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The revised four-factor motivational thought frequency and state motivation scales for alcohol control

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Further Analyses on the Motivational Thought Frequency and State Motivation Scales for
Alcohol Control Identify Four Factors

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Abstract

Introduction: Elaborated Intrusion (EI) Theory holds that both functional and dysfunctional motivational cognitions are characterized by their intensity, cognitive availability and involvement of imagery, and can be assessed in terms of their frequency and cross-sectional nature. Recently published data on the Motivational Thought Frequency (MTF-A) and State Motivation (SM-A) scales for alcohol control, which were based on EI theory, have shown acceptable fit for a three-subscale structure (Intensity, Imagery, Availability). However, subsequent analyses on the MTF's adaptation to diabetic regimen adherence suggested superior fit from a four-factor model, splitting Imagery into Incentives and Self-Efficacy Imagery. The current paper reanalyzed data on the MTF-A and SM-A, including an additional item on each and using a more robust statistical approach.

Methods: Participants (n = 504) reporting recent high-risk drinking or were currently trying to control alcohol consumption volunteered to complete an online survey that included the MTF-A, SM-A, Alcohol Use Disorders Identification Test and Readiness to Change Questionnaire. Confirmatory factor analyses employed robust maximum likelihood (MLR) with Yuan-Bentler χ^2 adjustment, and presented internal consistencies using omega.

Results: After omission of multivariate outliers, SM-A data were available from 399 participants, and MTF-A data from 351. Superior fit was found for the four-factor model on both measures, and high internal consistencies were obtained for all subscales. Incentives Imagery and Self-Efficacy Imagery were both associated with greater alcohol problems and readiness to change.

Conclusions: Use of four-factor versions of the scales is recommended.

Keywords: Motivation, Desire, Assessment, Confirmatory Factor Analysis, Alcohol, Alcohol Abuse.

Introduction

Elaborated Intrusion (EI) theory (Kavanagh, Andrade & May, 2005) holds that moment-to-moment experiences of motivation comprise conscious, affectively charged cognitions about an object, activity or potential internal state. These cognitive events are commonly described as desires or cravings, and are characterised by their frequency, affective intensity and cognitive availability (Kavanagh et al., 2013).

EI Theory contends that the extent these cognitions are embodied or involve mental imagery is particularly important, and subsequent research has confirmed associations between desire intensity and the vividness (May, Kavanagh & Andrade, 2015a) or frequency of target-related imagery (Martino et al., 2017). Measures based on EI theory have previously been developed to assess the frequency and strength of desires for alcohol (Statham et al., 2011) and of other appetitive desires (May et al., 2014): These measures have consistently had a factorial structure of Intensity, Imagery, and Intrusion (or cognitive availability). This factorial structure has much in common with the Desire Thinking Questionnaire (Caselli & Spada, 2011), which forms subscales of Imaginal Prefiguration and Verbal Perseveration (although we argue that high levels of availability are not restricted to verbal cognitions).

A recent paper in this journal by Robinson, Kavanagh, Connor, May and Andrade (2016) introduced the Motivational Thought Frequency (MTF-A) and State Motivation (SM-A) scales for assessment of motivation to address problematic alcohol consumption. Confirmatory Factor Analyses using SPSS AMOS found that a 3-factor model gave acceptable fit for both measures after omission of one item, and subscale scores were positively associated with greater alcohol problems and readiness to change. We named the subscales Intensity (e.g. on MTF-A: 'How often did you have a strong urge to do it'), Imagery (e.g. 'How often did you imagine yourself doing it?') and Availability (e.g. 'How often did other things remind you about it?'). The change in the third factor's name was

because ‘Intrusion’ seemed inappropriate for desires that people were trying to elicit or strengthen.

There was an important difference between Imagery items in the MTF-A and SM-A and those from the previous scales that informed their development. The earlier measures assessed the degree that specific senses were involved in craving imagery, whereas Imagery subscales of the MTF-A and SM-A assessed imagery content. This change was made to explicitly assess imagery on the key motivational determinants of behavior—incentives (expected consequences of goal attainment—e.g. “imagine how good it would be to do it”), and self-efficacy (confidence in being able to reach the behavioral goal—e.g. “imagine succeeding at it”; Bandura, 1986). Even if there are powerful incentives to achieve a behavioral goal, people are less likely selected it or invest effort and persistence if they see little chance of success (Bandura, 1986). Incentives and self-efficacy are explicitly targeted in motivational interviewing (Miller & Rollnick, 1991, 2012) and in the motivational intervention based on EI Theory, Functional Imagery Training (Andrade et al., 2016; Kavanagh et al., 2014; Rhodes et al., in press; Solbrig et al., in press): The measures allowed assessment of whether these targets were achieved.

Since the publication of Robinson et al. (2016), factorial structures of MTF adaptations to assess motivation for dietary, activity and glucose testing regimens in type 2 diabetes have been tested (Parham et al., 2017), using analyses that adjust for multivariate non-normality and kurtosis. The diabetes study also included an item that had been omitted from the original MTF-A paper (‘Over the last week, how often did you imagine how much better you’d feel if you did it?’)—an item that on content grounds seemed important. Parham et al. (2017) found that model fit improved when the Imagery factor was separated into its two distinct content areas (Incentives and Self-Efficacy). This separation made the scale more

theoretically coherent and distinguished between the two foci of motivational interviewing and Functional Imagery Training.

The results of Parham et al. (2017) raised the question of whether a four-factor model may also provide a better fit for the MTF-A and SM-A than the 3-factor structure in Robinson et al. (2016). Accordingly, we reanalysed the same dataset as Robinson et al. (2016), using the same analytic methods of Parham et al. (2017), and including all 13 items from the original draft measures. As in the earlier study, we then examined the subscales' correlations with degree of alcohol problems and readiness to change.

Method

Participants

Participants were adults who were trying to control their drinking or drank above Australian maximum guidelines for a single occasion at least once in the last month (> 4 drinks with 10gm ethanol; National Health and Medical Research Council, 2009), and were recruited via social media or networking sites and group emails to Queensland University of Technology staff and students. Of the 504 people who met criteria and gave consent, 59 did not answer any MTF-A or SM-A items, and another 31 only completed the SM-A. There were a further 18 cases with multivariate outliers on the SM-A, giving a sample for analysis of 399 (61% women; M Age 27.9, SD 9.4; 80% completed or undertaking tertiary studies; 43% single, 279, 70% born in Australia). Multivariate outliers caused a loss of 35 cases from the MTF-A, giving an analyzed sample of 351. Their demographics were all within 1% or one decimal point of the SM-A sample.

Materials and Procedure

An online survey that included the MTF-A and SM-A, the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, De La Fuente, & Grant, 1993; World Health Organisation, 2001) and the Readiness to Change Questionnaire (RCQ; Heather &

Rollnick, 1993; Rollnick, Heather, Gold, & Hall, 1992). The previous paper reported results on 12-item versions of the MTF-A and SM-A. However, a thirteenth item from each measure was available (Over the last week, how often did you imagine how much better you'd feel if you did it (MTF); Right now, how vividly can you imagine how much better you'll feel if you do it? (SM): These items were now included in analyses.

Confirmatory Factor Analyses (CFAs)

We initially tested the MTF-A and SM-A for the presence of multivariate outliers using multiple linear regression in IBMTM SPSS Statistics 23 and a criterion of Mahalanobis distance at $p < .001$: identified outliers were omitted from subsequent analysis. CFAs used the lavaan package (Roseel, 2012) and semTools (Pornprasertmanit et al., 2016) within R 3.2.4 (R Core Team, 2015). To adjust for multivariate non-normality and kurtosis, robust maximum likelihood (MLR) and Yuan-Bentler χ^2 adjustment were applied. Internal consistency was reported using ω_2 (Bentler, 2009). Consistent with the previous paper, we analyzed the MTF-A and SM-A separately, because we saw frequency and current strength as distinct constructs, and anticipated that users may wish to use each measure alone, depending on context.

Improved fit was indicated by a lower Akaike's Information Criterion (AIC). We also examined robust estimates of χ^2 , Bentler's Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Standardised Root Mean Square (SRMR), and Root Mean Square Error of Approximation (RMSEA). We defined good fit as CFI and TLI $> .90$, SRMR $< .08$ and RMSEA $< .05$, and acceptable fit as approximating these levels (e.g. RMSEA $< .10$). Since RMSEA can give variable results (Chen, Curren, Bollen, Kirby, & Paxton, 2008), we gave it less emphasis. We compared a 3-factor model (Intensity, Imagery, Availability) for the 13-item scale with a 4-factor one that split the Imagery subscale into Incentives Imagery and Self-Efficacy Imagery. We also examined modification indices to check for items that were

substantially cross-loading and see if correlating error terms within subscales further improved model fit. We stopped when acceptable fit was obtained. We provide the data and analysis scripts at <https://github.com/jon-may/MTF-AL>.

Results

Confirmatory Factor Analyses

MTF-A. As shown in Table 1, the 4-factor model gave superior fit to a 3-factor one. All indices except robust RMSEA indicated excellent fit. When we allowed two pairs of error terms within a factor to intercorrelate (the first of which was the same as in the previous paper), this further improved model fit, and brought robust RMSEA below .10.

Insert Table 1 about here

SM-A. The 4-factor model was clearly superior to the 3-factor one, but (as in the previous paper), “How easily can you keep it in mind” had to be omitted before the indices showed excellent (or in the case of RMSEA) acceptable fit.

Insert Table 2 about here

Internal consistency and subscale means

As shown in Table 2, all subscales showed high internal consistencies, and for unaffected subscales, the omega coefficients were almost identical to alphas in the previous paper. In this sample, item means within SM-A subscales were close to the midpoint, but MTF-A item means suggested that thoughts about controlling alcohol were relatively infrequent over the previous week. Zeros across all SM-A items were recorded by 39 participants (9%), but by 97 MTF-A respondents (25%).

Relationship with RCQ and AUDIT

Table 2 repeats the already reported relationships with the RCQ and AUDIT with the unchanged subscales. For the new subscales, these correlations were particularly strong for Incentives Imagery, especially on the MTF. Self-Efficacy Imagery also showed robust correlations with AUDIT and RCQ ($r \geq .45$) on the MTF, but weaker correlations on the SM ($r \geq .24$), except for RCQ Action ($r = .42$).

Discussion

A more sophisticated analysis of the data reported in Robinson et al (2016) showed that a 4-factor model, splitting the Incentives factor of the SM-A and MTF-A into its Incentives and Self-Efficacy constituents, provided better model fit than the previously reported 3-factor model. The new statistical approach also allowed retention of an additional item from the original scales, whose content was seen as potentially important. The new subscales had high internal consistency. While the current data suggested that many respondents in the current study reported that they wished to reduce their consumption of alcohol, especially during the session, a quarter reported no related cognitions at all during the previous week. Good fit on the MTF-A was obtained despite the presence of this substantial subset in the sample.

As in the previous paper, one SM-A item (“How easily can you keep it in mind?”) had to be omitted. That item implies an attempt to keep thoughts in attention, unlike other items in the subscale, which are about associative linkages (in SM-A: “How much are other things reminding you about it?” “How much are thoughts about it grabbing your attention?”). Omission of the item requires that model fit should be confirmed in a new sample of participants, and suggests that its contribution should be reexamined in relation to other motivational targets.

The four-factor structure obtained in the current analyses and in Parham et al. (2017) is highly consistent with Social Cognitive Theory (Bandura, 1986), which sees incentives and self-efficacy as separate determinants of achievements. The frequency of Self-efficacy Imagery on the MTF-A showed a strong association with AUDIT and RCQ subscales, but strength of Self-efficacy Imagery on the SM-A was primarily associated with RCQ Action. This finding is consistent with self-efficacy cognitions being of primary relevance to people who are about to engage in a task, rather than to those who are considering whether they want to do it, or are not interested in doing it. It is when people are about to undertake a task that its expected challenges and their current capacity to meet them are most likely to capture attention. Accordingly, we predict that Self-Efficacy Imagery on the MTF-A is likely to be an important longitudinal predictor of successful control of consumption in samples of treatment seekers. Such a result would be highly consistent with evidence on the power of self-efficacy to predict sustained outcomes from treatment for problematic drinking (e.g. Kavanagh, Sitharthan, & Sayer, 1996; Kavanagh, Sitharthan, Spilsbury, & Vignaendra, 1999; Sitharthan & Kavanagh, 1991). However, the contention awaits further test, as does the relationship between Self-Efficacy Imagery and more standard self-efficacy measures.

Conclusion

Given that a stable 4-subscale structure for both the SM and MTF is emerging across behavioral goals, we recommend that this version be used in future application of the scales. Importantly, the revised subscale structure now allows researchers and practitioners to assess the extent that motivational interventions including Functional Imagery Training impact on these two foci, and the contribution that each type of imagery contributes to treatment responses.

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Table 1. State Motivation Scale and Motivation Thought Frequency Scale for Alcohol CFA Sequence

	Robust χ^2	df	Robust CFI	Robust TLI	SRMR	Robust RMSEA	AIC
MTF Alcohol (13 items)							
3 factors	284.22	62	.951	.938	.019	.133	14702.36
4 factors	204.55	59	.968	.958	.023	.109	14563.17
4 factors, correlating errors ^{1,2}	132.92	57	.984	.978	.018	.080	14444.11
SM Alcohol							
3 factors, 13 items	505.16	62	.887	.858	.088	.152	21918.71
4 factors, 13 items ³	246.45	59	.953	.938	.083	.101	21586.02
4 factors, 12 items, omitting 'How easily can you keep it in mind?' ⁴	150.69	48	.973	.962	.043	.083	19749.58

1. '...imagine succeeding at it' with '...picture times you did something like this in the past'; '...imagine how good it will be to do it' with '...imagine how much worse you will feel if you don't do it.'
2. At the final step, the only modification index exceeding 20 of an item with another factor was between "How often did other things remind you of it" and Incentives Imagery (24.30).
3. At this step, "How easily can you keep it in mind" had substantial modification indices on other factors (Self-efficacy Imagery: 94.92; Incentives Imagery: 69.10; Intensity: 37.25).
4. At the final step, only two modification indices for items exceeded 20 on other factors ("How good it will be to do it"/Self-Efficacy Imagery: 26.05; "Picture times you did something like this in the past"/Availability).

Table 2. Internal consistency of the MTF-A and SM-A and intercorrelations with the Readiness to Change Questionnaire (RCQ) and Alcohol Use Disorders Identification Test (AUDIT)

	M (SD) ¹	Omega 2 (ω_2) at final step of CFA	Pearson correlations			
			AUDIT	Precontemplation	RCQ Contemplation	Action
MTF-A (13 items)	(n = 386) ²	(n = 351) ³	(n = 379) ²	(n = 381) ²	(n = 381) ²	(n = 381) ²
Intensity	2.6 (2.7)	.96	.48***	-.56***	.65***	.51***
Incentives Imagery	2.6 (2.8)	.98	.50***	-.51***	.61***	.51***
Self-Efficacy Imagery	2.4 (2.6)	.94	.45***	-.47***	.57***	.54***
Availability	2.7 (2.7)	.97	.55***	-.54***	.63***	.50***
Total	2.6 (2.5)	.99	.53***	-.55***	.65***	.55***
SM-A (12 items)	(n = 417) ²	(n = 399) ³	(n = 379) ²	(n = 381) ²	(n = 381) ²	(n = 381) ²
Intensity	3.0 (2.8)	.95	.51***	-.57***	.63***	.62***
Incentives Imagery	4.1 (2.9)	.91	.40***	-.48***	.53***	.50***
Self-Efficacy Imagery	4.5 (2.9)	.90	.24***	-.33***	.34***	.42***
Availability	2.5 (2.8)	.94	.50***	-.44***	.55***	.49***
Total	3.7 (2.4)	.97	.46***	-.52***	.58***	.59***

1. Reported as average item data on the 0-10 scale, for ease of comparison between subscales

2. Includes all available data.

3. Omits multivariate outliers.

*** $p < .001$.