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The impact of stimulus attributes on engagement of nursing home residents with dementia

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Abstract

We examined the influence of stimulus attributes on the engagement of 69 nursing home residents with dementia. Specifically, we looked at work-related stimuli versus manipulative block stimuli, and whether the color, size, and material of a stimulus affect the duration and quality of engagement. Engagement was assessed using the Observational Measurement of Engagement (OME). Results revealed a clear preference for the work-related rather than manipulative block stimuli. In addition, the study participants showed a significant preference for small rather than large blocks, regardless of color or material. The effect of material and color was not statistically significant. These findings may assist nursing home caregivers who wish to provide appropriate stimuli for engaging nursing home residents with dementia.

Keywords

stimulus attributes; engagement time; dementia in nursing home residents; non-pharmacological intervention

1. Introduction

Nursing home residents with dementia spend the majority of their time engaged in no activity at all, with studies finding rates of unstructured time in the nursing home of approximately two thirds of the day (Cohen-Mansfield et al., 1992; Aronstein et al., 1996; Lucero et al., 2001) or more (Burgio et al., 1994). Similarly, a study of 107 nursing home residents with dementia found that nearly 45 percent of participants received little to no facility activities, 20 percent received occasional activities, and 12 percent received daily activities, though these activities were deemed inappropriate for the functional levels and interests of residents (Buettner and Fitzsimmons, 2003). Inactivity has been linked to manifestations of agitated behaviors in nursing home residents with dementia. In a 3-month observational study of 24 agitated nursing home residents, it was found that residents manifested a greater number of agitated behaviors

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when they were unoccupied and fewer agitated behaviors when involved in structured or social activities (Cohen-Mansfield et al., 1992). Treating inactivity in the nursing home, therefore, has potential benefits for nursing home residents and their caregivers.

A number of studies have investigated the impact of appropriate activities for this population, and have demonstrated that engagement in activities can have positive effects on persons with dementia. These activities have been shown to increase constructive engagement (Orsulic-Jeras et al., 2000), positive emotions (Baker et al., 2001; Schreiner et al., 2005) and alertness, and improve activities of daily living (ADL) (Schnelle et al., 1995) and quality of life (Schreiner et al., 2005) for persons with dementia. Engagement in activities has also been linked to decreased boredom (Baker et al., 2001), apathy (Politis et al., 2004), and agitation in this population (Cohen-Mansfield and Werner, 1997; Buettner, 1999).

Although prior studies have evaluated the effects of providing nursing home residents with meaningful activities such as music (Tabloski et al., 1995; Cohen-Mansfield and Werner, 1997) and pet therapy (Churchill et al., 1999), few studies were found comparing the success of diverse activities and identifying common characteristics among successful interventions. In one such study that provided 23 sensorimotor recreational items to nursing home residents with dementia, allowing participants to choose the item they wished to use, the most often selected activity was a tetherball (Buettner, 1999). When comparing participation in therapeutic activities such as exercise, pet therapy and cooking, researchers found that active participation increased when an activity stimulated more senses, and when there was less down time prior to the activity (Kovach and Magliocco, 1998). When presented with a variety of stimulus objects, nine male patients diagnosed with Alzheimer's or alcohol-dementia were most actively engaged when activities involved turning dials or knobs or manipulating metal or mechanical items as compared to softer stimuli such as plush toys, fabric books, or dolls (Mayers and Griffin, 1990). For example, when presented with the fabric book, participants would often feel it without looking at it; when presented with mechanical objects, engagement tended to be both tactile and visual.

Manipulative activities were also popular in a study of 15 nursing home residents with Alzheimer's disease in which researchers provided 16 recreational interventions and trained nursing home staff members in the use of such interventions in caring for their residents (Aronstein et al., 1996). These interventions were divided into categories of manipulatives (flex cube, bead maze, etc.), nurturing (doll, stuffed animal), sorting/perception (word sorter, puzzles, etc.), tactiles (fabric book, squeeze ball, etc.), sewing (lacing tiles), and sound/music activities (melody bells, xylophone). The duration of engagement was longest in the nurturing category, averaging nearly 30 minutes, while manipulative and sorting/perceptual activities were second and third, at 8.31 and 8.13 minutes, respectively. Similarly, when 49 residents of a dementia unit at a nursing home were presented with items in random order, four products emerged as favorites, namely a busy box, curves and waves, pat mat, and spinner board (Lucero et al., 2000). Evaluation of the common characteristics of these items revealed that all of these products were used on a horizontal plane as a single-action activity, and all had relatively large yellow parts. Three of the four favorite products had smooth, hard surfaces with at least two stimuli of varying shapes and sizes, and provided immediate motion feedback when touched.

In a separate study of ten nursing home residents with dementia who displayed wandering behaviors, researchers observed participants' interaction with available objects during unstructured periods of the day and described differences in activity preferences by stage of dementia (Lucero et al., 2001). Participants in middle stages of dementia generally engaged in "normal" daily activities such as housekeeping or "work"-related tasks, or recreational activities, and used familiar objects in order to perform such tasks. In late dementia, activities were generally simplified into single actions, sometimes involving an object that was simple

in appearance and contrasting in color. The extent to which objects needed to be simple and contrasting varied with the progression of dementia. The researchers concluded that product development aimed at persons in middle stages of dementia should focus on familiar activities, while later stage dementia products should be manipulative boards, or items of different textures to touch. As discussed above, existing research has identified a number of activities that engage nursing home residents with dementia, including those that involve the manipulation of objects and others that focus on familiar, work-related activities. In this paper, we further address this issue by examining specific attributes of the stimuli, and ask specific questions, including whether work-related stimuli are more engaging than manipulative block stimuli, and whether the color, size, and material of which a stimulus is made affect duration and quality of engagement. The data presented in this paper are part of a larger study aimed at identifying stimuli that are most engaging to nursing home residents with dementia.

2. Methods

2.1. Participants

Participants were 69 residents of four Maryland nursing homes. All participants had a diagnosis of dementia. Fifty-three participants were female (76.8%), and age averaged 86 years, ranging from 60 to 98 years. The majority of participants were Caucasian (91.3%), and most were widowed (71.0%). ADL performance, which was obtained through the Minimum Data Set and scored as a mean of 10 variables, each rated on a 1-5 scale (MDS; Morris et al., 1991), averaged 3.4 ± 1.04 ($\pm$ S.D.), range = 1.33 – 5). Cognitive functioning, as assessed via the Mini-Mental State Examination (MMSE; Folstein et al., 1975), averaged 8.0. This group of 69 participants had an average of 6.3 medical diagnoses and received an average of 8.8 medications (Table 1).

2.2. Assessments

Background data were collected through chart review and 1-on-1 interviews. Engagement was assessed through systematic observations via the Observational Measurement of Engagement (OME).

2.2.1. Background assessment—Data pertaining to background variables were retrieved from the residents' charts at the nursing homes by a trained research assistant, and included information about gender, age, marital status, medical information (medical conditions from which the resident suffers; a list of medications taken), and performance of ADL; from the MDS; (Morris et al., 1991). ADL performance was assessed for 10 activities (bed mobility, transferring, locomotion on the unit, dressing, eating, toilet use, personal hygiene, bathing, and bowel incontinence) utilizing a scale from 1 to 5, with 5 representing maximum dependence; a mean ADL score was calculated for each participant. All participants had a diagnosis of a major degenerative disease of late life such as: Dementia - probable Alzheimer's disease; Dementia - possible Alzheimer's disease; Dementia - with the presence of vascular disorder (e.g., multi-infarct dementia); Dementia - with a diagnosis of Parkinson's disease; and Dementia - unknown etiology (i.e., cognitive impairment in an alert person that fits none of the categories above).

The MMSE (Folstein et al., 1975) was administered to each participant by a research assistant who was trained with regard to standardized administration and scoring procedures. The MMSE is a brief, easily scored test that assesses the resident's orientation to time and place, immediate recall, short-term memory, attention, language, and visual-spatial orientation. The sensitivity and specificity of the MMSE have been reported to be highly reliable (Folstein, 1983).

2.2.2. Engagement Assessment (OME)—OME data were recorded through direct observations using specially designed software installed on a handheld computer, the Palm One Zire 31™. Prior to initiating an engagement trial, we recorded whether or not it was necessary to transfer the resident to another place to conduct the trial, and whether or not we interrupted the participant during another activity (e.g., a group activity, watching television, sleeping or napping). Following our introduction of the engagement stimulus, we recorded whenever the participant refused the engagement stimulus (through words or actions) as well as whether or not the participant asked for additional help and/or modeling of the stimulus. We also recorded whenever another person interrupted the engagement trial (e.g., another resident, nursing staff). Specific outcome variables on the OME are described below:

Attention to the stimulus during an engagement trial was measured on this 4-point scale: not attentive, somewhat attentive, attentive, and very attentive. In addition, we recorded the highest rating (using the same 4-point scale) that had been seen during the trial.

Attitude to the stimulus during an engagement trial was measured on a 7-point scale: very negative, negative, somewhat negative, neutral, somewhat positive, positive, and very positive. We also recorded the highest rating of attitude (on the 7-point scale) that had been seen during the trial.

Duration referred to the amount of the time that the participant was engaged with the stimulus. This measure started after presentation of the engagement stimulus and ended at 15 minutes, or whenever the study participant was no longer engaged with the stimulus. Duration was measured in seconds.

Inter-rater reliability of the OME was assessed by 6 dyads of research assistants' ratings of the engagement measures during 48 engagement sessions with nursing home residents. The inter-rater agreement rate (for exact agreement) averaged 69% across the engagement outcome variables; the agreement rate within one discrepancy was 84%; Intraclass correlation (alpha values) averaged 0.78 for the engagement outcome variables.

2.3. Procedure

Informed consent was obtained for all study participants from their relatives or other responsible parties. Additional information on the informed consent process is available elsewhere (Cohen-Mansfield et al., 1988). Our main criterion for inclusion was a diagnosis of dementia (derived from either the medical chart or the attending physician) based on DSM-IV criteria and the Report of the NINCDS-ADRDA. The criteria for exclusion were:

- The resident had an accompanying diagnosis of bipolar disorder or schizophrenia.
- The resident had no dexterity movement in either hand.
- The resident could not be seated in a chair or wheelchair.
- The resident was blind or deaf.
- The resident was younger than 60 years of age.

Once consent was obtained for eligible participants, background information was obtained from each participant's chart in the nursing home. In addition, the MMSE was administered to each participant. Those who received MMSE scores greater than 23 were dropped from the study, as persons with a comparatively higher level of cognitive functioning are usually able to articulate their interests and needs.

2.3.1. Systematic observations of engagement—Each study participant was presented with each of 11 engagement stimuli over a period of several days (approximately 4 trials per

day). Engagement trials took place between 9:30 am – 12 pm and between 2 pm – 4:30 pm, as these are the times that residents are not usually occupied with other activities at the nursing home (e.g., meals in the dining room). Individual engagement trials were separated by a washout period of at least 5 minutes. The order of stimulus presentation was randomized for each participant.

Each engagement trial began with the presentation of an engagement stimulus to the participant by a trained research assistant. Following a brief (less than one minute) presentation and modeling of the engagement stimulus, the research assistant left the area in order to simulate the situation in the nursing home where overworked nursing staff often do not have time to stay with each resident. If a study participant asked questions or needed more modeling of the engagement stimulus, the research assistant provided these before leaving and this was recorded on the OME. If the participant refused the engagement stimulus, the research assistant removed it and left the room, and this information was recorded on the OME.

A second research assistant, who remained unobtrusive, observed the participant's reaction and engagement with the stimulus via the OME, entering the data directly onto a Palm One Zire 31™. As described earlier, the OME included items measuring the participant's attention to the stimulus during engagement, attitude toward the stimulus, and duration of engagement. Each trial lasted a minimum of 3 minutes. If the participant showed no interest in the stimulus after 3 minutes, the trial was terminated and the first research assistant retrieved the engagement stimulus. If the participant became engaged with the stimulus, the trial lasted throughout the extent of the participant's engagement – up to a cutoff time of 15 minutes. When it appeared to the research assistant that the study participant was no longer engaged (for those trials that lasted more than 3 minutes), the research assistant continued to observe the study participant, ending the trial after 30 seconds if the study participant showed no further engagement.

The aim of the study was to examine the impact of stimulus features on engagement, focusing on the dimensions of: stimulus size, materials used – natural vs. man made, color, and the meaning of stimuli – work/task related vs. simply manipulative. The 11 engagement stimuli fell into 2 categories: Blocks and Work-related activities. Five sets of blocks were included in our study; these were: large natural colored wooden blocks (approximately 5.5” in length), small natural colored wooden blocks (approximately 2.75” in length), multi-colored wooden blocks (approximately 4” in length), large colored plastic blocks (Duplos®), and small colored plastic blocks (Legos®). For each engagement trial of blocks, the stimulus was placed on a table in front of the study participant who was told that using the blocks would be “good for his or her hands”.

The 6 work-related stimuli were: folding towels and washcloths, stamping envelopes, stuffing envelopes, and three different sorting activities, namely: sorting envelopes by color, sorting a deck of playing cards, and sorting jewelry (into a jewelry box – for women)/tools (into a tool box – for men). In the case of the stimulus of sorting playing cards, the research assistant pretended to drop the cards on the table and then asked the resident if he/she would mind helping by sorting the cards. The other stimuli were presented as doing work that would help the research assistant.

2.3.2. Analytic approach—Dependent measures were duration, attention, and attitude (including, for the latter two measures, both the rating observed during most of the trial as well as the highest rating observed during any point in the trial). When a study participant refused our offer of a stimulus, we coded duration as 0 seconds and scored both the attention and attitude variables as missing for that trial for the purpose of analysis. Fifty-eight percent of the study participants (n = 40) refused 1 or more of the 5 block stimuli and 43.5% of the participants (n = 30) refused 1 or more of the 6 work-related stimuli.

Paired t-tests were used to examine the effect of stimulus attributes on engagement, comparing different options for each attribute; specifically, blocks vs. work-related stimuli, the activity of sorting playing cards vs. the activity of sorting colored envelopes, the activity of stamping envelopes vs. any of our sorting activities (cards, envelopes, jewelry or tools), wood blocks vs. plastic blocks (regardless of size), large blocks vs. small blocks (collapsing across wood/plastic and color), natural-colored wood blocks – large vs. small blocks, plastic blocks – large Duplos® vs. small Legos®, and small blocks – natural-colored wood vs. plastic (Legos®) blocks. To examine the role of cognitive impairment on engagement, study participants were grouped as either middle stage dementia (MMSE score from 10 to 23) or late stage dementia (MMSE of 9 or less), and independent samples t-tests were performed for the work-related stimuli and for the blocks; for these analyses, the dependent measures of engagement were duration, attention, and attitude. All statistical analyses were performed using SPSS software.

3. Results

Analysis revealed that engagement duration, attention, and attitude were significantly higher with the work-related stimuli as compared to the blocks for the residents in our study ($t_{(68)} = 6.1$, $p < 0.001$ for duration, $t_{(66)} = 3.6$, $p < 0.001$ for attention, $t_{(66)} = 3.2$, $p < 0.01$ for the highest rating of attention observed, and $t_{(66)} = 2.3$, $p < 0.05$ for attitude; Table 2). Our data show that study participants were engaged with the work-related stimuli for an average duration of 266.1 seconds (4.4 minutes), and were, on average, more than *somewhat attentive* to the stimuli throughout the trial (mean attention = 2.52) – with a rating of *attentive* being the highest rating of attention observed (mean highest attention = 2.75), and were found to display a *somewhat positive* attitude (mean attitude = 4.87). Other analyses that examined differences between specific types of work-related activities did not yield significant test statistics, with all being comparably successful in engaging the residents of the present study.

As to the block stimuli, results of a paired t-test in which we compared engagement with large versus small blocks (collapsing across other block attributes, e.g., wood vs. plastic and color) revealed found that study participants were more engaged when presented with small blocks than with large blocks, with results reaching statistical significance for attention ($t_{(61)} = 2.9$, $p < 0.01$) and for the highest rating of attention observed, $t_{(61)} = 2.7$, $p < 0.01$; see table 3). A trend toward longer duration of engagement for the small rather than the large blocks was seen ($t_{(68)} = 1.8$, $p = 0.07$; mean duration = 173.20 seconds (2.9 minutes) for small blocks as compared to 132.13 seconds (2.2 minutes) for large blocks. Two more t-tests were performed in which large versus small blocks were examined for natural-colored wooden blocks only and for plastic blocks only. As to the analysis concerning only the natural-colored wooden blocks, study participants were significantly more engaged with the small blocks with regard to attention ($t_{(45)} = 2.8$, $p < .$, $t_{(45)} = 2.6$, $p < 0.05$ for the highest rating of attention observed), and attitude ($t_{(45)} = 2.0$, $p < 0.05$ for attitude; Table 3). No impact of size was seen with the analysis of plastic blocks. Two more t-tests – one in which we compared wood blocks with plastic blocks and the other in which we compared small colored blocks with small natural-colored blocks – failed to yield significant test statistics. Finally, results of analyses that compared specific attributes of engagement stimuli relative to level of dementia were not statistically significant.

4. Discussion

We found two stimulus attributes to affect engagement in persons with dementia: the meaning of the stimulus, such as work, and the size of the stimulus. Specifically, engagement duration, attention, and attitude were significantly higher for work-related activities than blocks for the nursing home residents in our study. It is possible that the study participants showed a preference for the work-related stimuli because these activities tapped into a past role identity

(as described in Cohen-Mansfield et al., 2006) and felt familiar to the residents. Another possibility is that the residents showed this preference because the activity involved doing meaningful work that helped someone else. Subsequent analyses to discern which of the work-related stimuli was most engaging did not reach statistical significance, indicating that all of the work-related stimuli of our study were comparably successful with respect to engaging residents.

In examining the specific attributes of blocks, we found that the study participants showed a significant preference for small rather than large blocks, regardless of color or material. Earlier studies have also reported preferences for one stimulus attribute over another. For instance, Lucero et al. (2000) found that three of the four favorite stimuli for engaging residents on a dementia unit had smooth, hard surfaces and all had relatively large yellow-colored stimuli on them. Our results differ, in that the comparatively smoother surface of plastic and the colors of objects did not affect engagement. At this point, the reason that the residents of the present study showed a clear preference for the smaller blocks is not evident; therefore, further study is needed.

Our lack of significant findings regarding the impact of different types of work stimuli may indicate that the engaging effect of these is equivalent across older persons with dementia (i.e., when personal preferences or habits are not taken into account), or that the effect size is relatively small and this study did not have sufficient power to detect it. While there were few missing scores for the outcome measure of engagement time (study participant refusals were coded as 0 seconds), the outcome measures of attitude and attention were coded as missing every time that a participant refused a stimulus, resulting in a sample size of 37. Future research may repeat and refine this examination.

For someone not familiar with the daily routine of many nursing home residents with dementia, an engagement duration of around 4 minutes may not sound like much; however, we are encouraged by this finding as it is preferable to spending the majority of the day engaged in no activity at all (Cohen-Mansfield et al., 1992; Burgio et al., 1994; Aronstein et al., 1996; Lucero et al., 2001; Buettner and Fitzsimmons, 2003; Kolanowski et al., 2006) and it demonstrates that these residents can be engaged. The next step is to have a collection of engagement stimuli (e.g., sorting activities, stamping activities, folding towels – all relatively inexpensive and easy to obtain) and to have staff members who are able to present these stimuli to nursing home residents as often as needed over the course of the day. It has been shown that nursing assistants are able to implement stimulus presentation into their routine resident care, given they receive continuing support from administrators (Aronstein et al., 1996). Orsulic-Jeras et al. (2000) reported that long-term staff and volunteers could successfully conduct Montessori-based activities for nursing home residents with dementia within existing schedules and organizational structures and constraints. It is our hope that the findings from the present study will serve to challenge the common misperception that inactivity in dementia is an inevitable part of the disease.

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Table 1

Background information for the 69 study participants

GENDER (n, percentage)	
Female	53 (76.8%)
Male	16 (23.2%)
AGE in yrs (range = 60–98)	M = 85.9 ± 7.7
RACE (n, percentage)	
African American	3 (4.3%)
Asian/Pacific Islander	3 (4.3%)
Caucasian	63 (91.3%)
MARITAL STATUS (n, percentage)	
Widowed	49 (71.0%)
Married	12 (17.4%)
Separated	2 (2.9%)
Divorced	2 (2.9%)
Never Married	4 (5.8%)
ADL ^a (range = 1.3 – 5)	M = 3.4 ± 1.0
COGNITIVE FUNCTIONING ^b (range = 0 – 23)	M = 8.0 ± 6.8
# OF MEDICAL DIAGNOSES (range = 2 – 17)	M = 6.3 ± 2.4
# OF MEDICATIONS (range = 3 – 17)	M = 8.8 ± 3.3

^a Assessed via MDS (Morris et al., 1991). ADL performance was calculated for 10 activities (bed mobility, transferring, locomotion on the unit, dressing, eating, toilet use, personal hygiene, bathing, and bowel incontinence) each on a 5-point scale such that 5 represents maximum dependence

^b Assessed via MMSE, see text

M = mean ± S.D.

Table 2

Results of paired t-tests (means, test statistics) comparing **block stimuli** (5 types of blocks) versus **work-related stimuli** (sorting playing cards, sorting colored envelopes, sorting jewelry/tools, stamping envelopes, stuffing envelopes, folding towels) for the outcome measures of engagement.

		Duration (in seconds)	Attention	Attention Highest	Attitude	Attitude Highest
Blocks vs. work-related stimuli	Blocks	157.24	2.25	2.50	4.76	4.89
	Work-related	266.10	2.52	2.75	4.87	4.99
Sorting cards vs. sorting envelopes	Cards	$t_{(68)} = 6.1^{***}$	$t_{(66)} = 3.6^{***}$	$t_{(66)} = 3.2^{**}$	$t_{(66)} = 2.3^*$	$t_{(66)} = 1.5$
	Envelopes	268.04	2.39	2.62	4.76	4.90
Stamping envelopes vs. sorting activities		222.15	2.39	2.60	4.76	4.80
		$t_{(66)} = 1.1$	$t_{(50)} = 0.0$	$t_{(49)} = 0.1$	$t_{(49)} = 0.0$	$t_{(49)} = 0.1$
	Stamping	260.81	2.53	2.77	4.96	5.10
	Sorting	233.79	2.51	2.75	4.81	4.94
		$t_{(66)} = 0.7$	$t_{(46)} = 0.2$	$t_{(46)} = 0.1$	$t_{(47)} = 1.3$	$t_{(46)} = 1.4$

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.001$; 2-tailed significance

Table 3

Results of paired t-tests (means, test statistics) comparing the different blocks used in the study for the outcome measures of engagement

	Duration (in seconds)	Attention	Attention Highest	Attitude	Attitude Highest
All large vs. small blocks	132.13	2.10	2.31	4.69	4.84
	173.20	2.38	2.65	4.80	4.89
	$t_{(68)} = 1.8+$	$t_{(61)} = 2.9^{**}$	$t_{(61)} = 2.7^{**}$	$t_{(61)} = 1.2$	$t_{(61)} = 0.5$
Natural-colored wood blocks: large vs. small	113.16	1.96	2.20	4.65	4.78
	143.36	2.35	2.65	4.87	4.96
	$t_{(66)} = 1.0$	$t_{(45)} = 2.8^{**}$	$t_{(45)} = 2.6^*$	$t_{(45)} = 2.0^*$	$t_{(45)} = 1.5$
Plastic blocks: large vs. small	148.90	2.21	2.44	4.72	4.86
	204.78	2.28	2.49	4.65	4.74
	$t_{(68)} = 1.6$	$t_{(42)} = 0.4$	$t_{(42)} = 0.2$	$t_{(42)} = 0.5$	$t_{(42)} = 0.8$
Wood blocks (any color) vs. plastic blocks	143.98	2.28	2.53	4.82	4.92
	176.84	2.23	2.46	4.77	4.89
	$t_{(68)} = 1.3$	$t_{(60)} = 0.6$	$t_{(60)} = 0.5$	$t_{(60)} = 0.5$	$t_{(60)} = 0.2$
Small colored blocks vs. small natural-colored blocks	160.45	2.16	2.50	4.77	4.91
	145.60	2.41	2.77	4.89	5.05
	$t_{(66)} = 0.6$	$t_{(43)} = 1.6$	$t_{(43)} = 1.5$	$t_{(43)} = 0.3$	$t_{(43)} = 1.2$

* $p \leq 0.05$;

** $p \leq 0.01$;

*** $p \leq 0.001$; 2-tailed significance + $p = 0.07$