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Measuring Voluntary Control Over Hallucinations: The Yale Control Over Perceptual Experiences (COPE) Scales

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Auditory verbal hallucinations (AVH) frequently cause significant distress and dysfunction, and may be unresponsive to conventional treatments. Some voice-hearers report an ability to fully control the onset and offset of their AVH, making them significantly less disruptive. Measuring and understanding these abilities may lead to novel interventions to enhance control over AVH. Fifty-two voice-hearers participated in the pilot study. 318 participants with frequent AVH participated in the validation study. A pool of 59 items was developed by a diverse team including voice-hearers and clinicians. After the pilot study, 35 items were retained. Factorial structure was assessed with exploratory (EFA, n = 148) and confirmatory (CFA, n = 170) factor analyses. Reliability and convergent validity were assessed using a comprehensive battery of validated phenomenological and clinical scales. CFA on the final 18 items supported two factors for a *Methods* of Control Scale (5 items each, average ω = .87), and one factor for a Degree of Control Scale (8 items, average ω = .95). Correlation with clinical measures supported convergent validity. Degree of control was associated with positive clinical outcomes in voice-hearers both with and without a psychosis-spectrum diagnosis. Degree of control also varied with quality of life independently of symptom severity and AVH content. The Yale control over perceptual experiences (COPE) Scales robustly measure voice-hearers' control over AVH and exhibit sound psychometric properties. *Results* demonstrate that the capacity to voluntarily control AVH is independently associated with positive clinical outcomes. Reliable measurement of control over AVH will enable future development of interventions meant to bolster that control.

Key words: auditory hallucinations/control/questionnaire/Development/validation

Introduction

Although auditory hallucinations may be a prominent part of psychotic illness, many voice-hearers never develop the need to seek help for their experiences.[1–3] Individuals' beliefs and patterns of interacting with their voices predict the severity of resulting functional impairment.[4–7] Voluntary control over voice-hearing experiences has been strongly associated with the level of distress and functional impairment associated with these experiences.[8] Voluntary control over voice-hearing experiences, defined here as the ability to intentionally influence the timing, frequency, or intensity of voice-hearing experiences, has been described as taking a variety of forms. These abilities range from performing activities that impact voice-hearing that are unrelated to voice-hearing (termed nonengagement-based approaches such as hearing music)[9,10] to directly controlling the onset and/or offset of voice-hearing episodes (termed engagement-based approaches).[11–14] This heterogeneity poses a significant challenge to the characterization of the psychological and biological processes underlying the development of control over voice-hearing experiences. For example, nonengagement-based approaches, characterized by diverting attention away from voice-hearing, are likely to be subserved by very different neural mechanisms from engagement-based approaches, which directly manipulate the occurrence of voice-hearing events themselves.[8,15,16] The ability to measure these subtypes reliably is crucial for the identification of their neural substrates and the development of new treatments based upon this advancing knowledge.

Help-seeking and nonhelp-seeking voice-hearing populations also differ on several factors that could impact the development of control, including social support, level of distress caused by the voices, and voice content.[14,17–20] Despite these differences, recent qualitative work suggests that the ability to exert control over voice-hearing experiences is often developed in very similar stages regardless of help-seeking status.[15] This finding is particularly promising because it implies that control over voice-hearing experiences is not wholly dependent upon fixed differences in cognitive abilities, distress, or phenomenological characteristics,[1,4,15,19,21] but may be fostered nonetheless.

Although control over voice-hearing experiences may be important to prediction of clinical outcomes and novel treatment development, there are very few measures to directly characterize control over voice-hearing in detail.[22] Nonclinical voice-hearers' experiences and methods used to exert control have garnered interest within the mental health field in recent years.[23–25] However, there are no tools currently available to specifically assess the level, nature, and progression of control over voice-hearing experiences. Existing tools consist of single clinician-rated items on comprehensive scales of psychotic symptomatology such as the Psychotic Symptom Rating Scale (PSYRATS-AH)[17,26] and Chicago Hallucination Assessment Tool (CHAT),[27] as well as certain items on the BAVQ-R that focus on the relationship between the voice-hearer and their voices but do not delineate control abilities in a clinically useful manner.

With the extensive involvement of individuals who hear voices and vary in their need for care, we have developed the first scales specifically designed to measure the types of control individuals exhibit and their overall ability to exert this control. Here, we present data demonstrating the initial validity and reliability of the Yale Control Over Perceptual Experiences (COPE) Scales and their relationships to clinically-relevant aspects of functioning in voice-hearing populations.

Methods

Item Development and Piloting

Following recent qualitative work[15] and a review of relevant extant scales, an initial pool of 59 items capturing degree and methods of control was developed by a multidisciplinary team including mental health professionals, representatives of voice-hearer support groups, and spiritual communities with a high prevalence of voice-hearing experiences. Items used a 7-point Likert scale ranging from Never (1) to Always (7), reflecting the frequency of a particular experience when the voices first started and at the present time (See Figure 1 for the steps followed for development and scale validation. See Supplementary Table S1 for reviewed questionnaires). Initial item reduction was conducted with feedback from a pilot sample of 52 voice-hearers who had developed varying degrees of control by self-report (see Supplementary Material for sample details). Cognitive interviews[28] were conducted to obtain feedback on the items' simplicity, clarity, and phrasing. As a result, the wording of several items was changed to better reflect voice-hearers' experiences (see Supplementary Material for examples). 35 items were selected for the final COPE Scales. 21 of these captured Methods of Control, including 12 items to measure engagement-based and 9 items to measure nonengagement-based approaches. Overall Degree of Control over the voice-hearing experiences was captured by the remaining 14 items. Three independent raters consistently assigned items to the correct corresponding scale (Kappa = .703; 95%CI = .517 –.888) and determined their relevance (3 point scale from non relevant to very relevant, ICC = .720).

Scale Development and Psychometrics

Participants. All procedures were approved by the Yale University Institutional Review Board/ Human Interest Committee. A sample of 318 participants was selected from a total of 1134 participants enrolled in the ongoing Yale COPE Project (https://www.spirit.research.yale.edu/). Selection was based on completion of required scales, and presence of voice-hearing experiences meeting minimum frequency (at least once per month) and recency (within the last 6 months) thresholds. Participants younger than 18 and older than 65 were excluded, as were those with self-reported cognitive, neurological, or seizure disorders, and those reporting use of nonprescription drugs or alcohol during study completion. All participants completed an extensive online battery collecting demographic and clinical information in addition to behavioral data on computerized perceptual and cognitive tasks, coordinated through Yale's instantiation of Research Electronic Data Capture (REDCap@Yale).[29,30]

Data quality control was ensured by assessing response consistency on key items across all scales. The Miller Forensic Assessment of Symptoms Test (M-FAST)[31,32] and computerized binary Scale for Auditory Speech Hallucinations (cbSASH)[33,34] were used to flag responses for internal inconsistency and potential for malingering. If participants were flagged for any reason, a clinician from the research team (authors BQ, ES, and AH) conducted one-on-one online video interviews to ensure singular participation, clarity of responses, and data integrity prior to compensation and data inclusion. From the initial 327 selected participants, 74 were flagged. After a second analysis of their responses and/or interview, 9 failed to comply with the required interview and their data were excluded from final analysis. Additionally, 4 participants were excluded because they denied hearing voices rather than "hearing spirit" and 5 were excluded for suspicion of repeated participation (by IP address tracking).

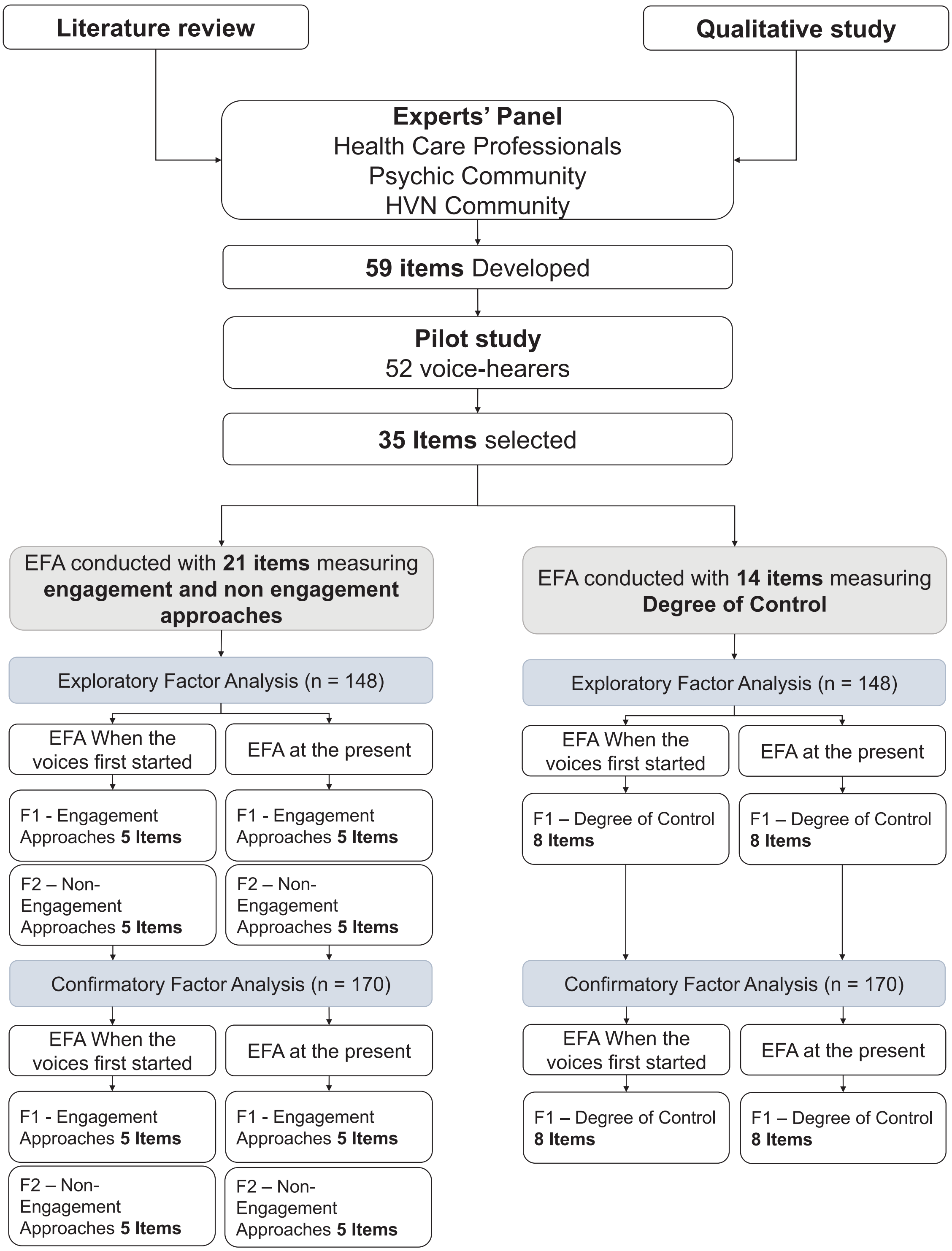

Figure 1. Scale development. Starting with a literature review and qualitative study around control over voice-hearing experiences, a panel of experts composed of healthcare professionals, members of spiritual communities, and members of the Hearing Voices Network subsequently developed 59 items meant to capture control over voice-hearing experiences. These were tested by a panel of 52 voice-hearers, and 35 items were retained. Exploratory and confirmatory factor analyses were performed on the items meant to capture degree of control and approaches used to exert control.

Measures. Convergent validity related to beliefs and distress due to voice-hearing was assessed using the following instruments: the Beliefs About Voices Questionnaire (BAVQ-R),[7,35] Launay-Slade Hallucination Scale (LSHS-R),[36] and the Peters Delusions Inventory (PDI-21).[35] The intensity and phenomenology of voice-hearing experiences were recorded using the Chicago Hallucination Assessment Tool (CHAT)[27] and Computerized Binary

Scale for Auditory Speech Hallucinations (cbSASH).[33] The White Bear Suppression Inventory (WBSI),[37] Daily Stress Inventory (DSI),[38] and the Quality of Life Enjoyment and Satisfaction Questionnaire-Short Form (QOL)[39] were included to assess cognitive and daily functioning. Finally, the Personality Disorders Questionnaire (SCID-II) and Patient Health Questionnaire-9 (PHQ-9)[40] assessed for the presence of characterological and mood pathology. Clinical interviews were conducted on a subsample of participants to assess for consistency of self-reported and clinical diagnosis. Interviews consisted of a full Mini International Neuropsychiatric Interview (MINI) for Psychotic Disorders Studies 7.0.2 along with one item from Auditory Hallucination Rating Scale (AHRS)[41] and another from Psychotic Symptom Rating Scales (PSYRATS)[17] to assess the degree of control over the voice-hearing experiences. Results demonstrated high agreement of self-reported and clinical diagnosis ($N = 32$; $\kappa = 0.683$; 84% agreement; see Supplementary Table S2 for demographics of interviewed sample).

Analysis. The sample was randomly split into 2 subsamples. One subsample ($n = 148$) was used for exploratory factor analysis (EFA) and the other was reserved for subsequent confirmatory factor analysis (CFA) ($n = 170$). No significant differences between the two samples were found on any demographic or clinical variables (Table 1 and Supplementary Table S2). Item responses were treated as ordinal variables.[42] Polychoric matrices of correlations were generated for factorial analyses. Diagonally-weighted least squares (DWLS)[43] were used as estimation methods for EFA and CFA. Items were then removed from the scales based on their complexity/cross-loading (com >1.3), factor loadings ($\lambda < 0.4$), and internal consistency (item-test correlation).[44] Goodness-of-fit for CFA was evaluated using the root mean square error of approximation (RMSEA < 0.08), the comparative fit index (CFI > 0.95), and the Tucker-Lewis index (TLI > 0.95).[45] Internal consistency was assessed using the omega coefficient (ω).[46] Measurement Invariance (MI) with the complete sample was conducted between participants that reported a psychosis-spectrum diagnosis ($n = 72$) and those without such a diagnosis ($n = 246$). Concurrent validity was assessed by analyzing the matrix of correlations between the COPE scales and the above measures. Analyses were performed on R using the packages *coefficient alpha* (v. 0.5), *Lavaan (* v. 0.6- 5), *mediation* (v. 4.5.0), and *Polycor* (v. 0.7-10).

Results

Sample Description

Supplementary Table S2 provides a full description of sample demographics. The sample was varied in terms of level of functioning and rates of self-reported mental illness (Table 1). The vast majority (88.6%) reported having completed some post-secondary education, but 41.82% reported being currently unemployed, and only 31% reported working more than 30 hours per week. Nearly half (47.5%) of participants reported having a mental health diagnosis, with 28.62% reporting having 2 or more diagnoses. 22.64% reported having received a psychosis-spectrum diagnosis (schizophrenia, psychosis, bipolar I, bipolar II, bipolar unspecified, and schizoaffective disorders). The most common diagnoses endorsed were anxiety (16.98%), depression (15.09%), and PTSD (7.23%).

The SCID-II self-report questionnaire was used to screen for potential character pathology. The most common positive screen (36.16%) was for potential schizotypal personality disorder (Table 1). Nearly half (45.3%) met the threshold for odd beliefs (PDI score >8),[47] and 30.5% reported having visual hallucinations in addition to auditory hallucinations. Nearly all (94.03%) reported having heard voices within the last month; the remaining 5.97% had heard voices within the last 6 months. Frequency of voice-hearing ranged from daily (39.94%) to weekly (32.39%) to monthly (27.67%).

The majority of participants endorsed clear and extensive voice-hearing experiences on the cbSASH: 67.0% reported that the voices were clear like a sound, 64.5% that the voices had conversations, and 65.5% heard more than one voice. Affective response to the voices and attribution varied: 56.4% reported that they were not bothered by the voices, 45.5% identified the voices as those of spirits and 53.1% as those of deceased people, while 17.4% indicated that they hear voices because of their mental illness. Figure 3A outlines additional phenomenological characteristics of the sample's voice-hearing experiences.

Item Reduction

EFA and CFA were conducted independently for each time period. The numbers of factors were determined using parallel analysis, scree plots, and Kaiser's rule (eigenvalues > 1) (Figure 2A). Parallel analysis suggested use of 3 factors while the scree plots suggested 2 factors for the Methods of Control Scale at both time points (21 items). Testing of the 3-factor model showed that the third factor had only 5 items, and only 2 without significant cross-loadings. Given these results, a 2-factor model was chosen. After EFA, 11 items were removed because of: a) factor loadings lower than 0.4 (items 13 and 28); b) significant cross-loading (items 9, 10, 14, and 22); and c) redundancy of content with no impact on internal consistency (items 1, 4, 5, 17, and 35). A similar procedure was followed with the Degree of Control Scale (14 items). The parallel analysis, scree plot, and Kaiser's rule suggested a solution of only one factor. All the items of the Degree of Control Scale performed appropriately ($\lambda \geq .04$). After EFA, 6 items were dropped because of redundancy of content with no impact on internal consistency (see Supplementary Table S3). The final scale to measure Methods of Control was composed of 10 items (5 for Engagement- and 5 for

Table 1. Self-Reported Diagnosis

Diagnosis	EFA Subsample		CFA Subsample		Total Sample	
	Frq	%	Frq	%	Frq	%
Most frequently reported diagnosis						
Anxiety	25	16.89	27	15.88	54	16.98
Depression	26	17.57	25	14.71	48	15.09
Post traumatic stress disorder	11	7.43	13	7.65	23	7.23
Borderline personality disorder	8	5.41	8	4.71	16	5.03
ADHD	7	4.73	5	2.94	14	4.40
Dissociative identity disorder	2	1.35	3	1.76	6	1.89
Dysthymia	1	0.68	1	0.59	1	0.31
Major depression	1	0.68	8	4.71	12	3.77
Obsessive compulsive disorder	4	2.70	4	2.35	9	2.83
Other diagnosis	10	6.75	14	8.24	24	7.55
Psychosis-spectrum illness						
Bipolar II	5	3.38	4	2.35	9	2.83
Bipolar I	3	2.03	2	1.18	5	1.57
Bipolar unspecified	10	6.76	8	4.71	18	5.66
Paranoid schizophrenia	1	0.68	1	0.59	2	0.63
Psychosis	6	4.05	6	3.53	12	3.77
Schizophrenia	2	1.35	6	3.53	8	2.52
Schizoaffective disorder	8	5.41	10	5.88	18	5.66
Total psychotic-like spectrum	35	23.65	37	21.76	72	22.64
Total reported psychiatric diagnosis						
0	76	51.40	91	53.50	167	52.52
1	32	21.60	28	16.50	60	18.87
2	17	11.50	25	14.70	42	13.21
3	15	10.10	9	5.30	24	7.55
4	3	2.00	13	7.60	16	5.03
5	3	2.00	1	0.60	4	1.26
6	2	1.40	3	1.80	5	1.57
Personality disorders (SCID-II)						
Avoidant	22	14.86	14	8.24	36	11.32
Dependent	4	2.70	1	0.59	5	1.57
Obsessive compulsive	27	18.24	23	13.53	50	15.72
Passive aggressive	11	7.43	8	4.71	19	5.97
Depressive	12	8.11	12	7.06	24	7.55
Paranoid	21	14.19	13	7.65	34	10.69
Schizotypal	56	37.84	59	34.71	115	36.16
Schizoid	5	3.38	3	1.76	8	2.52
Histrionic	1	0.68	3	1.76	4	1.26
Narcissistic	20	13.51	13	7.65	33	10.38
Borderline	27	18.24	23	13.53	50	15.72
Conduct disorder	20	13.51	5	2.94	25	7.86

Note: All the diagnoses listed were self-reported by the COPE participants. Personality Disorders (SCID-II) cutoffs for each diagosses were used to compute their frequencies.

Nonengagement-Based Approaches). The Degree of Control Scale included 8 items.

Reliability and Latent Structure

CFA conducted with the remaining 170 participants showed good fit indices for both the Methods o f Control and Degree of Control scales (Figure 2B–C). Small and nonsignificant correlations between Engagement- and Nonengagement-Based factors supported a distinction between these factors for both time points ($r(170)_{present} = -0.294$, $P < .001$, $r(170)_{past} = -0.105$, P = ns). Internal consistency measures for Engagement-Based and Nonengagement-Based approaches were excellent (mean $\omega_{nonengagement\text{-}based\ (present\ and\ past)} = 0.88$ and mean $\omega_{engagement\text{-}based(present\ and\ past)} = 0.85$), as was internal consistency for the Degree of Control ($mean_{present\ and\ past} = 0.95$) (Supplementary Table S4).

Convergent and Discriminant Validity

No instruments exist to measure degree and methods of control over voice-hearing experiences. Several measures related to phenomenology and clinical status as well as single items pertaining to control were included to assess convergent and discriminant validity (Supplementary

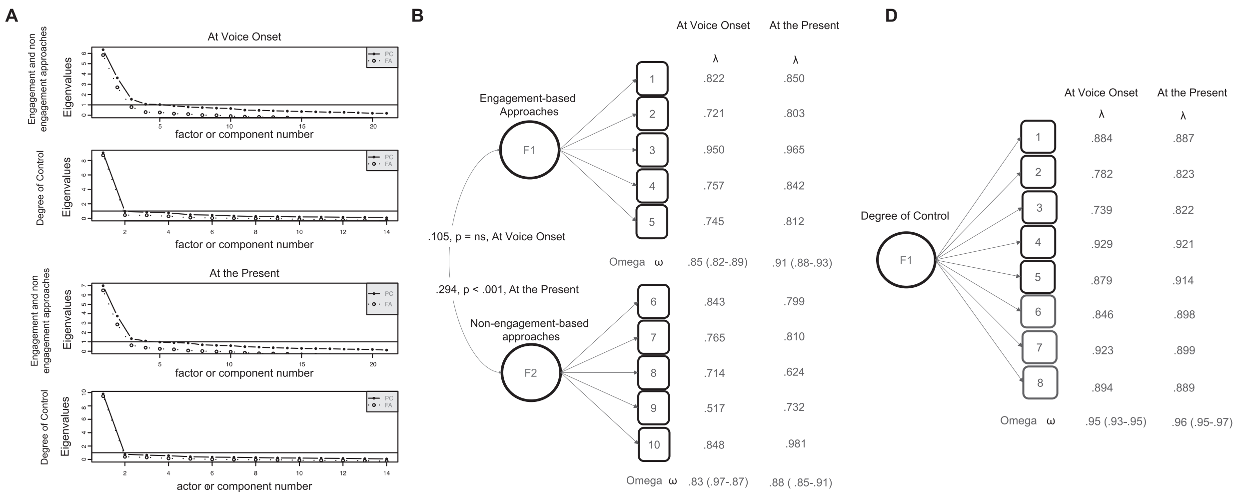

Figure 2. Psychometrics. A. Scree plot for Degree of Control and Methods of Control items at time of voice onset and at the present. Solid line demarcates eigenvalue = 1. PC = data derived from Principal Components Analysis; FA = data derived from Factor Analysis. B. CFA for methods of control. Factor loadings (λ) for both time points are reported. Ordinal coefficient (ω) was used to compute scale internal consistency. Fit indices (at present): X^2 (34) = 104.607, p <.001; CFI =.988; TLI =.984; RMSEA =.111 (95% CI =.87 - 11); SRMR =.097. C. CFA for Degree of Control. As in B, factor loadings for both time points are reported and ω provides a measure of internal consistency. Fit indices: at present, X^2 (20) = 15.805, p <.001; CFI =.998; TLI =.995; RMSEA =.081 (95% CI =.046 - 115); SRMR =.028; at voice onset, X^2 (20) = 45.809, p <.001; CFI =.993; TLI =.990; RMSEA =.087 (95% CI =.057 - 120); SRMR =.042.

Table S7). Voice-hearing experiences have been associated with higher propensity toward odd beliefs (PDI), other unusual perceptual experiences (LSHS-R; CHAT), and unwanted thoughts (WBSI). Additionally, beliefs held about the malevolence and omnipotence of voices (BAVQ-M, BAVQ-O) as well as resistance to voices (BAVQ-R) have been related to distress, impairment, and likelihood of obtaining a diagnosis in voice-hearers.[4,5,19] Consistent with these studies, Degree of Control and Engagement-Based Approaches were negatively and significantly associated with distress due to delusions (PDI Distress), hallucination severity (CHAT), intrusive thoughts (WBSII, WBSIS, WBSID), beliefs about voices' malevolence and omnipotence (BAVQ-M, BAVQ-O), and resistance to voices (BAVQ-R). These scales were positively and significantly correlated with beliefs in voices' benevolence (BAVQ-B) and engagement with the voices (BAVQ-E). The opposite pattern was generally observed for use of Nonengagement-Based approaches. Hallucination frequency was negatively correlated with use of engagement-based approaches ($r_{(295)past}$ = –.180, $r_{(295)present}$ = –.276, *ps* <.01) and degree of control exhibited ($r_{(295)past}$ = –.180, $r_{(295)present}$ = –.253, *ps* <.01), but not with use of nonengagement-based approaches. Finally, as was expected, the use of engagement-based approaches was highly correlated with degree of control ($r_{(318)\ past}$= 0.812, $r_{(318)present}$ = 0.875, *ps* < 0.001) (Supplementary Table S7).

Consistency Self-reported and Clinician-Rated Control

Semi-structured interviews were conducted with thirty-two participants. This subsample was similar to the complete sample on voice frequency and recency, degree of control over the voices, and self-reported psychosis-spectrum illness (Supplementary Table S2). Two additional clinician-rated items were administered during the interview to capture participants' abilities to control their voice-hearing experiences. Clinicians were blind to the participants' self-report ratings for all the questionnaires administered. Clinician ratings of (1) how frequently participants felt in control of the voices (Cronbach α =.761) and (2) how much effort was required to ignore the voices (Cronbach α =.704) were consistent with self-reported degree of control. All correlations were stronger for the present ($r_{(32)engagement\ present/(1)}$ = .737, $r_{(32)engagement\ present/(2)}$ = .540, $r_{(32)Degree\ control\ present/(1)}$ = .795, $r_{(32)Degree\ of\ control\ present/(2)}$ = –.553, *ps* < .001), than for the past ($r_{(32)engagement\ past/(1)}$ = .268, $r_{(32)engagement\ past/(2)}$ = –.328, *p* = ns, $r_{(32)Degree\ control\ past/(1)}$ = .427, $r_{(32)Degree\ of\ control/(2)}$ = –.370, *P* < .05).

Clinical Relevance of the Yale COPE Scale

The COPE scales demonstrated good internal consistency at both time points and for both participants with and without psychosis-spectrum diagnosis (see Supplementary Table S5). The pattern of z-order correlations between the scales between both groups on the COPE scales was similar except for the relationship between the frequency of use of engagement-based versus nonengagement-based approaches at the present ($r_{(246)\ no\ diagnosis}$ = –.236, *P* < .001; $r_{(72)diagnosis}$ = –.091, *p* = ns; Figure 3B–C). Participants with a psychosis-spectrum diagnosis used engagement-based approaches less frequently ($t_{(134.661)present}$ = 3.88, $t_{(175.889)past}$ = 2.984, *P* < .005), reported a lower degree of control overall ($t_{(144.119)present}$ = 4.760, $t_{(201.688)past}$ = 5.012, *P* < .001) and

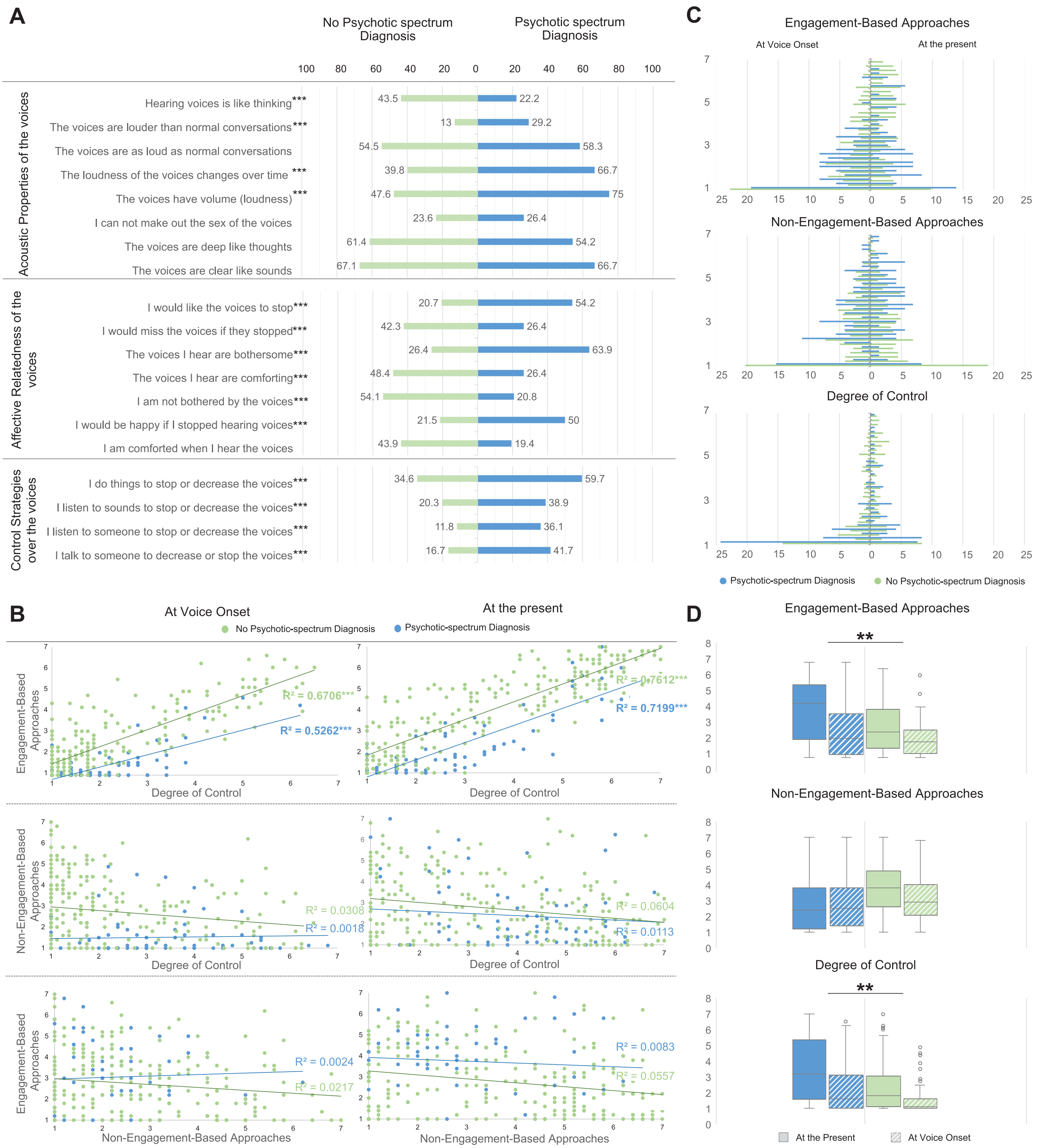

Figure 3. Voice characteristics and control in individuals with and without a psychotic-spectrum diagnosis. A. Selected phenomenological characteristics of voices, derived from the computerized binary Scale for Auditory Speech Hallucinations (cbSASH), as endorsed by individuals with (blue) and without (green) a psychotic-spectrum diagnosis. Note minor differences in acoustic characteristics and several predominating differences in affective response and strategies used to exert control over voices. ***, p < 0.001. B. Correlations of scores on each subscale, split between those with (blue) and without (green) a psychotic-spectrum diagnosis. Relationships among the variables do not differ based on diagnosis. C. Distribution of average item ratings per scale at voice onset and present time, split by presence of psychotic-spectrum diagnosis. D. Average item ratings at the present (solid) and at time of voice onset (hashed), split by diagnostic category (blue/ green). **, p < 0.01.

a higher frequency of the use of nonengagement-based approaches at the present ($t_{(316)present} = 4.930$, $P < .001$). Interestingly, no differences were found in the frequency of use of nonengagement-based approaches between the groups when the voices started (see Figure 3C–D).

Using independent stepwise linear regressions (one for each category reported on Figure 3A—acoustic properties, control strategies, and affective relatedness), the predictive capacity of phenomenological features of voice-hearing experiences over degree of control over the voices at the present was explored (see Supplementary Table S6). Acoustic properties explained 13.9% of the variance in present degree of control, nonengagement-based methods of control explained 9.7 %, and affective relatedness explained 42.3%.

Lastly, we examined relationships between the COPE scales and functional status. Significant and positive correlations were observed between use of both Engagement-Based Approaches and Degree of Control scores and quality of life, educational level, and working hours per week (Supplementary Table S7). By contrast, use of nonengagement-based approaches was significantly and negatively related to all of these measures. Importantly, associations between engagement-based approaches ($r_{QOL(124)}$ = .248, P = .005; $r_{work(124)}$ = .237, P = .008) and degree of control at the present ($r_{QOL(124)}$ = .240, P = .007; $r_{work(124)}$ = .188, P = .035) with these outcomes remained significant after controlling for both malevolence beliefs (BAVQ-M) and distress due to delusions (PDI Distress). A simple mediation model (Figure 4) demonstrates that Degree of Control partially mediates the relationship between beliefs about voices' malevolence and quality of life (Sorvel's test, z = –1.992, P = .046). Indirect effects were also significant: using 5,000 bootstrapped samples, the unstandardized indirect effect was 0.84 with a 95% confidence interval of [–.1216, –.0132].

Discussion

The current study presents new self-report measures of control over voice-hearing experiences, evaluates their psychometric properties, and provides initial support for their construct validity.

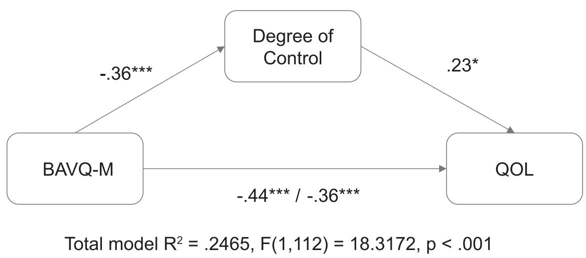

Figure 4. Structural equation model of relationship between beliefs about voices, degree of control, and quality of life. Beliefs about voices' malevolence, measured by the Beliefs about Voices Questionnaire, Malevolence subscale (BAVQ-M), negatively predicts both degree of control and quality of life (QOL). Degree of control positively predicts quality of life and results in a decreased amount of variance explained by malevolence beliefs. *, $P < .05$; ***, $P < .001$.

The ability of voice-hearers to function is predicted by many factors, including psychiatric comorbidities, beliefs about voices, and the content of what is heard. As we[8,15] and others[19,48–50] have argued, control over voice-hearing experiences is another, potentially modifiable determinant of functioning. Here, we demonstrate that the impact of control over voice-hearing experiences extends beyond these other factors. We show that different methods of achieving control over voice-hearing experiences exhibit differential patterns related to functioning and quality of life—namely, that approaches based on engagement with voices are associated with higher quality of life and overall functioning. This supports findings that tie beliefs about voices and engagement styles to distress and clinical status[4,7,19,51] and extends these findings to control over voice-hearing experiences, which may be a key benefit arising from these beliefs and engagement styles.[52] Other measures (such as the BAVQ-R[36]) have similarly highlighted the importance of engagement with voices as a critical predictor of functioning. The COPE Scales extend this work by simultaneously measuring the strategies used to exert control over voice-hearing experience and participants' ability to do so.

One key feature of the Yale COPE Scales is their ability to quantify control abilities and characterize the methods used to exert them without the use of comprehensive structured interviews and clinician ratings. The ability of the scales to differentiate between methods of exerting control and how these abilities change over time from the participant's perspective is crucial for development of interventions meant to enhance them. Applied prospectively, the scales may aid in the prediction of conversion to psychosis in those at clinical high risk for psychosis. Individuals in this group often present with perceptual abnormalities that, while at times distressing, do not themselves predict conversion.[53] Precise measurement of control abilities also allows for identification of predictors of control over voice-hearing experiences. Static (e.g., trauma history, cognitive capacity) and dynamic (e.g., daily stress, medication dose) factors may each contribute to the degree and trajectory of control development, and their identification will be crucial for recognition and amelioration of barriers to control development. Creation of therapies specifically meant to foster control for those in the earliest phases of psychosis may allow for the effective curtailment of functional decline often accompanying voice-hearing in the clinical setting. Existing therapies like cognitive behavioral therapy for psychosis (CBTp) may already work to enhance control and have been tested in those at Clinical High Risk for Psychosis.[54] Several new therapeutic approaches (e.g., AVATAR Therapy,[55,56] Relating Therapy,[57] and Talking with Voices[57,58]) encourage engagement with voices in the service of functional improvement. Engagement is also a critical piece of other approaches to coping with psychotic experiences more broadly, including the Maastricht

Assessment of Coping Strategies[59] and work focused on appraisals of psychotic-like experiences across the clinical spectrum.[60–62] The COPE Scales may represent a way of measuring their efficacy in enhancing control over voice-hearing experiences by engaging with voices.

Recent work in neurofeedback methods for auditory hallucinations highlights these methods' potential for improving functioning in voice-hearers by altering activity in the auditory cortex.[50,63,64] One potential outcome of these approaches may be enhanced control over hallucinations,[48] speaking to the potential involvement of auditory cortices in the exertion of control over voice-hearing experiences. The work presented here may be a means by which control itself may be systematically interrogated and enhanced, first by identifying circuits underlying control over voice-hearing experiences, and then using noninvasive techniques like neurofeedback to specifically alter activity in these networks in individuals without control abilities. Measuring how individuals exert control is crucial for the identification of participants capable of demonstrating direct, voluntary control over the onset and offset of voices in the scanner in an effort to identify circuits underlying these abilities. This information can then be leveraged for future brain-based therapeutic approaches.

This work has some limitations. First, only 22% of the participants reported a psychotic-spectrum diagnosis, although the analyses indicate a similar performance across clinical and nonclinical voice-hearers even in this limited sample. Second, the sample was skewed toward females. This bias has been consistently observed in other studies with predominantly nonclinical voice-hearers.[65] Previous studies have described sex differences in symptomatology[66] and functioning[67] in voice-hearers, although gold-standard measures have shown measurement invariance across sex.[68,69] Future studies should similarly assess for measurement invariance of the COPE scales between sexes and in samples of help-seeking voice-hearers.

The current study contributes to the growing body of psychological,[8,13,15] computational,[70–73] and neuroimaging-based[74] research that contends with the historical view and common conception that hallucinations are impenetrable to voluntary control.[75] The fact that hallucinations may be susceptible to voluntary influence challenges strict modularist conceptualizations of perception as informationally encapsulated from cognition.[76] An understanding of the neural dynamics leading to a meaningful top-down modulation of perceptual systems by higher-level cognition could lead not only to new therapeutic approaches based upon these manipulations, but the development of technologies meant to augment human perceptual capabilities writ large. Thus, reliable identification of individuals capable of voluntary control over perceptual events may be a step toward not only treatment for hallucinations, but a shift in our ability to understand and manipulate perception.

Supplementary Material

Supplementary material is available at *Schizophrenia Bulletin* online.

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