, and the relationship between fatigue, stamina and sleep, provides a basis for speculation of a relationship between consistency of hand use and stamina, energy and fatigue.

The relationship observed between consistent and inconsistent hand use, sleep, and other health related items has consistently been significant. Furthermore, the relationship between sleep and stamina has been established. Therefore, this study will test for a correlation between consistency and inconsistency of hand use and levels of stamina, energy and fatigue. Specifically, it was predicted that relative to the consistent hand use group, the inconsistent hand use group would score lower in stamina and energy and higher on self-perceived fatigue.

Method

Participants

Ninety-eight right-handed undergraduate university students were used in the study. Equal numbers of participants were assigned to the consistent (n=49) and inconsistent (n=49) hand-use groups. In forming these consistent and inconsistent groups, they were matched as closely as possible for their distributions of ethnicity (there was 1 “American Indian”, 11 “Asian”, 16 “Caucasian”, 6 “Mexican American”, 3 “other Hispanic”, 4 “Pacific Islander” and 8 “other” in the inconsistent group; in the consistent

group there were 2 “African American”, 16 “Asian”, 15 “Caucasian”, 8 “Mexican American”, 2 “other Hispanic”, 1 “Pacific Islander” and 2 “other”), age (the range for each groups was 17-25 years), and gender (there were 20 men and 29 women in each group). All of the participants in this study were classified as right-handed on the Briggs-Nebes Handedness Scale. This step was taken to hold handedness classification constant between the two groups.

Variables

Consistency of Hand Use: To assess consistency of hand use, a scoring procedure for the 12 item Briggs-Nebes Handedness Scale was used (Briggs & Nebes, 1975). In responding to the item Briggs-Nebes Handedness Scale, individuals were asked to indicate hand preference on the following 5-point scale: Always left, Usually left, No preference, Usually right, Always right. Consistent hand use was defined as a score of Always right or Always left to all 12 items. Inconsistent hand use was defined as ≤ 6 items marked as Always right or Always left. A copy of the Briggs-Nebes Handedness Scale is included in Appendix B.

Stamina: To test for levels of stamina, the Stamina Scale for Students (Inman, Rutherford, Hicks & Pellegrini, 1999) was administered to all participants. This 43 item scale asks questions such as, “I’m one of those people who just keep going no matter what happens.” The response choices are in Likert form and range from N = Never or

almost never (scored 1); S = Seldom (scored 2); O = Occasionally (scored 3); F = Frequently (scored 4); and A = always or almost always (scored 5). Thus, scores range from 43 (no stamina) to 215 (extremely high stamina). A copy of the Stamina Scale for Students is included in Appendix C.

Energy: To test for energy, the Visual Analog Scale was administered (Lee, Hicks & Nino-Murcia, 1991). In responding to the 5 items of this scale, participants are instructed to mark a line on a graphic scale where they feel they are at the present time.

For example, “not at all active.....extremely active”

To score the Visual Analog Scale, the response line was divided into five equal segments and each segment was given a point value. Scores varied from 1 (no energy) to 5 (extremely high energy). Thus, scores ranged from 5 (no energy) to 25 (extremely high energy). A copy of the five questions of the Visual Analog Scale which comprise the Energy Scale is included in Appendix D.

Fatigue: To test for levels of fatigue, the Fatigue Impact Scale was administered (Fisk, Pontefract, Rivito, Archabald & Murray, 1994). This scale consists of 38 items such as, “I have difficulty paying attention for a long period.” Individuals respond to each item on this scale using a Likert-type format that varies from No problem (scored 0) to Extreme problem (scored 4). The scores on this scale can vary from 0 (no fatigue) to 190 (extremely high fatigue). A copy of the Fatigue Impact Scale is included in Appendix E.

Design

The independent variables in this experiment were consistency and inconsistency of hand use. The response variables were levels of stamina, energy and fatigue.

Procedure

To test for the possibility that consistency of hand use is a correlate for stamina, an empirical test was formed. On the basis of the Briggs-Nebes Handedness Scale groups were selected which met the criteria for either consistent or inconsistent hand use.

After identifying the participants in each group, their responses to the Stamina Scale for Students, Fatigue Impact Scale and the energy section of the Visual Analog Scale were scored. The results were analyzed using independent sample t-tests with hand-use (consistent and inconsistent) as the manipulated variables and degrees of stamina, energy and fatigue as the response measures.

Results and Discussion

The means and standard deviations for each group for each of the response measures are listed in Table 1. Also listed in Table 1 are the statistics that were computed to test the differences between the consistent and inconsistent hand use group means for each response measure.

By examining the results summarized in Table 1, it is clear that each of the predictions that were made on page 12 were realized. That is, relative to the Consistent Hand-use Group, the Inconsistent Hand-use Group reported significantly lower levels of stamina (8% lower), significantly lower levels of energy (16% lower) and significantly higher levels of fatigue (48% higher). Collectively, these data fit together to support the notion that fatigue and its correlated behaviors of low stamina and low energy are a symptom which is associated with the inconsistency of hand use.

Table 1

Means, Standard Deviations, t statistics and estimated ω^2 that were computed to evaluate the differences between the Consistent ($n = 49$) and Inconsistent ($n = 49$) Hand-use Groups each response variable

| Response Measure | <u>Consistent Group</u> | | <u>Inconsistent Group</u> | | t | p | est. ω^2 |
|------------------|-------------------------|-----------|---------------------------|-----------|------|-----|-----------------|
| | <u>M</u> | <u>SD</u> | <u>M</u> | <u>SD</u> | | | |
| Stamina | 136.45 | 11.74 | 126.59 | 13.70 | 3.28 | .01 | .07 |
| Energy | 16.92 | 4.37 | 14.61 | 4.73 | 2.51 | .01 | .03 |
| Fatigue | 34.89 | 25.24 | 51.59 | 26.87 | 3.17 | .01 | .04 |

As was noted, we have demonstrated that inconsistent hand-users are more likely to experience certain symptoms of insomnia than their consistent hand-use peers. Thus, the results of this study could be viewed as a manifestation of these sleep problems. In this regard, Carskadon (1993) has stated, "Fatigue is not the same thing as sleepiness, although people tend to confuse these words when describing how they feel..." and she defined sleepiness "...in direct relationship to factors which create a sleep debt." and reserved the term fatigue "...to describe the detrimental physical and psychological effects of prolonged performance in any number of domains." She added, "For example, an individual who is sleepy will readily fall asleep...on the other hand, a person who is fatigued may not be at all sleepy, but may be unable to perform a function at peak efficiency because of fatigue." (p. 241). Therefore, it seems prudent to determine if the differences between these groups should be attributed to fatigue or to differences in sleepiness. To check for these alterations, 40 students who were consistent in the use of their hands (15 men and 25 women; mean age 19.7 ± 3.5 years) and 42 students who were inconsistent in the use of their hands (14 men and 28 women; mean age 19.9 ± 3.1 years) were asked to respond to the items of the Epworth Sleepiness Scale (Johns, 1991). Consistent with the participants in this study, all of these students were classified as right-handed.

The Epworth Sleepiness Scale is a widely used scale that is used to assess the level of sleepiness that is typically experienced while engaging in a number of common activities. Respondents are asked to assign a rating to each of the eight items that measure

the self-perceived sleepiness that is typically associated with each activity i.e., 0 = would never doze; 1 = slight chance of dozing; 2 = moderate chance of dozing; and 3 = high chance of dozing. Thus, scores range from 0 (no sleepiness) to 24 (high sleepiness). A copy of the Epworth Sleepiness Scale is included in Appendix F. The mean Epworth score for the Consistent group was 9.7 ± 4.7 and was 9.9 ± 3.8 for the Inconsistent group. The difference between those means was not significant; $t(80) = .27$. Therefore, it seems unlikely that the differences in fatigue-related variables between the Consistent and Inconsistent Hand-use groups can be attributed to differences in sleepiness. Thus it seems reasonable to conclude that the consistency of hand-use is associated with fairly substantial differences in fatigue.

Methodology and Handedness Classification

Three methods to explain hand use preference are detailed by Annett (1970). The first is to argue that “variability (of hand use) is a product of the natural sinistral to use the right hand.” (p.304). A second approach is “to assign scores to questionnaire responses, sometimes weighted according to the subjects opinion of the strength of preferences, and to derive a laterality quotient ranging from extreme left to extreme right.” (p.304). The third method is to “distinguish a variety of handedness between the dextral and sinistral. This intermediate type has been described in several ways as ambidextrous or ambivelous, mixed handed, inconsistent or intermediate.” (p.304). In classifying hand use in this third way, the integrity of the variables continuous nature is maintained. Based on the series of studies discussed, it can be logically concluded that

consistency of hand use is a method of classifying handedness that does not carry the methodological problems of grouping mixed handers with left handers or ignoring them altogether. Furthermore, consistency of hand use seems to be an important correlate of handedness and health related factors.

As noted by Briggs and Nebes (1975), "One of the major defects of these works (on handedness) is that seldom has any attempt been made to determine either gradations of non-right handedness or their relative frequencies." (p.230). Furthermore, classifying handedness into two distinct categories (left and right) results in the misinterpretation of handedness being represented as a discrete variable. In reality, handedness is a continuous variable and in order to investigate variables associated with it, it must be represented as such.

As stated earlier, research on handedness has focused for the large part on differences between left- and right- handers. In many studies (Coren & Searleman, 1987; Halpren & Coren, 1988; Coren & Halpren, 1991) mixed handers have been either ignored or pushed into a non-right handed category and counted as left-handers. Thus, conclusions which have been made concerning left- and right-handers, when using methods which push mixed handers into a left handed classification (creating an inconsistent group), no longer apply to right and left handers but rather to consistent right and inconsistent handed individuals.

This methodological problem is apparent in a study by Coren and Halpren's (1991) concerning decreased life span of left handers. As noted by Harris' (1993)

commentary on this article, “Coren did not identify the classification rule (for handedness) used in this study, but he has informed me that he dichotomized the subjects of the basis of the (R-L)/N index...if so, then the effect would seem to have been to divide the sample into ‘right-sided’ and ‘non-right-sided’ groups.” (p.218). The result of this is that the groups were not divided into right and left-handedness classifications but rather into right and inconsistent handers. In Coren’s reanalysis of his work on accident proneness and left-handers, he concluded that “Perhaps it would be more accurate to say that non-right-handed subjects are more susceptible to accident-related injuries that are consistently right-handed individuals.”(Harris, 1993; p. 1346)

Other authors have attempted to classify individuals as consistent and inconsistent (McManus, Porac, Bryden & Boucher, 1999) and in doing so defined consistency as writing and throwing with the same hand and inconsistency as writing and throwing with different hands. They stated that:

The present paper developed out of the work of Peters (Peters, 1990; Peters & Pang, 1992; Peters & Servoes, 1989) which has shown that left-handers, defined in terms of the preferred hand for writing, are not a homogeneous group, but instead a substantial number are ‘inconsistent’, in particular preferring to throw with their right hand (and in fact also being more skilled at throwing with their right hand)...Similarly, Peters has not published data asking whether, by analogy, inconsistent right-handers might also exist who write with their right-hand but

prefer to throw with their left-hand. The extremely large study of Gilbert and Wysocki (1992) did however present data confirming the existence of inconsistent left-handers. It also suggested that inconsistent right-handers do indeed exist, as was suggested by Grimshaw and Bryden (1994)." (p.174-175).

Although our method for defining consistent and inconsistent hand use vary, from theirs, our sample supports their claim that inconsistent hand use exists in right handers. In fact, in the previous studies involving consistency of hand use, right-, mixed-, and left-handers have been included for both consistent and inconsistent groups.

Consistency of Hand use and Underlying Behaviors (or Health-related Variables)

In our earlier studies, we have for the most part, argued that differences that we have observed between consistent and inconsistent hand-users could be due to differences in general motor coordination. However, in more recent studies, it became apparent the consistency of hand use is more broadly related to health status. When taken together with the results that have demonstrated increased insomnia and increased frequency of colds for inconsistent hand-users, these data involving fatigue, energy and stamina may indicate that consistency of hand use may be associated with level of functioning of immune system. Clearly, much more work will be needed to verify this hypothesis but it is a hypothesis that should be pursued. This collection of studies provides a basis for the conclusion that consistency of hand use is indeed an important factor in health related issues.

Implications for Future Research

By recognizing consistency of hand use as an alternative method for classifying hand use (as opposed to left- right hand preference) an entirely new field of study is created. Studies involving implications of brain laterality and consistency of hand use has yet to be examined. The theory of the 'alinormal pattern' as discussed by Coren and Searleman ought to be examined from a perspective of consistency of hand use. Furthermore, replications of the past studies concerning consistency of hand use have yet to replicated by another group using the same methodology to determine the general validity of the results. Finally, statistics defining the distribution of consistent and inconsistent handed individuals in the general population would also be of interest.

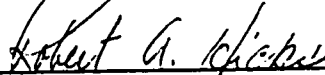
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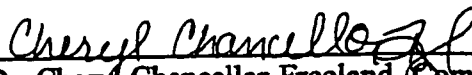
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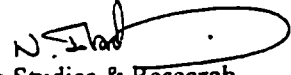
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FROM: Nabil Ibrahim, 
AVP, Graduate Studies & Research

DATE: December 9, 1999

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

"Consistency of Hand Use, Stamina, and Fatigue"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to any and all data that may be collected from the subjects. The Board's approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Nabil Ibrahim, Ph.D., immediately. Injury includes but is not limited to bodily harm, psychological trauma and release of potentially damaging personal information.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Appendix B: Briggs-Nebes Handedness Scale

| Indicate Hand Preference | Always left | Usually left | No preference | Usually right | Always right |
|---|-------------|--------------|---------------|---------------|--------------|
| To write a letter legibly | | | | | |
| To throw a ball to hit a target | | | | | |
| To play a game requiring the use of a racquet | | | | | |
| At the top of a broom to sweep dust from the floor | | | | | |
| At the top of a shovel to move sand | | | | | |
| To hold a match when striking it | | | | | |
| To hold scissors to cut paper | | | | | |
| To hold thread to guide through the eye of a needle | | | | | |
| To deal playing cards | | | | | |
| To hammer a nail into wood | | | | | |
| To hold a toothbrush while cleaning teeth | | | | | |
| To unscrew the lid of a jar | | | | | |

Appendix C: Stamina Scale for Students

Instructions: This questionnaire deals with persistence and hardiness. For each question select the response which best describes you and your feelings. Select from the following response alternatives:

Never (or almost never) Seldom Occasionally Frequently Always(or almost always)

1. I am one of those people who just keeps going no matter what happens. N S O F A ___
2. I seem to have less energy than other people. N S O F A ___
3. Regardless of the task, I enjoy hard work. N S O F A ___
4. I often find it hard to get things done. N S O F A ___
5. My involvement in nonwork activities or hobbies provides me
with a sense of meaning and purpose. N S O F A ___
6. I follow the rule that "practice makes perfect" in doing the things I do. N S O F A ___
7. The work and activities required to reach a goal are often more
pleasing than the goal itself. N S O F A ___
8. I tend to "fall apart" easily. N S O F A ___
9. I find it hard to get things done when I am upset. N S O F A ___
10. My life is filled with challenges that need to be met. N S O F A ___
11. Most people consider me to be relaxed and easy going. N S O F A ___
12. I am usually competitive and hard driven. N S O F A ___
13. Most people consider me to be hardworking and energetic. N S O F A ___
14. I consider myself to be much more responsible than most people. N S O F A ___
15. When I start a task I work until it is finished. N S O F A ___
16. Leisure time, to me, is more important than work. N S O F A ___
17. I have the energy and commitment to earn an undergraduate degree. N S O F A ___
18. If I could earn an undergraduate degree without going to college, I would be pleased. N S O F A ___
19. I feel that I am more able to succeed than most students that I have known. N S O F A ___

20. Typically, when preparing for an exam, I wait until just before the exam to start studying. N S O F A ___
21. I often feel that other students in my courses are better prepared than I am. N S O F A ___
22. When I think about my future, I am not sure what I would like to do. N S O F A ___
23. I feel that I am in the top 10% of my class. N S O F A ___
24. I enjoy studying for my favorite courses. N S O F A ___
25. I enjoy studying for my courses. N S O F A ___
26. I enjoy solving problems. N S O F A ___
27. I schedule my time so that I study at regular intervals each week. N S O F A ___
28. I often seek coaching or advice that will help me improve my ability
to perform tasks. N S O F A ___
29. I have the energy and commitment to complete a demanding graduate
program like medical school. N S O F A ___
30. I often feel like most of my life is wasted on meaningless things. N S O F A ___
31. I have little enthusiasm for my work. N S O F A ___
32. I never have felt that life is empty or has no meaning for me. N S O F A ___
33. I work just to get paid; I really don't enjoy my work. N S O F A ___
34. The most exciting things for me are often are often my own fantasies. N S O F A ___
35. Much of my life is uninteresting. N S O F A ___
36. My daily life is full of things that keep me interested. N S O F A ___
37. I get discouraged in my present work. N S O F A ___
38. I find I have very little interest in my present job. N S O F A ___
39. I often wonder why I work at all. N S O F A ___
40. I am encouraged by seeing others around me succeed. N S O F A ___
41. I need to be recognized for my achievements to feel good about them. N S O F A ___
42. Those around me feed off my enthusiasm; I motivate others. N S O F A ___

43. I have always had role models who influence the way I lead my life. N S O F A ___

Appendix D: Visual Analog Scale (Energy)

You are asked to place an X through these lines to indicate how you are feeling RIGHT NOW. For example, suppose you have not eaten since yesterday. Where would you put the X on the line below?

Not at all hungryExtremely hungry.

You would probably put the X closer to the "extremely hungry" end of the line.

This is where I put it.

Not at all hungryExtremely hungry.

NOW PLEASE COMPLETE THE FOLLOWING ITEMS.

Not at all energeticExtremely energetic

Not at all activeExtremely active.

Not at all vigorousExtremely vigorous.

Not at all efficientExtremely efficient.

Not at all livelyExtremely lively

Appendix E: Fatigue Impact Scale

Please circle the appropriate response to each of the following statements as they pertain to the last month including today. 0 = No problem, 1 = Small problem, 2 = Moderate problem, 3 = Big problem, 4 = Extreme problem.

Because of my fatigue:

| | |
|---|-----------|
| I feel less alert. | 0 1 2 3 4 |
| I have difficulty paying attention for a long period. | 0 1 2 3 4 |
| I feel like I can not think clearly. | 0 1 2 3 4 |
| I find that I am more forgetful. | 0 1 2 3 4 |
| I find it difficult to make decisions. | 0 1 2 3 4 |
| I am less motivated to do anything that requires thinking. | 0 1 2 3 4 |
| I am less able to finish tasks that require thinking. | 0 1 2 3 4 |
| I find it difficult to organize my thoughts when I am doing things at work or at home. | 0 1 2 3 4 |
| I feel slowed down in my thinking. | 0 1 2 3 4 |
| I find it hard to concentrate. | 0 1 2 3 4 |
| I am more clumsy and uncoordinated. | 0 1 2 3 4 |
| I have to be careful about pacing my physical activities. | 0 1 2 3 4 |
| I am less motivated to do anything that requires physical effort. | 0 1 2 3 4 |
| I have trouble maintaining physical effort for long periods. | 0 1 2 3 4 |
| My muscles feel much weaker than they should. | 0 1 2 3 4 |
| My physical discomfort is increased. | 0 1 2 3 4 |
| I am less able to complete tasks that require physical effort. | 0 1 2 3 4 |
| I worry about how I look to other people. | 0 1 2 3 4 |
| I have to limit my physical activities. | 0 1 2 3 4 |

| | |
|--|-----------|
| I require more frequent and longer periods of rest. | 0 1 2 3 4 |
| I feel that I am more isolated from social contact. | 0 1 2 3 4 |
| I have to reduce my workload or responsibilities. | 0 1 2 3 4 |
| I am more moody. | 0 1 2 3 4 |
| I work less efficiently (this applies to work inside or outside the home) | 0 1 2 3 4 |
| I have to rely on others to help me or do things for me. | 0 1 2 3 4 |
| I am more irritable and more easily angered. | 0 1 2 3 4 |
| I am less motivated to engage in social activities. | 0 1 2 3 4 |
| I have few social contacts outside of my own home. | 0 1 2 3 4 |
| Normal day-to-day events are stressful for me. | 0 1 2 3 4 |
| I avoid situations that are stressful for me. | 0 1 2 3 4 |
| I have difficulty dealing with anything new. | 0 1 2 3 4 |
| I feel unable to meet the demands that people place on me. | 0 1 2 3 4 |
| I am less able to provide financial support for myself and my family. | 0 1 2 3 4 |
| I engage less in sexual activity. | 0 1 2 3 4 |
| I am less able to deal with emotional issues. | 0 1 2 3 4 |
| I have difficulty participating fully in family activities. | 0 1 2 3 4 |
| I am not able to provide as much emotional support to my family as I should. | 0 1 2 3 4 |
| Minor difficulties seem like major difficulties. | 0 1 2 3 4 |

Appendix F: The Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation.

0 = would never doze

1 = slight chance of dozing

2 = moderate chance of dozing

3 = high chance of dozing

| Situation | Chance of dozing |
|---|------------------|
| Sitting and reading..... | _____ |
| Watching TV..... | _____ |
| Sitting inactive in a public place (e.g. a theatre or meeting)..... | _____ |
| As a passenger in a car for an hour without a break..... | _____ |
| Lying sown to rest in the afternoon when circumstances permit..... | _____ |
| Sitting and talking to someone..... | _____ |
| Sitting quietly after a lunch without alcohol..... | _____ |
| In a car, while stopped for a few minutes in traffic..... | _____ |