Applied Cognitive Psychology, *Appl. Cognit. Psychol.* (2014)
Published online in Wiley Online Library (wileyonlinelibrary.com) **DOI**: 10.1002/acp.3078

On Cognition, Need, and Action: How Working Memory and Need for Cognition Influence Leisure Activities

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Summary: The present study examined the relationships among college students' need for cognition (NFC), their working memory capacity, and their preferred leisure activities. Results indicated that scoring higher on the NFC scale was related to participants engaging in cognitively higher load leisure activities (e.g., writing) than lower load leisure activities (e.g., watching TV). We did not find a relationship between participants' cognitive ability (as measured by an attentional capacity task) and their choice of leisure activities. In sum, personal dispositions contributed to the choice and complexity of people's leisure activities, whereas cognitive ability did not. These findings provide a theoretical framework for further exploring the relationships between disposition, cognition, and action. Copyright © 2014 John Wiley & Sons, Ltd.

Cognitive psychology is brimming with studies examining individual differences and the structure of cognitive abilities, but we still know little about the intersection of cognitive ability and individuals' *need* to engage in thinking. Further, we know even less about how a need for cognition (NFC) manifests in individuals' choices in their day-to-day activities. The main research goal of the present study was to garner a better understanding of how students' cognitive abilities [i.e., working memory (WM)] and preference for cognitive engagement (i.e., the NFC scale; Cacioppo & Petty, 1982) influence what they choose to do in their free time. To address this question, we assessed students' NFC, surveyed their preferred leisure activities and measured their WM. Although we know that WM influences students' choice of strategies during academic tasks (Dunlosky & Kane, 2007; Schelble, Therriault, & Miller, 2012), its impact on non-academic choices remains unexplored.

College students spend a significant portion of their time engaging in cognitively demanding tasks in school. Another important component of this study was to explore and document how students spend their leisure time. Specifically, we were interested in whether students would choose cognitively demanding tasks during their free time, and the factors influencing these decisions (i.e., individual differences in personality, motivation, and/or cognition). Finding evidence of a direct link between individuals' dispositions and their cognition is important to further validate claims that self-report scores on the NFC predict actual behavior and, more generally, further our understanding of people's motivation for cognitive engagement and their actual cognitive abilities.

Need for cognition

A tool often used in personality and social psychology to explore dispositions related to thinking is Cacioppo and Petty's (1982) NFC scale. Conceptually, the scale was crafted from Cohen, Stotland, and Wolfe's (1955) observations that individuals have "a need to understand and make reasonable the experiential world" (p. 291). Cacioppo and Petty (1982) developed the scale using a sample of university faculty members (who they characterized as high NFC) and a sample of assembly-line workers (who they characterized as low NFC). Final results revealed a single factor, representing participants' reported tendency to engage in and enjoy effortful cognitive activity. In their original work, Cacioppo and Petty (1982) conducted several follow-up studies extending the results of the instrument (using a population of undergraduate students), reporting a significant positive correlation between NFC scores and general intelligence and a significant negative correlation between NFC and being closed-minded.

The NFC scale has traditionally been employed as a construct that captures the tendency to engage in mental action as well as the affective enjoyment of thinking (Cacioppo, Petty, Feinstein, & Jarvis, 1996). In their review of studies employing the NFC, Cacioppo et al. (1996) suggested that the bulk of the evidence still points to a unidimensional construct. However, other researchers have posited that the construct is multidimensional in nature (Davis, Severy, Kraus, & Whitaker, 1993; Tanaka, Panter, & Winborne, 1988; Lord & Putrevu, 2006). For example, Lord and Putrevu's (2006) factor analyses of the original 34-item scale, the 34-item scale that consisted of exclusively positively worded items, and a short 18-item version scale, provided convergent evidence for the multidimensionality of the NFC scale (Lord & Putrevu, 2006). On the basis of the magnitude and consistency of factor loadings of items across the three factor analysis studies conducted (i.e., original 34-item, positively worded 34-item, and short 18-item versions of the NFC scale), the authors concluded that the NFC scale is best characterized by the following three factors: (i) *enjoyment of cognitive stimulation*; (ii) *desire for understanding*; and (iii) *commitment of cognitive effort*. To further examine the factor structure of the NFC scale, we tested the NFC as a single construct (Cacioppo et al., 1996) and as multiple constructs (three factor; Lord & Putrevu, 2006) to assess potential conceptual differences

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in the makeup of the construct as they relate to our variables of interest.

Leisure and the need for cognition

Leisure activities are an essential part of psychological health and overall well-being (Sonnentag, 2003). Leisure has also been positively linked to intellectual development, work engagement, and personal initiative (Beard & Ragheb, 1983; Hansen, Dik, & Zhou, 2008). To date, the role of cognitive preferences in choice of leisure activities has received little attention. Higher scores on the NFC scale are often used to infer that individuals will engage in more effortful and cognitively complex thinking tasks (Cacioppo, Petty, & Morris, 1983). The scale is also purported to be predictive of future behavior. That is, it "can be linked to important life outcomes such as academic achievement" (Cacioppo et al., 1996, p. 247). However, few studies examining the relationship between NFC and participants' activities actually examine how participants voluntarily spend their time. Rather, the link between NFC and action has largely been measured using laboratory tasks where participants, who do not have a choice about which activities to complete, provide a reaction to cognitively demanding tasks such as math, anagrams, or brainstorming (for a review, see Cacioppo et al., 1996). These studies provide evidence that individuals higher in NFC react more positively to complex stimuli, but not that they *actively* seek them out.

Another potential difficulty assessing NFC through contrived tasks (e.g., number search) is the prevalence of social desirability bias (for a review, see Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). That is, the tendency of participants to over-report that they would engage in or select more cognitively complex tasks in order to be viewed more favorably by others (i.e., seen as being more intellectual). This is especially important in a university setting, where students' perceptions of their intellectual ability may be closely tied with their affective reaction to academic tasks. However, it is important to note that in Cacioppo and Petty's (1982) original study, the correlation between NFC and social desirability was not significant.

The current research was designed to examine how NFC would relate to the level of cognitive effort required for activities participants choose independently. This prompted our examination of whether college students' preference for intellectual challenge related to the leisure activities they choose. We created an instrument to assess the range of participants' leisure activities and the cognitive load associated with each activity. We posit that surveying students' leisure activities before assessing cognition or motivation provides a more direct window into the *action* component of cognition.

Although this research approach is relatively novel, there exists precedent. For example, Furguson, Chung, and Weigold (1985) surveyed individuals on the sources they used to gather their news (TV vs. newspapers/magazines) and then tested them on NFC. They reported that individuals higher in NFC were more likely to gather information from more active (e.g., newspapers) than passive sources (e.g., television). Our research expands upon this approach, in that we are examining a much broader range of real-life activities.

Links between working memory and need for cognition

Although the NFC has been conceptualized as reflecting cognitive motivation rather than cognitive ability (Cacioppo et al., 1996), NFC scores have been shown to correlate positively with individuals' cognitive capacities, including verbal ability (Bors, Vigneau, & Lalande, 2006; Tidwell, Sadowski, & Pate, 2000), performance on college entrance exams (Cacioppo & Petty, 1982; Petty & Jarvis, 1996), and crystallized knowledge (Martin, Ward, Achee, & Wyer, 1993; Tidwell et al., 2000). Results reporting the relationship between the NFC and general cognitive ability, such as fluid intelligence, are mixed. Fleischhauer et al. (2010) suggested that the relationship between NFC and speed–accuracy ratio may mediate the relationship between NFC and intelligence. Some researchers have found small positive relationships between NFC and the Ravens Advanced Progressive Matrices task (Day, Espejo, Kowollik, Boatman, & McEntire, 2007), but still other studies using the same intelligence task have found no relationship (Bors et al., 2006).

We explored the relationship between NFC and cognition by including WM, a construct strongly related to intelligence (Conway, Cowan, Bunting, Therriault, & Minkoff, 2002; Kane, Hambrick, & Conway, 2005), as well as to problem solving (Swanson, 2006; Wu et al., 2008), and academic tasks such as reading comprehension (Engle, Cantor, & Carullo, 1992; Ericsson & Kintsch, 1995). With the exception of a recent study (Hill et al., 2013), links between WM and NFC have not been directly examined. Surprisingly, Hill et al. (2013) found that NFC predicted fluid ($\beta = .40$, $p < .001$) and crystallized intelligence ($\beta = .32$, $p < .001$), but not WM ($\beta = .12$, *ns*). As noted in their discussion, this finding is unexpected, given the strong association between gF (fluid intelligence) and WM reported in the literature. It is important to note that the Hill et al. (2013) structural equation model regressed WM upon NFC (i.e., conceptually NFC was used to predict WM scores). We do not know of any studies that have examined the relationship in reverse; that is, using WM to assess NFC. In the present study, we included measures of WM to reassess possible relationships between WM and NFC. Further clarifying the relationship between NFC and WM is important, because NFC has been shown to relate to many abilities that WM historically predicts. Another important component of exploring WM and NFC is determining how individual differences in these variables relate to real-world behavior. Specifically, we examined how participants' leisure activities differed in their level of cognitive load as a function of their WM capacity. In other words, do the activities participants choose to engage in during their free time vary more as a function of NFC (a motivational factor), or WM (a cognitive factor)?

THE PRESENT STUDY

The purpose of this study was to examine relationships among participants' WM scores, self-reported NFC, and leisure activities. Drawing from the literature reviewed earlier, we tested the following hypotheses regarding the relationships among cognition, motivation, and leisure activities:

1. People who report higher NFC will report engaging in leisure activities with higher cognitive load.
2. People with high WM capacity will report engaging in leisure activities with higher cognitive load.
3. People with high WM capacity will report higher NFC.

In consideration of questions regarding the dimensionality of the NFC scale, we also examined the factor structure of the original instrument (Cacioppo & Petty, 1982).

METHOD

Participants

Data from 263 participants from a large southeastern university was used to conduct the exploratory factor analysis of the NFC scale. A subset of the data, consisting of 160 participants, who completed the WM task [Symmetry Span task (SymSpan)] in addition to the NFC scale, was used for the subsequent analyses in which we explored the relationships among WM, NFC, and leisure activities. Participants received course credit in exchange for their participation.

Materials

Leisure Activity Questionnaire

The Leisure Activity Questionnaire (LAQ) was constructed by the first and second authors. Participants responded, in writing, to a prompt that asked them to list and briefly describe the five activities they engage in most often in their free time, in order of most frequent to least frequent. Participants were instructed to only list activities they did for fun (e.g., not homework or household chores). Using a 7-point Likert scale, three researchers with different backgrounds and leisure activity experiences independently rated the cognitive load of each leisure activity reported. For example, leisure activities rated higher (ratings 5 to 7) for cognitive load/complexity included writing poetry, reading newspapers, and practicing the cello. Lower rated activities included sun bathing (rating of 1) and hanging out with friends (rating of 2). Activities listed by participants that did not meet the criteria for a leisure activity (e.g., going to work and doing homework) were excluded from the analysis. Interrater reliability ranged from .69 to .81. If two of the three raters rated an activity the same, that rating was used. If all three raters rated an activity differently, the activity was discussed until a consensus was reached. The average cognitive load score of participants' reported leisure activities was used to obtain the LAQ score for each participant. The NFC score was obtained by calculating the total of participants' Likert-scale ratings of agreement with each statement, accounting for reverse scoring of some items. Overall, students reported 46 different types of leisure activities; Appendix A provides a listing of the activities, their cognitive load, and prevalence rates.

Need for cognition scale

The original (34-item) NFC scale was used as the measure of NFC (Cacioppo & Petty, 1982). Participants rated their agreement with statements that corresponded to either a high NFC (e.g., I really enjoy a task that involves coming up with new solutions to problems) or a low NFC (e.g., I only think as hard as I have to). Items that represented low NFC were reverse-scored. Reliability estimates for the 34-item NFC reveal high internal consistency, with most studies reporting Cronbach's αs above .85 (see Cacioppo et al., 1996, for a review). Acceptable convergent and discriminant validity have been demonstrated using a variety of individual difference measures, including personality and self-monitoring scales (Cacioppo et al., 1996).

Symmetry Span

The Symmetry Span task (SymSpan) was used to obtain a measure of participants' WM capacity (Unsworth, Redick, Heitz, Broadway, & Engle, 2009). During the SymSpan, participants determine if a shape is symmetrical while trying to remember the position of a series of presented boxes. In this task, participants view a shape on the computer screen followed by a prompt to indicate whether the shape is symmetrical or not. After making their selection, a screen of 4×4 boxes appears with one of the boxes colored red. The participant's task is to remember the position of the single red box. After a series of shape/box combinations, participants view a screen with an empty 4×4 matrix of boxes and must recall the correct red box positions in order.

Procedure

Upon arriving at the lab, participants read and signed an informed consent document. Next, they completed the LAQ, followed by the NFC, which were both paper-and-pencil tasks. Finally, participants completed the SymSpan task on a computer.

Scoring the Symmetry Span task measure

In accordance with the recommendations of Conway et al. (2005), we used partial-credit (total number of items recalled) scoring of performance on the WM span task. SymSpan scores were calculated by totaling the number of red box locations recalled in the correct order on each trial (i.e., participants received credit for any locations recalled in the correct order; it was not necessary for the entire sequence to be correct). Participants' SymSpan scores ranged from 0 to 40. A single participant was excluded owing to a high number of errors on the SymSpan task; however, we did not use the traditional 85% processing accuracy cutoff to exclude additional participants because recent literature suggests this is unnecessary (Unsworth et al., 2009).

ANALYSES

Confirmatory factor analyses were conducted on the NFC scale with maximum likelihood robust estimation in MPLUS 6. Geomin-rotated factor analysis was used to determine the factor loadings for each item. Decisions regarding the number of factors to retain were based on a set of absolute, relative, and comparative goodness-of-fit indices for maximum likelihood estimation, including the root mean square error of approximation, the standardized root mean square

Table 1. Confirmatory factor analysis goodness-of-fit indices for one- and three-factor need for cognition model

Model	χ^2	*df*	*p*-value	RMSEA	CFI	TLI	SRMR
1-Factor NFC model	1186.35	527	<.001	0.07	0.64	0.61	0.08
3-Factor NFC model	1159.72	524	<.001	0.07	0.65	0.63	0.09
Abbreviated 1-factor NFC model	156.31	102	<.001	0.05	0.94	0.93	0.05
Abbreviated 3-factor NFC model	312.42	165	<.001	0.06	0.87	0.85	0.07

Note: RMSEA, root mean square error of approximation; CFI, comparative fit index; TLI, Tucker–Lewis index; SRMR, standardized root mean square residual; NFC, Need for Cognition Scale.

residual (RMSEA), the comparative fit index (CFI), and the Tucker–Lewis Index (TLI). The chi-square test statistic was also obtained. The cutoff values recommended by Hu and Bentler (1999) were used: (CFI/TLI) ≥ 0.90, (RMSEA) ≤ 0.06, and standardized root mean square residual (SRMR) ≤ 0.08. A probability value of $\alpha = .05$ for the chi-square (χ^2) test statistic is also reported, which tests the null hypothesis (i.e., that there is no significant different between the model's implied covariances and the observed covariances). However, because χ^2 is sensitive to sample size and model complexity (Kline, 2005), we made use of the above goodness-of-fit (GOF) indices to provide additional evidence for conclusions regarding factor retention.

Table 2. Standardized factor loadings of NFC items from confirmatory factor analysis in one-factor model

Scale item	Factor
1	.41
2	.48
3	.18
4	.22
5	.43
6	.18
7	−.03
8	.40
9	.36
10	.47
11	.43
12	.43
13	.57
14	.40
15	.45
16	.38
17	.72
18	.45
19	.33
20	.18
21	.34
22	.64
23	.28
24	.43
25	.62
26	.74
27	.23
28	.25
29	.41
30	.51
31	.48
32	.58
33	.41
34	.24

Note: NFC, Need for Cognition Scale.

For the one-factor model, all 34 items were specified to load on a single factor. For the three-factor model, the items were specified to load on the factors as follows: items 1, 5, 10, 12, 13, 14, 15, 16, 17, 18, 24, 25, 26, and 28 on Factor 1; items 6, 7, 8, 9, 11, 20, 21, 23, 31, 32, 33, and 34 on Factor 2; and items 2, 3, 4, 19, 22, 27, 29, and 30 on Factor 3 (Table 2). The decisions regarding item specification for the three-factor model were guided by results of the exploratory factor analysis conducted by Lord and Putrevu (2006), in which three dimensions (Enjoyment of Cognitive Stimulation, Desire for Understanding, and Preference for Complexity) were identified for the NFC scale.

Linear regression analyses were then conducted to test our hypotheses that WM would predict higher NFC, WM and NFC would make unique contributions to the complexity of people's self-reported leisure activities (Hypotheses 1 and 2), and WM would predict higher NFC (Hypothesis 3). The following observed variables were included in our regression analyses: WM, NFC (including a single-factor NFC variable and the NFC variables representing three separate factors), and leisure activities.

RESULTS

Confirmatory factor analysis of the need for cognition scale

The GOF indices from the CFA of the one- and three-factor models of the NFC scale are presented in Table 1.

Table 2 presents the standardized factor loadings of all 34 retained items on the single-factor NFC model (descriptions of the original retained scale items can be found in Cacioppo & Petty, 1982). All items with a factor loading below .40 were dropped. This resulted in an abbreviated one-factor NFC scale consisting of 16 items (Table 3). Similarly, Table 4 presents the standardized factor loadings of all 34 items in the NFC scale for the three-factor NFC model, and Table 5 presents the standardized factor loadings of the 20 items that were retained in the abbreviated three-factor NFC scale after items with low factor loading (below .40) were dropped. The following labels were assigned to the three NFC factors: (i) Enjoyment of Cognitive Stimulation; (ii) Desire for Understanding; and (iii) Preference for Complexity (Lord & Putrevu, 2006).

Modifications were made using theoretical considerations (underlying similarities among items), reference to the modification indices (MIs) > 3.84, and large expected change

Table 3. Standardized factor loadings of NFC items from confirmatory factor analysis in abbreviated one-factor model

Scale item	Factor
5	.40
8	.43
10	.48
13	.62
14	.42
15	.46
17	.73
18	.48
22	.68
24	.48
25	.62
26	.74
30	.42
31	.43
32	.58
33	.43

Note: NFC, Need for Cognition Scale.

Table 4. Standardized factor loadings of NFC items from confirmatory factor analysis in three-factor model

	Factor[a]		
Scale Item	1	2	3
1	.38		
2			.63
3			.30
4			.32
5	.43		
6		.14	
7		−.004	
8		.39	
9		.35	
10	.49		
11		.36	
12	.42		
13	.58		
14	.39		
15	.49		
16	.42		
17	.76		
18	.48		
19			.40
20		.22	
21		.41	
22			.49
23		.27	
24	.44		
25	.64		
26	.76		
27			.34
28	.22		
29			.59
30			.64
31		.66	
32		.75	
33		.45	
34		.25	

Note: NFC, Need for Cognition Scale.
[a]Factor labels: (1) Enjoyment of Cognitive Stimulation, (2) Desire for Understanding, and (3) Preference for Complexity.

Table 5. Standardized factor loadings of NFC items from confirmatory factor analysis in abbreviated three-factor model

	Factor[a]		
Scale Item	1	2	3
2			.51
5	.43		
10	.49		
12	.42		
13	.58		
15	.49		
16	.42		
17	.76		
18	.48		
19			
21		.43	
22			.72
24	.45		
25	.63		
26	.76		
29			.40
30			.48
31		.53	
32		.70	
33		.49	

Note: NFC, Need for Cognition Scale.
[a]Factor labels: (1) Enjoyment of Cognitive Stimulation, (2) Desire for Understanding, and (3) Preference for Complexity.

parameters (ECPs). For example, item 31 (‘Simply knowing the answer rather than understanding the reasons or the answer to a problem to a problem is fine with me’) and item 32 (‘It’s enough for me that something gets the job done; I don’t care how or why it work’; both reverse-scored items) share similar features in that they represent a fixation on achieving an absolute solution to a problem and a lack of interest in understanding the reasons underlying the solution. In addition, these items had large MIs and ECPs in both the one- and three-factor models (MI = 70.52, 63.46, ECP = 0.49, 0.47, respectively). Therefore, there was conceptual and empirical support to allow the residuals between these two items to correlate.

Descriptive statistics

The descriptive statistics of the scores from the LAQ, SymSpan, and NFC (average total and average factor scores) are presented in Table 6. For both the single NFC factor and each of the three NFC factors, the observed variables were specified by the average of the item ratings for that factor. For example, for the three-factor NFC model, Factor 1 (Enjoyment of Cognitive Stimulation) was specified by the average ratings of items 5, 10, 12, 13, 15, 16, 17, 18, 24, 25, and 26.

Table 7 contains the complete correlation matrix for the total NFC average, NFC factors 1 to 3 average, SymSpan, and the LAQ scores.

The NFC average score (NFCAve) had a significant positive relationship with the average rating for the cognitive load of participants’ leisure activities (LAQ; $r = .38$, $p < .01$) but did not correlate significantly with the WM score

Table 6. Descriptive statistics

	LAQ	SymSpan	NFCAve	NFC1	NFC2	NFC3
Mean	2.87	27.66	3.64	3.53	4.01	3.35
SD	0.41	7.36	0.60	0.63	0.70	0.66
Skew	0.26	−0.98	−0.41	−0.33	−1.0	−0.19
Kurt	−0.21	1.31	0.10	−0.33	1.01	−0.21
Min, Max	2.0, 3.91	0, 40	2.44, 4.53	1.73, 4.91	2.0, 5.0	1.5 5.0

Note: LAQ, Leisure Activity Questionnaire; SymSpan, Symmetry Span task; NFC, Need for Cognition Scale; NFCAve, NFC average score.

(SymSpan; $r = .06$, *ns*). The three factors of the NFC scale, Factor 1 (Enjoyment of Cognitive Stimulation), Factor 2 (Desire for Understanding), and Factor 3 (Preference for Complexity) were positively related to the LAQ score, $r = .33$, .27, and .37, $p < .01$, respectively. These results lend evidence to our hypothesis that an individual's NFC relates to the complexity of their choice in leisure activities. More specifically, the patterns of correlations indicate that the Enjoyment of Cognitive Stimulation, Desire for Understanding, and Preference for Complexity sub-factors of the NFC construct are positively related to leisure activities that engage more complex cognitive processes. Contrary to expectations, WM score did not correlate with any of the NFC scores or the LAQ score, indicating that an individual's attentional capacity is not related to their NFC nor to their engagement in cognitively complex leisure activities.

Regression analyses exploring the relationships among need for cognition, working memory, and leisure activities

Prior to running the linear regression analyses, the strengths of the relationships among independent variables in the models were examined to test for possible cases of multicollinearity. The correlations between independent variables in the same model ranged between $r = -.003$ and .61. Collinearity diagnostics indicated that the variance inflation factor did not exceed 5 across all of the models (Kutner, Nachtsheim, & Neter, 2004). In all of our regression models, the strength of the relationship between the predictor variables was low to moderate in range, and the variance inflation factor < 5 (Kutner et al., 2004), providing evidence that that multicollinearity was not an issue with respect to our independent variables. Examination of the histograms, normal P–P plots, and scatterplots of the residuals for all regression models presented in this study indicated that the assumptions of normality and linearity were not violated.

Table 7. Correlations among need for cognition, working memory, and leisure activity scores

	1	2	3	4	5	6
1. NFCAve	1.00					
2. NFC F1	.93**	1.00				
3. NFC F2	.73**	.54**	1.00			
4. NFC F3	.68**	.57**	.46**	1.00		
5. SymSpan	.10	.08	.03	.11	1.00	
6. Leisure activity	.36**	.31**	.22**	.34*	.16	1.00

Note: NFC, need for cognition scale total score; NFC1 to NFC3, need for cognition factors 1 to 3; (1) Enjoyment of Cognitive Stimulation; (2) Desire for Understanding; (3) Preference for Complexity; average score of items in factor—SymSpan, Symmetry Span Working Memory task total score; Leisure Activity, average score of the leisure activity complexity ratings.
*$p < 0.05$; **$p < .01$.

A series of linear regression models were conducted to test the three hypotheses regarding the relationships among NFC, WM, and leisure activities. The standardized regression coefficients of the linear regression models predicting LAQ score are shown in Table 8. To test Hypothesis 1—people who report higher NFC will report engaging in more complex leisure activities—a linear regression analysis was conducted to test a model for predicting LAQ scores from the one-factor NFC score (NFCAve; Model 1). To test Hypothesis 2—people with high WM capacity will also report engaging in more complex leisure activities—a model for predicting LAQ scores from the SymSpan and NFCAve scores was tested (Model 2).

The linear regression model with NFCAve as a predictor of LAQ scores showed that $R^2 = .13$, $F(1, 157) = 23.26$ $p < .001$. When the SymSpan score was added as a predictor in the model, $R^2 = .14$, $F(2, 155) = 12.67$, $p < .001$. As shown in Table 8, the single-factor NFC score significantly predicted leisure activities with higher cognitive load (LAQ score), $\beta = .36$, $p < .001$. When WM was added to the model, NFC continued to predict the LAQ score, $\beta = .34$, $p < .001$, but WM did not predict the LAQ score, $\beta = .13$, $p = .10$.

To test Hypothesis 1, we examined whether scores on the three sub-factors of the NFC scale predicted the cognitive load of reported leisure activities (Model 3). A model predicting LAQ scores with the SymSpan and NFC factor scores was used to test Hypothesis 2 (Model 4). For Model 3, $R^2 = .14$, $F(3, 155) = 8.13$, $p < .001$. When the SymSpan

Table 8. Predicting cognitive load of leisure activities from need for cognition and working memory

Predictor	β	R^2	Adjusted R^2
Model 1			
NFC	.36***	.13	.12
Model 2			
NFCAve	.34**		
SymSpan	.12	.14	.13
Model 3			
NFC F1 (Enjoyment of Cognitive Stimulation)	.17		
NFC F2 (Desire for Understanding)	.02		
NFC F3 (Preference for Complexity)	.23*	.14	.12
Model 4			
NFC F1 (Enjoyment of Cognitive Stimulation)	.16		
NFC F2 (Desire for Understanding)	.03		
NFC F3 (Preference for Complexity)	.22*		
SymSpan	.12	.15	.12

*$p < .05$; **$p < .01$; ***$p < .001$.

score was added as a predictor (Model 4), $R^2 = .15$, $F(4, 153) = 6.57$, $p < .001$.

In Model 3, Factor 3, Preference for Complexity, predicted leisure activities ($\beta = .23$, $p < .05$). Factor 1, Enjoyment of Cognitive Stimulation, and Factor 2, Desire for Understanding, did not significantly predict leisure activities, $\beta = .17$, .02, $p = .08$, .80, respectively. When the SymSpan score was added as a predictor (Model 4), Factor 3, Preference for Complexity, continued to positively predict LAQ scores, $\beta = .22$, $p < .05$. Factors 1 and 2 did not predict LAQ. WM (SymSpan score) did not predict leisure activities, failing to support Hypothesis 2.

Finally, to test Hypothesis 3—people with high WM capacity will also report higher NFC—a linear regression model for predicting the NFCAve from the SymSpan score was tested. The linear regression model with the SymSpan score as a predictor of the NFCAve score showed that $R^2 = .005$, $F(1, 156) = .75$, $p = .39$. Results indicated that WM was not a significant predictor of the cognitive load of leisure activities, $\beta = .07$, $p = .39$.

Altogether, results indicate that NFC contributes to the complexity of people's leisure activities. We found support for the hypothesis that people who report higher NFC overall will report engaging in more complex leisure activities (Model 1). Further investigation of how the three separate factors of the NFC scale predicted leisure activities showed that Factor 3, Preference for Complexity, significantly predicted leisure activities (Model 3). We did not find evidence for our hypothesis that people with higher WM would also report engaging in more complex leisure activities (Models 2 and 3). Finally, WM also failed to predict participants' NFC.

Leisure activities

Students' top 3 self-reported leisure activities were socializing (e.g., text messaging, talking on the phone, and going to parties), using the Internet (e.g., Facebook), and watching TV. Overall, the two most popular activities were text messaging (98%) and using Facebook (95%). Facebook and text messaging were rated as low cognitive load by the researchers because, although these activities require reading and writing, they do not often rise to the level of cognitive demand of other reading/writing related leisure activities, such as poetry, doing Sudoku, or reading novels. Students reported high rates of many other activities, but none were nearly as prevalent as text messaging or Facebook. For example, 55% of students reported reading books in their free time. Although the students in our sample almost uniformly reported enjoying activities related to social media, they are also engaging in other activities, such as exercising (78%), and volunteering in their communities (48%).

DISCUSSION

The present study illustrates how individuals' NFC is linked to their choice of leisure activities. Our review of previous work reveals that NFC scores are often coupled with participants' laboratory behavior such as selecting among different cognitive tasks, rating cognitive tasks that have been assigned, or considering hypothetical scenarios (Cacioppo et al., 1996; Haddock, Maio, Arnold, & Huskinson, 2008; Nair & Ramnarayan, 2000). These studies have been important in providing evidence that the NFC scale predicts the degree of cognitively challenging behaviors people select. To our knowledge, the present research represents a first attempt at establishing a more direct link between participants' NFC and daily activities. By examining leisure choices, we propose that the present work represents a clearer picture of participants' true NFC, as we have provided a window into what they choose to do outside of a planned laboratory exercise (excluding the times they are occupied with school, work, or household chores). Our results indicate that individuals who scored higher on the NFC were more likely to choose leisure activities that induce higher cognitive load. This relationship between NFC and participants' leisure activities further demonstrates the practical relevance of the NFC, which may be of use to future researchers in social and cognitive psychology. Additionally, recent calls for broadening the scope of assessments to identify students' academic and professional achievements beyond traditional measures of cognitive ability illustrate the need for new types of measurements (Kaufman, 2013; Stanovich & West, 2000). The NFC scale may be able to fulfill some of these needs, as it provides information about the types of activities individuals may be more motivated to pursue. Personality, motivation, and cognitive traits may account for different aspects of information processing (e.g., Kaufman, 2013). Thus, the NFC scale and its relationships to leisure, academic engagement, and success may merit further examination.

Working memory and leisure activities

Working memory capacity predicts individuals' performance on academic tasks such as reading comprehension (Engle et al., 1992; Just & Carpenter, 1992) and mathematical problem solving (Kane & Engle, 2002). However, in the current study, WM did not predict students' leisure choices. Specifically, individuals with higher WM were not more likely than individuals with low WM to choose high-load leisure activities. Our data suggest that personal disposition (need for thinking) influences the selection of leisure activities, whereas cognitive ability (WM) does not. It could be the case that WM predicts subsequent student success on leisure activities, but this remains an open question.

Working memory and the need for cognition

Although previous literature reports that some form of cognitive ability (e.g., fluid intelligence or WM) may relate to individuals' NFC (Day et al., 2007; Fleischhauer et al., 2010), the present study did not provide evidence for a relationship between these variables. This result is not entirely surprising, as noted by Fleischhauer et al. (2010); results have been mixed on the status of the relationship (Bors et al., 2006). Perhaps, having more attentional resources does not always predispose individuals to want to deploy these resources. It is clear that more research will be needed to fully explain how WM relates to individuals' preferences for cognitive engagement. However, our pattern of results lends further support to the Cacioppo et al. (1996) assessment that NFC is motivational in nature, and, although intellectual ability may be related to NFC, NFC is not a sub-construct of intellectual ability.

Both the SymSpan (our WM measure) and the NFC scale are well-established measures. Examining them together with self-reported leisure activities informs our understanding of how cognition and motivation influence behavior in a setting not constrained by forced choices. Scoring higher on the NFC was related to reporting higher load leisure activities.

Need for cognition factors and their relation to leisure activities

A single component of the NFC was significantly related to the level of cognitive load produced by participants' reported leisure activities. Greater agreement with items that comprised the 'Preference for Complexity' (e.g., 'I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought') subscale was associated with reporting higher cognitive-load leisure activities. The Preference for Complexity subscale appears to measure the degree of enjoyment in tasks that require higher-order cognitive processes, and seeking out such tasks even when it is not required (e.g., watching educational programs, solving complex problems, and discussing international issues). This factor measures the amount of enjoyment and fulfillment people find in tasks that require deep thinking; it follows that these individuals would prefer more cognitively demanding leisure activities, as these leisure activities are more likely to require deep thinking.

The other two factors, 'Enjoyment of Cognitive Stimulation' and 'Desire for Understanding', did not significantly predict the cognitive load of participants' reported leisure activities. Desire for Understanding was conceptualized as a curiosity about the underlying mechanisms of a phenomenon (i.e., understanding the reasons for the answer to a problem). Thus, although participants' overall NFC relates to their leisure activities, specific components of their preference for cognitive stimulation are more strongly predictive of their free-time choices than others. More specifically, the subscale that tapped into people's motivation for complex thinking predicted high cognitive load leisure activities, whereas higher scores on the subscales that assessed people's willingness to put forth cognitive effort and self-reported behaviors were not related to the complexity of their leisure activities.

College students' leisure activities

In addition to describing the relationship between WM, NFC, and leisure activities, we provided a detailed picture of how college students are spending their free time (Appendix A). It is clear that Internet and social media activities have increased in popularity in recent years; the overwhelming majority of our sample listed texting and using Facebook as leisure activities they engage in frequently (95–98%). However, our survey also revealed that college students are frequently doing non-Internet/social media activities: Reading books, exercising, and volunteering were all in the top 10% of activities reported.

Nearly all of the college students in our sample reported texting and using Facebook (relatively low-load activities). However, those who scored higher on a measure of preference for cognitive challenge (i.e., NFC) were more likely to participate in more cognitively challenging leisure activities, in addition to low-load activities such as using Facebook and texting. Thus, among students with high NFC scores in our data, Facebook use and text messaging do not seem to be *replacing* more cognitively challenging activities. This is also consistent with current research demonstrating a significant positive correlation between time spent on Facebook and time spent in co-curricular activities (Junco, 2012).

Our review of the literature on leisure reveals that students should be encouraged to engage in out-of-class activities. Psychological and academic gains are greater for students as they increase the number of their activity contexts (Fredricks & Eccles, 2006). Further, Gillen's (2003) meta-analysis of college students demonstrated gains in critical thinking skill as a function of engaging in extramural activities. Our results showing that preference for cognitive challenge relates to *actual* engagement in more cognitively loaded leisure activities may be helpful for researchers looking to explore the reasons for some of the reported benefits of leisure activities.

Limitations

It is important to note the limitations associated with methods employed in this research. Idiosyncratic beliefs about cognitive effort could have impacted the raters' decisions regarding the cognitive load of leisure activities. We attempted to mitigate this by employing multiple raters and holding discussion when rating disagreement occurred. Nonetheless, we relied upon judgments of cognitive load (i.e., we did not have access to online measure of cognitive load for participants' leisure activities). To our knowledge, there exists no research that has documented online cognitive load levels associated with leisure activities (although we see this as a productive area for future research).

Conclusion

The present study furthers our theoretical understanding of the relationships among cognition (WM), disposition (NFC), and action (leisure selection). Whereas NFC has been shown to relate to many abilities that WM historically predicts, our results indicate that one's NFC and cognitive ability appear to be separate constructs. Surprisingly, individuals with more attentional resources (higher WM) were not found to seek more intellectually stimulating activities during their spare time than participants with low WM. Only dispositional measures predicted the selection of leisure activities.

On a practical front, our study provides others with one of the first assessments, of which we are aware, that depicts how students spend their leisure time. Our study also demonstrates that personality and motivational factors that measure preference for cognitive challenge relate to *actual* engagement in cognitively challenging leisure activities. Specifically, individuals who enjoy seeking, understanding, and dealing with abstractness reported engaging in intellectually challenging leisure activities, and this relationship was not influenced by cognitive capacity.

REFERENCES

Beard, J., & Ragheb, M. (1983). Measuring leisure motivation. *Journal of Leisure Research*, *15*, 219–228.

Bors, D. A., Vigneau, F., & Lalande, F. (2006). Measuring the need for cognition: Item polarity, dimensionality, and relation with ability. *Personality and Individual Differences*, *40*, 819–828.

Cacioppo, J. T., & Petty, R. E. (1982). The need for cognition. *Journal of Personality and Social Psychology*, *42*, 116–131.

Cacioppo, J. T., Petty, R. E., Feinstein, J., & Jarvis, W. B. G. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin*, *119*, 197–253.

Cacioppo, J. T., Petty, R. E., & Morris, K. J. (1983). Effects of need for cognition on message evaluation, recall, and persuasion. *Journal of Personality and Social Psychology*, *45*, 805–818.

Cohen, A. R., Stotland, E., & Wolfe, D. M. (1955). An experimental investigation of need for cognition. *Journal of Abnormal and Social Psychology*, *51*, 291–294.

Conway, A. R. A., Cowan, N., Bunting, M. F., Therriault, D. J., & Minkoff, S. R. B. (2002). A latent variable analysis of working memory capacity, short-term memory capacity, processing speed, and general fluid intelligence. *Intelligence*, *30*(2), 163–184.

Conway, A. R., Kane, M. J., Bunting, M. F., Hambrick, D. Z., Wilhelm, O., & Engle, R. W. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic Bulletin & Review*, *12*(5), 769–786.

Davis, T. L., Severy, L. J., Kraus, S. J., & Whitaker, J. M. (1993). Predictors of sentencing decisions: The beliefs, personality variables, and demographic factors of juvenile justice personnel. *Journal of Applied Social Psychology*, *23*, 451–477.

Day, E. A., Espejo, J., Kowollik, V., Boatman, P. R., & McEntire, L. E. (2007). Modeling the links between need for cognition and the acquisition of a complex skill. *Personality and Individual Differences*, *42*, 201–212.

Dunlosky, J., & Kane, M. J. (2007). The contributions of strategy use to working memory span: A comparison of strategy assessment methods. *Quarterly Journal of Experimental Psychology*, *60*, 1227–1245.

Engle, R. W., Cantor, J., & Carullo, J. J. (1992). Individual differences in working memory and comprehension: A test of four hypotheses. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *18*(5), 972.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review*, *102*(2), 211.

Fleischhauer, M., Enge, S., Brocke, B., Ullrich, J., Stroble, A., & Stoble, A. (2010). Same or different? Clarifying the relationship of need for cognition to personality and intelligence. *Personality and Social Psychology Bulletin*, *36*(1), 82–96.

Fredricks, J. A., & Eccles, J. S. (2006). Is extracurricular participation associated with beneficial outcomes? Concurrent and longitudinal relations. *Developmental Psychology*, *42*(4), 698–713.

Furguson, M., Chung, M., & Weigold, M. (1985). Need for cognition and the medium dependency component of reliance and exposure. Paper presented at the International Communications Association Meeting, Honolulu, Hawaii.

Gillen, A. (2003). The effect of undergraduate student involvement on critical thinking: A meta-analysis of the literature 1991–2000. *Journal of College Student Development*, *44*(6), 746–762.

Haddock, G., Maio, G. R., Arnold, K., & Huskinson, T. (2008). Should persuasion be affective or cognitive? The moderating effects of need for affect and need for cognition. *Personality and Social Psychology Bulletin*, *34*(6), 769–778.

Hansen, J. C., Dik, B. J., & Zhou, S. (2008). An examination of the structure of leisure interests of college students, working-age adults, and retirees. *Journal of Counseling Psychology*, *55*(2), 133–145.

Hill, B. D., Foster, J. D., Elliott, E. M. Shelton, J. T., McCain, J., & Gouvier, W. D. (2013). Need for cognition is related to higher general intelligence, fluid intelligence, and crystallized intelligence, but not working memory. *Journal of Research in Personality*, *47*, 22–25.

Hu, L., & Bentler, P. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.

Junco, R. (2012). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. *Computers & Education*, *58*(1), 162–171.

Just, M. A., & Carpenter, P. A. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review*, *99*, 122–149.

Kane, M. J., & Engle, R. W. (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual-differences perspective. *Psychonomic Bulletin & Review*, *9*(4), 637–671.

Kane, M. J., Hambrick, D. Z., Conway, A. R. A. (2005). Working memory capacity and fluid intelligence are strongly related constructs: Comment on Ackerman, Beier, and Boyle. *Psychological Bulletin*, *131*(1), 66–71.

Kaufman, S. B. (2013). *Ungifted: Intelligence redefined*. New York: Basic Books.

Kline, R. B. (2005). *Principles and practice of structural equation modeling*. New York: Guilford Press.

Kutner, M. H., Nachtsheim, C., & Neter, J. (2004). *Applied linear regression models*. New York: McGraw-Hill/Irwin.

Lord, K. R., & Putrevu, S. (2006). Exploring the dimensionality of the need for cognition scale. *Psychology & Marketing*, *23*, 11–34.

Martin, L. L., Ward, D. W., Achee, J. W., & Wyer, R. S. (1993). Mood as input: People have to interpret the motivational implications of their moods. *Journal of Personality and Social Psychology*, *64*, 317–326.

Nair, K. U., & Ramnarayan, S. (2000). Individual differences in need for cognition and complex problem solving. *Journal of Research in Personality*, *34*(3), 305–328.

Petty, R. E., & Jarvis, B. G. (1996). An individual difference perspective on assessing cognitive processes. In N. Schwarz, & S. Sudman (Eds.), *Answering questions: Methodology for determining cognitive and communicative processes in survey research* (pp. 221–257). San Francisco: Jossey-Bas.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*, 879–903.

Schelble, J. L., & Therriault, D. J., & Miller, M. D. (2012). Classifying retrieval strategies as a function of working memory. *Memory and Cognition*, *40*(2), 218–230.

Sonnentag, S. (2003). Recovery, work engagement, and proactive behavior: A new look at the interface between nonwork and work. *Journal of Applied Psychology*, *88*, 518–528.

Stanovich, K. E., & West, R. F. (2000). Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences*, *23*, 645–726.

Swanson, H. L. (2006). Cross-sectional and incremental changes in working memory and mathematical problem solving. *Journal of Educational Psychology*, *98*(2), 265.

Tanaka, J. S., Panter, A., & Winborne, W. C. (1988). Dimensions of the need for cognition: Subscales and gender differences. *Multivariate Behavioral Research*, *23*, 35–50.

Tidwell, P. S., Sadowski, C. J., & Pate, L. M. (2000). Relationship between need for cognition, knowledge, and verbal ability. *Journal of Psychology*, *134*, 634–45.

Unsworth, N., Redick, T. S., Heitz, R. P., Broadway, J. M., & Engle, R. W. (2009). Complex working memory span tasks and higher-order cognition: A latent-variable analysis of the relationship between processing and storage. *Memory*, *17*(6), 635–654.

Wu, S. S., Meyer, M. L., Maeda, U., Salimpoor, V., Tomiyama, S., Geary, D. C., & Menon, V. (2008). Standardized assessment of strategy use and working memory in early mental arithmetic performance. *Developmental Neuropsychology*, *33*(3), 365–393.

APPENDIX A: Cognitive load of leisure activities and number and percent of participants reporting each activity

Leisure activity	Cognitive load (ratings ranging from 1 to 7, higher rating indicates greater cognitive load)	Number who reported this activity	Percentage who reported this activity
Internet—video	2	26	9.89
Internet—Facebook	3	249	94.68
Internet—chat	3	93	35.36
Internet—blog	4	9	3.42
Internet—other	3	129	49.05
Internet—news	5	103	39.16
Media—TV fiction	2	218	82.89
Media—TV news	4	85	32.32
Media—watch movies	2	160	60.84
Media—make movies	5	7	2.66
Sports—exercise	2	205	77.95
Sports—organized	3	83	31.56
Sports—outdoor activities	3	35	13.31
Cause—community service	4	126	47.91
Cause—attend worship services	3	74	28.14
Cause—charity	4	20	7.60
Cause—political	4	8	3.04
Hobby—play instrument	6	27	10.27
Hobby—cook	4	143	54.37
Hobby—garden	4	5	1.90
Hobby—puzzle	6	5	1.90
Hobby—play game	3	22	8.37
Hobby—draw	4	26	9.89
Hobby—paint	4	13	4.94
Hobby—photography/editing	5	36	13.69
Hobby—sewing	4	6	2.28
Hobby—scrapbooking	3	12	4.56
Hobby—crossword puzzle	6	49	18.63
Read—book	5	145	55.13
Read—magazine	3	58	22.05
Read—news	5	60	22.81
Write story	7	12	4.56
Write poetry	7	16	6.08
Write other	7	28	10.65
Other—shopping	2	96	36.50
Other—attend sport event	2	98	37.26
Other—fantasy sports	3	8	3.04
Social—talking on phone	2	219	83.27
Social—texting	2	258	98.10
Social—go to clubs	2	77	29.28
Social—go to parties	2	99	37.64
Social—dancing	3	61	23.19
Social—consuming alcohol	1	61	23.19
Social—socializing	2	229	87.07
Social—other	2	7	2.66

