Title: Test-Retest Reliability of the Stanford Hypnotic Susceptibility Scale, Form C and the Elkins Hypnotizability Scale

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Abstract

This project aimed to assess the consistency of hypnotizability over time when measured by the Stanford Hypnotic Susceptibility Scale: Form C (SHSS:C) and the Elkins Hypnotizability Scale (EHS), and to contrast score distribution and pleasantness of these scales. University students were either administered the SHSS:C or the EHS twice with one week delay by separate experimenters. Test-retest reliability of the EHS and the SHSS:C was $\rho = .82$ [.71-.92] and $\rho = .66$, 95% [.47-.86] respectively. Hypnotizability was comparable at test and retest in the EHS group, SHSS:C scores decreased by the retest. We found that the SHSS:C produced higher scores than the EHS, and the pleasantness of the two scales was comparable. Overall our results supported the reliability of the EHS, while SHSS:C scores were more inconsistent over time. More research is warranted.

Keywords: hypnotizability, reliability, psychometrics, EHS, SHSS:C,

Test-Retest Reliability of the Stanford Hypnotic Susceptibility Scale, Form C and the Elkins Hypnotizability Scale

People's responsiveness to suggestions during hypnosis have shown individual differences. This ability to respond to hypnotic suggestions is measured by hypnotizability scales (Gary R. Elkins, Barabasz, Council, & Spiegel, 2015). Because hypnotic depth and spontaneous phenomena following a neutral hypnotic induction vary as a function of hypnotizability (Cardeña, Jönsson, Terhune, & Marcusson-Clavertz, 2013), and because of hypnotizability's consistent (albeit small) correlation with clinical effects of hypnotic interventions (Montgomery, Schnur, & David, 2011), we rely heavily on hypnotizability scales in hypnosis research. Yet, there is limited data on the psychometric properties of these measures. In the present study, we measured the test-retest reliability of two commonly used hypnotizability scales, while at the same time contrasting their pleasantness, the average scores they produced, and whether they show evidence of diminished responsiveness over time. Due to hypnotizability being assessed commonly in hypnosis research, it is paramount to have highly reliable measures that are also practical and safe to administer at scale.

The Stanford Hypnotic Susceptibility Scale: Form C (SHSS:C) has been considered the gold standard scale in the field, but over time, this scale has been criticized on multiple accounts. Lack of safety and pleasantness, lengthy administration, and dichotomous ratings of responses were among these criticisms (see Kekecs, Bowers, Kendrick, & Elkins, 2016 for a summary). The Elkins Hypnotizability Scale (EHS), a recently developed alternative to the SHSS:C, was designed to fit the needs of modern hypnosis research, with safety, pleasantness, speed, and possibility for graded assessment of responses in mind. The hypnotizability scores measured with these two scales are highly correlated ($r = .86$) when they are measured back-to-back by the same experimenter (Kekecs, Bowers, Johnson, Kendrick, & Elkins, 2016), and they are commonly used in hypnosis research. However, information on the consistency of these measures over time is limited. Information on the reliability of the scales is not only important to establish the consistency of their scores, but it also puts data on convergent validity into wider perspective, since reliability of measurement puts an upper limit on the possible correlation of two scales (Carmines & Zeller, 1979). The lack of understanding of the test-retest reliability of these two scales is a critical literature gap.

To our knowledge there is no published report on the test-retest reliability of the SHSS:C, which is surprising given its critical importance in the field. We could infer the retest reliability based on data from other related scales. For example, the test-retest

correlation of SHSS: A and B is .83 - .90 (Hilgard, 1965), and there is also data on the long-term retest correlation of hypnotizability measured with SHSS:A over a 25-year follow-up (.64- .82) (Piccione, Hilgard, & Zimbardo, 1989). However, it is uncertain how much these results can be extended to SHSS:C, due to the mismatch in the types of test suggestions these scales contain. Retest correlations of the shared items of SHSS:A and SHSS:C are only .60 - .77, which indicates that the retest reliability of SHSS:C might be lower than that measured for forms A and B (Hilgard, 1965). By contrast there is prior data on the test-retest reliability of the EHS in a small clinical sample ($r = 0.91$) (G. Elkins, Fisher, & Johnson, 2012), but it is unclear whether the results of this study can be extrapolated to the healthy population, and the population of university students where most samples come from in laboratory hypnosis research. Past research on the consistency of hypnotizability scores over time and convergent validity of different hypnotizability scales is also limited by the fact that the scales are often administered by the same experimenter. Thus, the knowledge about the results of the previous administration can leave room for experimenter biases, potentially artificially increasing the correspondence of the two scores. Furthermore, if the two scales are administered shortly after one-another, this could lead to the enhancement of responsiveness on the second administration (Hilgard, Weitzenhoffer, Landes, & Moore, 1961). These limitations increase our uncertainty about the consistency of SHSS:C and EHS scores over time. For example, the work of Fassler and colleagues (Fassler, Lynn, & Knox, 2008) indicate that responsiveness to suggestions diminish by the second administration of the scale, but this has not been studied for SHSS:C or EHS. There is also limited information about the comparability of certain properties of the two scales, such as the average hypnotizability scores produced by them, and the subjective pleasantness of undergoing SHSS:C and EHS.

The current study aims to assess the test-retest reliability of the SHSS:C and the EHS and the overall consistency of the scores produced by these scales after repeated administration. Furthermore, we compared the average hypnotizability scores produced by these scales, and the reported pleasantness of these scales by participants. To avoid potential biases from demand characteristics, researcher expectancy, or other biases resulting from the same researcher administering the hypnotizability test multiple times with the same participants, a protocol where the administrations of the scale were separated by multiple days and the researchers administering the scales were blinded to participant's previous hypnotizability score.

We had six specific hypotheses in this project. These hypotheses were pre-registered after the data collection was completed, but before analysis (see <https://osf.io/xa6ym> in the files menu):

- 1a. We expected that the EHS will have good (>0.8) test-retest reliability.
- 1b. We expected that the SHSS:C will have good (>0.8) test-retest reliability.
- 2a. We expected that EHS scores will slightly decrease by the second administration.
- 2b. We expected that SHSS:C scores will slightly decrease by the second administration.
3. We expected that the average score measured by the EHS and the SHSS:C will be similar.
4. We expect that the EHS will be rated as more pleasant compared to the SHSS:C.

Methods

Sample size and power analysis

An a-priori power calculation with G*Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) was conducted to determine the sample size. Assuming a minimum of $r = .60$ for test-retest correlation and using an α error probability of .05, the minimally sufficient sample size calculated was 25 for both the EHS and SHSS:C to detect a significant correlation with 80% power. This calculated sample size was doubled to achieve higher precision (i.e., $n = 50$ for both EHS and SHSS:C). The total sample size for this study was set to 125 participants to account for attrition.

Participants

Participants were Baylor University students recruited through IRB-approved flyers and the Baylor SONA system, which is an online research participant management system. Participants recruited through SONA were awarded course credit at the end of study participation.

Eligible participants were English-speaking individuals of at least 18 years of age with the ability to give his or her own consent for study participation. Individuals with a self-reported history of borderline personality disorder, schizophrenia, or other psychiatric conditions involving psychosis were excluded from the study due to contraindication with hypnosis (Kekecs et al., 2016; MacHovec, 1986; Walker, 2016).

Procedures

This study was approved by the Baylor University Institutional Review Board (IRB number: 698395). Informed consent was completed prior to the start of the study. The study was executed according to the principles described by the Declaration of Helsinki.

In this study, participants were administered either the EHS or the SHSS:C twice during two lab visits which were one week apart. The sequence of which participant was administered EHS or SHSS:C was determined randomly before data collection was

started. This procedure was set up with the assumption that all experimenters were trained in administering both scales. However, during the course of the project several experimenters joined who were only trained in administering one of the scales. For this reason, the pre-randomized sequence was broken, and group allocation was based on which scale the experimenter available at a given time slot was trained in.

During the first lab visit, participants provided informed consent, followed by a demographic questionnaire and a series of numbered analog scales with ratings about cognitive expectancy, dissociation, trust, and resistance. Participants were then given information about hypnosis, and any myths or misconceptions about hypnosis were addressed by the researcher. The APA Division 30 Brochure about hypnosis was used in this process (see Materials on Open Science Framework (OSF)). Prior to hypnotizability scale administration, all participants rated their relaxation and absorption levels. Participants were then administered either the EHS or the SHSS:C. Participants who were randomly assigned to the EHS group were asked to rate their relaxation and absorption following the item on positive hallucination of a rose scent. After completing the hypnotizability scale, participants rated their post-hypnotic relaxation and absorption levels, rated pleasantness of the items on the hypnotizability scale, and completed the Dissociative Ability Scale. Post-hypnotic debriefing was provided as needed.

One week later, participants returned for their second lab visit. During this visit, participants underwent the same hypnotizability scale as their first visit, administered by a different researcher. Similar to the first visit, all participants provided relaxation and absorption ratings before and after the hypnotizability scale, and participants in the EHS group provided additional relaxation and absorption ratings after the item on positive hallucination of a rose scent. All participants provided pleasantness ratings for the items on the hypnotizability scale, and completed the Dissociative Ability Scale a second time. Post-hypnotic debriefing was again provided as needed.

Measures

Demographic Questionnaire. This is an eleven-item self-report questionnaire that included questions regarding age, gender, race/ethnicity, undergraduate classification, marital status, and psychiatric diagnoses.

Elkins Hypnotizability Scale (EHS). The EHS (Elkins, 2014) is a brief six-item measure of hypnotizability that takes approximately 25 minutes to administer by a trained assessor. The EHS starts with standardized introduction of the scale followed by a standardized induction, which includes suggestions for relaxation and calmness. The six items include: 1) arm heaviness or immobilization, 2) arm levitation, 3) imagery involvement or dissociation of being in a garden, 4) positive hallucination of the smell of

a rose, 5) positive hallucination of a blue block, and 6) posthypnotic amnesia. Responses are scored based on subjective experience of the participant and behavioral observation by the assessor. A total score is obtained from summing all item scores, producing a range of scores from 0 to 12. The EHS demonstrates good internal consistency (.85) and test-retest reliability (.93) (Elkins et al., 2012; Elkins, 2014). Correlations between the EHS and SHSS:C (Weitzenhoffer & Hilgard, 1962) range from .82 to .91, indicating good convergent validity (Kekecs et al., 2016; Elkins, 2014; Elkins et al., 2012).

Stanford Hypnotic Susceptibility Scale: Form C (SHSS: C). The SHSS: C (Weitzenhoffer & Hilgard, 1962) is a 12-item measure of hypnotizability that takes approximately 45 to 60 minutes to administer by a trained assessor. Items range from simple (motor responses) to difficult (posthypnotic amnesia). Responses are scored as a dichotomous pass (score of 1) or fail (score of 0) scoring based on assessor observation and summed to produce a total score ranging from 0 to 12. Good internal consistency of the SHSS:C has been reported at .85 (Hilgard, 1965). The SHSS:C has been considered the gold standard hypnotizability scale and frequently serves as the standard against which all other scales are compared to (Kihlstrom, 1985; Woody & Barnier, 2008).

Pleasantness Scale. Participants rated the overall pleasantness of the hypnotizability scale and pleasantness of each item on the hypnotizability measure on a 10-point Likert scale, ranging from 1 (not at all pleasant) to 10 (very pleasant).

There were a number of other scales administered to participants. Measures about self-reported relaxation and absorption, hypnosis depth, perceived effectiveness of hypnosis, attitudes about hypnosis and motivation to get hypnotized, and trait dissociative ability. However, the research questions preregistered for this paper did not concern these measures, so results on these are not reported here. Information on these scales can be found in the Materials section of the OSF page of the project (<https://osf.io/kg8tx/>).

Data Management

Data was recorded by participants and experimenters on pre-printed charts. Data from these charts were entered in duplicate and later compared to ensure accuracy of data entry. The few mismatches (0.3%) between the two data entry sheets were reconciled based on the original charts.

The analysis plan was devised and registered by researchers who had no access to the data until the preregistration was complete.

Data of participants who had missing data on any item of the hypnotizability scale were discarded from all confirmatory analysis involving hypnotizability. Data of participants who had missing data on the overall pleasantness rating of the hypnosis session on either of the two sessions were discarded from all confirmatory analysis involving this variable. Missing data were not replaced in this study.

Data availability statement: Data collected in this study cannot be shared because the participants enrolled in this study did not consent to such data sharing.

Data Analysis

We hypothesized that the EHS and the SHSS:C would demonstrate good ($>.80$) test-retest reliability. Because the normality assumption of parametric regression was violated in the case of total hypnotizability scores, the test-retest reliability of both scales was assessed by means of Spearman's rank-order correlation. Confidence intervals for these test-retest correlations were bootstrap estimated with the help from the *boot* package (Canty & Ripley, 2017) in R utilizing 10 000 resamples per parameter.

Equivalence tests were conducted to assess whether participants exhibited diminished responsiveness upon reassessment. For each participant, the difference in total score between the first and second hypnotizability assessment was calculated. A Smallest Effect Size Of Interest (SESOI) was set by establishing a symmetric equivalence bound of -1 to +1 raw difference score for both the EHS and the SHSS:C. It was specified that if the 95% confidence interval of the difference between administrations was completely contained within the equivalence bound, the effect would be deemed as too small to be interesting. The same rationale was used for the equivalence tests described below. Because all distributions were non-normal, basic type confidence intervals for all equivalence tests were bootstrapped using 10 000 resamples per parameter. Complementary Wilcoxon signed-rank tests were then computed for the two scales to assess whether there is a difference in the scores between the first and second administration of the scales.

The hypnotizability scores measured at first and second administrations were then aggregated by averaging the score within participants for both the EHS and the SHSS:C. The difference

between the mean aggregated hypnotizability scores evoked by the two scales was used to determine whether the population mean of hypnotizability is equivalent when measured with the EHS and SHSS:C. Because these aggregated responsiveness scores were not normally distributed, a nonparametric Wilcoxon signed-rank test was used to test this hypothesis. A SESOI was specified by establishing a symmetric equivalence bound of -1 to +1 raw difference scores between the means.

Finally, to assess whether the EHS was rated as generally more enjoyable than the SHSS:C, we compared the pleasantness ratings given after the administrations of the two scale. Pleasantness ratings were aggregated by averaging the scores within participants for both scales. Because the mean pleasantness ratings violated the assumption of normality, a Mann-Whitney U-test was conducted to test the hypothesis that the EHS was rated as more overall pleasant than the SHSS:C. An SESOI was specified as a ± 1 mean difference in pleasantness between the scales.

All statistical procedures were carried out in version 3.5.1 of the R software for statistical computing (Team, 2019) with the alpha thresholds of statistical significance set to $p < .05$ for all confirmatory tests. Because all data distributions were non-normal, standardized effect sizes with bias-corrected-and-accelerated (BCa) confidence intervals were estimated with bootstrapping methods as advised by Kelley (2005) with help from the *bootES* package (Gerlanc & Kirby, 2013) utilizing 10 000 resamples per parameter. All basic type confidence intervals for the unstandardized differences between group means were likewise bootstrapped in this manner. Other R packages utilized for data management, visual inspection and assumptions testing were, in alphabetical order, *car* (Fox & Weisburg, 2011), *dplyr* (Wickham, François, Henry, & Müller, 2018), *ggplot* (Wickham, 2016), *lmttest* (Zeileis & Hothorn, 2002), *psych* (Revelle, 2017) and *rio* (Chan, Chan, Leeper, & Becker, J., 2018). The confirmatory analysis plan and the associated R-code was preregistered through OSF before viewing the data. The preregistered and final analysis codes are accessible as digital supplementary materials through <https://osf.io/wcegj/>.

Results

A total of 112 undergraduate students at Baylor University participated in the experiment in exchange for course credits. Thirteen of them were not included in this analysis on account of not showing up for the retest. Moreover, one participant was excluded due to the researcher's scoring being unclear. The final sample for this analysis thus consisted of 98 participants (M=28, F=70) with a mean age of 18.97 (SD=1, Range=18-25), who completed the entire experimental procedure by participating in both hypnotizability assessment sessions and providing complementary pleasantness ratings. Most of them were freshman (n=55), but sophomores (n=36) and juniors (n=7) were also represented. Seventy-one percent identified themselves as caucasian, sixteen percent as african american and seven percent as asian. Fifteen percent categorized their ethnicity as “other”. None of them were currently married. **Table 1** displays the distributions of participant demographics across the two experimental groups.

	EHS (n=51)	SHSS:C (n=47)	Test of group difference
Age	Mean= 19, SD=0.78	Mean=18.97, SD=1	$t(87) = 0.29, p = .77$
Gender	Male=13, Female=38	Male=15, Female=32	$\chi^2(1) = 0.23, p = .63$
Attrition	10/62 (16%)	4/51 (6 %)	$\chi^2(1) = 2.49, p = .11$

Table 1. Distribution of participant characteristics across the two experimental groups.

The test-retest reliability was good for the EHS, $\rho = .82$, 95% CI [.71, .92]. As shown in Figure 1, 16% of those who were allocated to the EHS scored identically on both administrations. In total, the test and retest scores fell within one point of each other in 63% of the cases and within two points in 88% of the cases. When the EHS scores were assigned into their corresponding hypnotizability range, i.e. very low (0-1), low (2-3), middle (4-8), high (9-10) and very high (11-12) (Elkins, 2014), it was found that 55% of all participants were placed in the matching category upon reassessment. For the sake of a clearer comparison between the two scales, the

scores were also assigned into their corresponding SHSS:C hypnotizability ranges (see below); in this case 67% of all participants were placed in the matching category upon reassessment.

The test-retest reliability of the SHSS:C was $\rho = .66$, 95% CI [.47, .86], so it did not reach our pre-registered criterion for good reliability. As shown in Figure 1, 15% of all participants who underwent the SHSS:C received identical scores upon reassessment. In total, the test and retest scores fell within one point of each other in 68% of the cases and within two points in 83% of the cases. When the SHSS:C scores were assigned into their corresponding hypnotizability range, i.e. low (0-4), medium (5-7), high (8-10) and very high (11-12), it was found that 47% of all participants were placed in the matching category upon reassessment. For the sake of a clearer comparison between the two scales, the scores were also assigned into their corresponding EHS hypnotizability ranges (see above); in this case 64% of all participants were placed in the matching category upon reassessment.

The low reliability of the SHSS:C was a surprising result, so we conducted some post-hoc data exploration in an attempt to find the source or sources of the low test-retest correlation. During this exploration, we noted that two participants in the SHSS:C group received hypnotizability scores at the second administration that were 6 and 7 points lower than their score at the first assessment. The removal of these extreme cases would increase SHSS:C's reliability from .66 to .78 (still below the expected reliability, but closer). There was one participant with similarly great difference between test and retest in the EHS group. Removing this participant from the dataset raised the scale's reliability but did not affect the reliability of the EHS substantially (reliability changed from .81 to .85). We did not pre-register outlier exclusion in our analysis plan, and there were no indications in the experiments' notes which would point to irregularities in these particular cases that would warrant the exclusion of these cases, so the analyses presented below are performed on the full dataset.

Figure 1. Distribution of EHS and SHSS:C test-retest score difference. The error bars represent the unstandardised confidence interval of the difference of first-to-second administration of the hypnotizability scale. The vertical dotted lines marks zero (no difference between first and second administration).

Participants who were allocated to the EHS scored an average of .41 raw units lower upon reassessment, but this difference was not statistically significant, $Z = 598$, $p = .12$, $g_{rm} = -.13$, BCa 95% CI [-0.29, 0.03]. The confidence interval of the unstandardized difference was completely contained within the ± 1 equivalence bound, 95% CI [-0.90, 0.07]. The research hypothesis specifying diminished responsiveness upon reassessment for the EHS group was thus rejected, and the difference between the first and second administration scores was deemed as negligible.

Changes in individual item scores for EHS between the two sessions are explored in Table 2. The greatest difference in pass frequency from test to retest is seen in the elbow-lift task and in hallucinating a rose smell.

Item	Test pass frequency (%)	Re-test pass frequency (%)	Re-test pass frequency minus test pass frequency (%)	Same score across test and retest frequency (%)
1. Subjective Heaviness	92	86	-6	82
2. Arm Immobilization	47	49	2	78
3. Subjective Lightness	75	75	0	84
4. Arm Levitation	41	43	2	86
5. Elbow Lift	24	12	-12	84
6. Imagery	78	75	-4	76
7. Dissociation	45	43	-2	78
8. Faint Rose Smell	59	47	-12	69
9. Distinct Rose Smell	18	10	-8	84
10. Vague Hallucination	41	43	2	78
11. Clear Hallucination	0	4	4	96
12. Recalls One or Less Items	24	24	0	84

Table 2. Changes in EHS items scores in time.

There was on the other hand a statistically significant difference in the mean of the total scores of the first and second administration of the SHSS:C, so that participants scored an average of .91 units raw score lower upon reassessment $Z = 624, p = 0.003, g_{rm} = -0.36$, BCa 95% CI [-0.59, -0.16]. Moreover, the unstandardized confidence interval of this difference spanned outside of the +/- 1 equivalence bound, 95% CI [-1.46, -0.36]. The research hypothesis that repeated administration of the SHSS:C would result in diminished responsiveness was thus retained, and

the effect size was deemed as non-negligible.

Changes in individual item scores for SHSS:C between the two sessions are explored in Table 3.

The table reveals that the mosquito hallucination, taste hallucination, dream, anosmia, and post-hypnotic amnesia items all showed at least 10 percentage points or more decrease on average by the second administration. Note that these are characterized as “cognitive” or “perceptual” suggestions (Acunzo & Terhune, 2019).

Item	Test pass frequency (%)	Re-test pass frequency (%)	Re-test pass frequency minus test pass frequency (%)	Same score across test and retest frequency (%)
1. Hand Lowering	100	98	-2	98
2. Moving Hands Apart	100	94	-6	94
3. Mosquito Hallucination	87	77	-11	85
4. Taste Hallucination	74	57	-17	83
5. Arm Rigidity	66	62	-4	70
6. Dream	66	55	-11	72
7. Age Regression	21	17	-4	79
8. Arm Immobilization	47	49	2	77
9. Anosmia to Ammonia	64	45	-19	60
10. Hallucinated Voice	2	6	4	91
11. Negative Visual Hallucination	21	17	-4	87
12. Post-Hypnotic Amnesia	43	23	-19	77

Table 3. Changes in SHSS:C items scores in time.

On average, the total hypnotizability scores of those participants who were allocated to the SHSS:C (Mean = 6.45) was 1.17 units raw score higher than for those who were allocated to the EHS (Mean = 5.28). The confidence interval of the unstandardized difference between the mean responsiveness elicited by the two scales spanned outside of the +/-1 equivalence bound, 95% CI [0.40, 1.95]. This difference was also statistically significant with a two-tailed criterion, $U = 1499.5$, $p = .032$, $g = 0.45$, BCa 95% CI [0.05, 0.84]. Therefore, we interpreted this finding as evidence against the null hypothesis that the population mean of hypnotizability would be equivalent when measured with the two scales. To help to understand the source of this difference, the distribution of the hypnotizability scores on the two scales averaged over the two administrations is displayed on Figure 2. The main difference is that there are more participants scoring low on the EHS while very low scores are absent from the SHSS:C group.

The difference between the means of the aggregated pleasantness rating from both scales was 0.18 units raw score higher for the EHS (Mean = 8.4) than for the SHSS:C (Mean = 8.2), 95% CI [-0.21, 0.60]. The 95% confidence interval of this difference was fully contained within the equivalence bound and the rank sum test was not statistically significant, $W = 1359$, $p = .25$, $g = 0.13$, BCa 95% CI [-0.26, 0.55]. The research hypothesis that the EHS would be rated as generally more pleasant than the SHSS:C was thus rejected, instead, we found evidence that the pleasantness of the two assessment methods was equivalent.

Figure 2: Frequency histograms of the aggregated total hypnotizability scores (the mean of the assessment and reassessment total hypnotizability score for each participant) in purple for the EHS (top) and in red for the SHSS:C (below) groups.

Discussion

This project assessed the consistency of hypnotizability scores over time when measured by the EHS and the SHSS:C, and compared the distribution of hypnotizability scores and pleasantness ratings between the two scales. Test-retest reliability between two scale administrations was good for the EHS, which is in line with our original hypothesis. However, reliability was questionable and lower than expected for the SHSS:C. We found that hypnotizability scores decreased by about 1 point on average by the second administration when

measured by the SHSS:C, while scores did not decrease from the first to the second administration when measured by the EHS. The mean hypnotizability score was about 1 point higher in the group where the SHSS:C was used compared to the EHS. We also found that the two scales were comparable in pleasantness.

Surprisingly, the test-retest consistency of the SHSS:C scores did not reach 0.8, or pre-specified criteria for good reliability while the EHS did surpass this threshold. Previous test-retest data for the SHSS:C and EHS are limited. Previously, the test-retest correlation of SHSS:A and B was found to be good (.83 - .90, Hilgard, 1965), so we assumed that SHSS:C would also show high retest reliability. The unexpectedly low reliability may be an indication that previous studies overestimated the test-retest reliability of hypnotizability scales, which might be due to the lack of blinding. In prior studies the same researchers may have delivered the scale at both sessions, potentially leading to bias because of the knowledge about the previous score of the participant. In the present study we avoided such experimenter effects with subsequent administrations being performed by different researchers who were blinded about the previous scores of the participants. The difference in retest reliability between the earlier forms of the SHSS might also be due to the cognitive and perceptual test suggestions, which were added in form C. Exploration of outliers revealed that the low consistency of SHSS:C in our study may be partially due to a few extreme cases who scored much lower on the second administration than the first one. Nevertheless, reliability still remained below 0.8 even without these extreme cases.

A larger sample size study is necessary to get a better estimate for the test-retest reliability of SHSS:C. This is especially important as SHSS:C is often used in the validation of

other hypnotizability scales, and the reliability of a scale puts an upper limit on the achievable convergent validity with other scales. For example, if the reliability of a measure is 0.7, the highest possible true correlation between the measure and another measure is also 0.7. If later studies confirm the poor reliability of SHSS:C, it may be necessary to consider other, more reliable measures as gold standards for future validation studies. The reliability of the EHS surpassed the pre-set criterion for good reliability, but it is important to realize that reliability was not directly contrasted between the two scales in this study. A larger scale study is necessary to make such a direct comparison, and the present report may provide valuable data to properly power such a study.

The variation in the hypnotizability scores from the first to the second administration seemed to be random for the EHS, while we found a systematic negative effect of time for the SHSS:C in addition to the random variation. Fassler et al. (2008) found a similar decreased responsiveness over time when using the CURSS scale and attributed the diminished scores to boredom and disengagement from the procedure. We did not measure boredom and engagement with the procedure in our study, but it is possible that the novelty of the SHSS:C engaged participants during the first administration, but the interest dropped in the repeated exposure because of the lengthy procedure. Likewise, due to its relative brevity, the EHS was perhaps less prone to boredom effects, but more studies are necessary to confirm this. The comparison of item-by-item pass frequencies at test and retest indicated that the cognitive and perceptual suggestions in SHSS:C may yield lower responses at the second administration. There were five items which showed more than 10 percentage point decrease in pass frequency in the SHSS:C group, all of which were cognitive items. As a comparison, there were only two items with 10

percentage point decrease in the EHS group, one of which is a perceptual task, the other a motor task. The EHS contains both cognitive and perceptual tasks just like the SHSS:C, and most of these tasks did not show a decreased pass frequency in the EHS from test to retest. Thus, the presence of such task alone is unlikely to provide sufficient explanation to why we see diminished responses in SHSS:C from test to retest. Nevertheless the mosquito hallucination, taste hallucination, dream, anosmia, and post-hypnotic amnesia suggestions in SHSS:C should be investigated further in test-retest studies to assess their consistency over time.

Average scores of participants receiving the SHSS:C were approximately one unit higher than that of EHS participants, which is contrary to the hypothesis that the population mean would be equivalent for EHS and SHSS:C scores. It is unclear why average scores would differ between the two scales. A previous study has found high correlation for hypnotizability scores on the two scales and no asymmetry was reported in the difference scores between the two scales (Kekecs et al., 2016). However, in that study the two scales were administered by the same experimenter and within a single session. Thus, the similarity of the scores in that study might have been increased by expectancy and experimenter effects. The difference in score averages is mainly a result of the more frequent occurrence of low hypnotizability scores in the EHS group compared to the SHSS:C group. This may indicate that the SHSS:C has more test suggestion items that are easy to pass relative to the EHS.

At the end of each study visit, participants were asked to rate how pleasant their experiences were with the hypnotizability scales overall. Though we hypothesized that the EHS would be rated as more pleasant, the ratings for the two scales were statistically equivalent with

an average answer close to the end marker of “Very Pleasant” for both. It was thought that the EHS would be rated more pleasant because during the design of the EHS, specific attention was taken to avoid items that may be unpleasant or stressful, such as the anosmia to ammonia, mosquito hallucination, and age regression, items in the SHSS:C which could be upsetting for some individuals (Elkins, 2014). It is possible, however, that these items do not have a major impact on the overall pleasantness rating of SHSS:C itself, or that the population of university students do not find these items so unpleasant. An analysis of the pleasantness of individual items might shed more light on this. It is also possible that social desirability and a tendency to please the experimenter have biased the results, masking differences between the two scales.

Limitations

Since the EHS is used more frequently in the experiments in our laboratory, experimenters in our lab are more familiar with administering the EHS than the SHSS:C. This may have led to mistakes or deviations from the SHSS:C protocol that the experimenters were not aware of or did not report, and could have contributed to the finding of poorer reliability for the SHSS:C. Closely monitoring protocol fidelity and assessing the effect of familiarity with each scale may be necessary in a replication attempt of the current study. Future studies attempt to contrast test-retest reliability of the two scales directly to confirm that the EHS produces more consistent scores over time. Also, as described above, the random sequence for scale administration was broken and group allocation was determined by the availability of experimenters who were trained in administering either EHS or SHSS:C. This, together with the fact that some experimenters only administered EHS and not SHSS:C, may have resulted in

experimenter effects, or some effects of time and schedule. Although unlikely, if such effects were present, they may partially explain the difference in the distribution of the hypnotizability scores between the two scales. Thus, we encourage the use of randomized group allocation in similar future studies.

Further research should also assess factors involved in diminished responsiveness from the first to the second administration of the SHSS:C. For instance, changes in pre-session expectancies or perceptions of novelty versus boredom may be affecting some participants, especially as the delivery of the scale takes about an hour. Additionally, in the current study, all participants returned for the second visit one week after their first visit. Studies wherein the re-test is administered closer, or further apart in time from the original test would also shed light on factors involved in score differences over time.

Conclusions

Our results indicate that the EHS produces reliable results over time, while the consistency of hypnotizability scores measured by the SHSS:C were less convincing. Specifically, the test-retest reliability of the SHSS:C was below expectations, and scores measured with SHSS:C were lower at the second administration of the scale. Further research is necessary to establish that the findings presented here are reproducible, and to better understand the source of inconsistency in the SHSS:C scores. Nevertheless, if the findings turn out to be reproducible it would indicate that the EHS is better suited for for scale validation purposes and for research studies assuming the consistency of hypnotizability over time. We also found that the SHSS:C produced higher average scores compared to the EHS, indicating a difference in

distribution between the scores produced by the two scales, possibly due to more easy-to-pass test suggestions in the SHSS:C. Our study suggests that the overall pleasantness of the EHS and the SHSS:C are comparable, at least in the university student population. Overall, our findings further support the usefulness and reliability of the EHS in hypnosis research.

References

- Acunzo, D., & Terhune, D. (2019). *A critical review of standardized measures of hypnotic suggestibility*. <https://doi.org/10.31234/osf.io/m93uy>
- Canty, A., & Ripley, B. (2017). *Ripley B. boot: Bootstrap R (S-Plus) functions*. R package version 1.3-18.2016.
- Cardeña, E., Jönsson, P., Terhune, D. B., & Marcusson-Clavertz, D. (2013). The neurophenomenology of neutral hypnosis. *Cortex*, 49(2), 375–385. <https://doi.org/10.1016/j.cortex.2012.04.001>
- Carmines, E. G., & Zeller, R. A. (1979). *Reliability and Validity Assessment*. SAGE Publications.
- Chan, C., Chan, G. C., Leeper, T. J., & Becker, J. (2018). rio: A Swiss-army knife for data file I/O (Version R package version 0.5.16).
- Elkins, G., Fisher, W., & Johnson, A. (2012). P02. 30. *Assessment of hypnotizability in clinical research: Development, reliability, and validation of the Elkins hypnotizability scale*. *BMC Complementary and Alternative Medicine*, 12(1), 86.
- Elkins, G. R. (2014). *Hypnotic relaxation therapy: Principles and applications*. New York, NY: Springer Publishing Company.
- Elkins, Gary R., Barabasz, A. F., Council, J. R., & Spiegel, D. (2015). Advancing Research and Practice: The Revised APA Division 30 Definition of Hypnosis. *International Journal of*

Clinical and Experimental Hypnosis, 63(1).

<https://doi.org/10.1080/00207144.2014.961870>

Fassler, O., Lynn, S., & Knox, J. (2008). *Is hypnotic suggestibility a stable trait?. Consciousness and cognition*, 17(1), 240-253.).

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). *G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods*, 39(2), 175-191.

Fox, J., & Weisburg, S. (2011). *Car, An {R} Companion to Applied Regression, Third Edition*. Retrieved from <https://socialsciences.mcmaster.ca/jfox/Books/Companion/>

Gerlanc, D., & Kirby, K. (2013). bootES: Bootstrap Effect Sizes. (Version 1.2). Retrieved from <https://CRAN.R-project.org/package=bootES>

Hilgard, E. R. (1965). *Hypnotic susceptibility*. New York, NY: Harcourt, Brace and World.

Hilgard, E. R., Weitzenhoffer, A. M., Landes, J., & Moore, R. K. (1961). The distribution of susceptibility to hypnosis in a student population: A study using the Stanford Hypnotic Susceptibility Scale. *Psychological Monographs: General and Applied*, 75(8), 1–22. <http://dx.doi.org/10.1037/h0093802>

Kekecs, Z., Bowers, J., Johnson, A., Kendrick, C., & Elkins, G. (2016). The Elkins Hypnotizability Scale: *Assessment of Reliability and Validity. International Journal of Clinical and Experimental Hypnosis*, 64(3), 285–304. <https://doi.org/10.1080/00207144.2016.1171089>

Kelley, K. (2005). The Effects of Nonnormal Distributions on Confidence Intervals Around the Standardized Mean Difference: Bootstrap and Parametric Confidence Intervals—Ken Kelley, 2005. Retrieved September 14, 2019, from <https://journals.sagepub.com/doi/abs/10.1177/0013164404264850>

- Kihlstrom, J. F. (1985). Hypnosis. *Annual Review of Psychology*, 36(1), 385–418.
<https://doi.org/10.1146/annurev.ps.36.020185.002125>
- MacHovec, F. J. (1986). *Hypnosis complications: Prevention and risk management*. Springfield, IL: Charles C Thomas.
- Montgomery, G. H., Schnur, J. B., & David, D. (2011). The Impact of Hypnotic Suggestibility In Clinical Care Settings. *International Journal of Clinical and Experimental Hypnosis*, 59(3), 294–309. <https://doi.org/10.1080/00207144.2011.570656>
- Piccione, C., Hilgard, E. R., & Zimbardo, P. G. (1989). On the degree of stability of measured hypnotizability over a 25-year period. *Journal of Personality and Social Psychology*, 56(2), 289–295. <https://doi.org/10.1037/0022-3514.56.2.289>
- Revelle, W. (2017). *psych: Procedures for Personality and Psychological Research*, Northwestern University. Retrieved from <https://CRAN.R-project.org/package=psych>
Version = 1.8.10
- Team, R. C. (2019). R: A language and environment for statistical computing (Version 3.3.1). Retrieved from <http://www.R-project.org/>
- Walker, W. L. (2016). Guidelines for the use of hypnosis: When to use hypnosis and when not to use. *Australian Journal of Clinical and Experimental Hypnosis*, 41 (1), 41–53.
- Weitzenhoffer, A. M., & Hilgard, E. R. (1962). *Standard Hypnotic Susceptibility Scale, Form C*. Palo Alto, CA: Consulting Psychologists Press.
- Wickham, H. (2016). *ggplot2: Elegant Graphics for Data Analysis* (Version 3.2.0). Springer-Verlag, New York.
- Wickham, H., François, R., Henry, L., & Müller, K. (2018). *dplyr: A Grammar of Data Manipulation* (Version 0.7.8). Retrieved from <https://CRAN.R-project.org/package=dplyr>
- Woody, E. Z., & Barnier, A. J. (2008). Hypnosis scales for the twenty-first century: What do we

need and how should we use them? In *The Oxford handbook of hypnosis: Theory, research, and practice* (M. R. Nash & A. J. Barnier, pp. 255–282). Oxford, UK: Oxford University Press.

Zeileis, A., & Hothorn, T. (2002). *Diagnostic Checking in Regression Relationships*. Retrieved from <https://CRAN.R-project.org/doc/Rnews/>

References

Canty, A. & Ripley, B (2017). *boot*: Bootstrap R (S-Plus) Functions. R package version 1.3-2

Chan, C., Chan, G. CH, Leeper, T.J. & Becker, J. (2018). *rio*: A Swiss-army knife for data file I/O. R package version 0.5.16

Carmines, E. G., & Zeller, R. A. (1979). *Reliability and Validity Assessment* (Vol. 17). Thousand Oaks, CA: Sage.

Elkins, G. R. (2014). *Hypnotic relaxation therapy: Principles and applications*. New York, NY: Springer Publishing Company.

Elkins, G., Fisher, W., & Johnson, A. (2012). P02. 30. Assessment of hypnotizability in clinical research: Development, reliability, and validation of the Elkins hypnotizability scale. *BMC Complementary and Alternative Medicine*, 12(1), 86.

Fassler, O., Lynn, S. J., & Knox, J. (2008). Is hypnotic suggestibility a stable trait?. *Consciousness and cognition*, 17(1), 240-253.)

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39(2), 175-191.

Fox, J. & Weisberg, S. (2011). *car*, An {R} Companion to Applied Regression, Third Edition.

Thousand Oaks CA: Sage. URL: <https://socialsciences.mcmaster.ca/jfox/Books/Companion/>

Fisher, W., Johnson, A., & Elkins, G. (2013). Principal component analysis of a measure of non-pathological dissociation: The dissociative ability scale. *Contemporary Hypnosis & Integrative Therapy*, 30(1), 32–44.

Gerlanc, D. & Kirby, K. (2015). *bootES*: Bootstrap Effect Sizes. R , package version 1.2.

<https://CRAN.R-project.org/package=bootES>

Hilgard, E. R. (1965). *Hypnotic susceptibility*. New York, NY: Harcourt, Brace and World.

Kekecs, Z., Bowers, J., Johnson, A., Kendrick, C., & Elkins, G. (2016). The Elkins Hypnotizability Scale: Assessment of reliability and validity. *International Journal of Clinical and Experimental Hypnosis*, 64(3), 285-304.

Kelley, K. (2005). The Effects of Nonnormal Distributions on Confidence Intervals Around the Standardized Mean Difference: Bootstrap and Parametric Confidence Intervals. *Educational and Psychological Measurement*, 65(1), 51–69. doi:10.1177/0013164404264850

Kihlstrom, J. F. (1985). Hypnosis. *Annual Review of Psychology*, 36(1), 385-418.

Kihlstrom, J. F. (2008). The domain of hypnosis, revisited. In M. R. Nash & A. J. Barnier (Eds.) *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 21-52). New York, NY: Oxford University Press.

MacHovec, F. J. (1986). *Hypnosis complications: Prevention and risk management*. Springfield, IL: Charles C Thomas.

Piccione, C., Hilgard, E.R., Zimbardo, P.G. (1989). On the degree of stability of measured hypnotizability over a 25-year period. *Journal of Personality and Social Psychology*, 56(2), 289-95.

R Core Team (2014). R: A language and environment for statistical computing. R Foundation for

Statistical Computing, Vienna, Austria.: URL: <http://www.R-project.org/>

Revelle, W. (2018) psych: Procedures for Personality and Psychological Research,

Northwestern University, Evanston, Illinois, USA,

<https://CRAN.R-project.org/package=psych> Version = 1.8.10

Slonena, E. E., Kekecs, Z., & Elkins, G. (2018). The revised factor structure of the dissociative ability scale: a measure of non-pathological dissociation. *Contemporary Hypnosis & Integrative Therapy*, 33(1).

Walker, W. L. (2016). Guidelines for the use of hypnosis: When to use hypnosis and when not to use. *Australian Journal of Clinical and Experimental Hypnosis*, 41(1), 41-53.

Weitzenhoffer, A. M., & Hilgard, E. R. (1962). *Stanford Hypnotic Susceptibility, Form C*. Palo Alto, CA: Consulting Psychologists Press.

Wickham, H. (2016) ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag, New York, Version 3.2.0

Wickham, H., François, R., Henry, L., & Müller, K. (2018). dplyr: A Grammar of Data Manipulation. R package version 0.7.8. <https://CRAN.R-project.org/package=dplyr>

Woody, E. Z., & Barnier, A. J. (2008). Hypnosis scales for the twenty-first century: What do we need and how should we use them. In M. R. Nash & A. J. Barnier (Eds.) *The Oxford handbook of hypnosis: Theory, research, and practice* (pp. 255-282). New York, NY: Oxford University Press.

Zeileis, A. & Hothorn, T. (2002). Diagnostic Checking in Regression Relationships. R News 2(3), 7-10. URL <https://CRAN.R-project.org/doc/Rnews/>