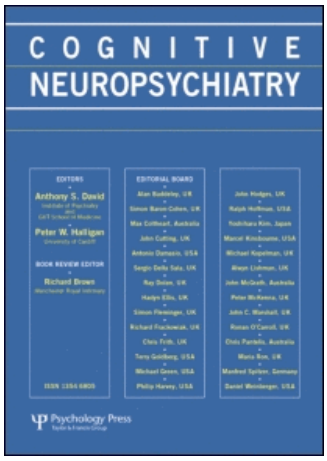

Cognitive Neuropsychiatry
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713659088

Exploring the perceptual characteristics of voice-hallucinations in deaf people

Online Publication Date: 01 July 2007
To cite this Article: Atkinson, Joanna R., Gleeson, Kate, Cromwell, Jim and O'Rourke, Sue , (2007) 'Exploring the perceptual characteristics of voice-hallucinations in deaf people', Cognitive Neuropsychiatry, 12:4, 339 - 361
To link to this article: DOI: 10.1080/13546800701238229
URL: http://dx.doi.org/10.1080/13546800701238229

COGNITIVE NEUROPSYCHIATRY
2007, 12 (4), 339–361

Psychology Press
Taylor & Francis Group

Exploring the perceptual characteristics of voice-hallucinations in deaf people

Joanna R. Atkinson

Deafness, Cognition and Language Centre, University College of London, London, UK

Kate Gleeson

University of Bristol, Bristol, UK

Jim Cromwell

National Deaf Services, South West London and St George's Mental Health NHS Trust, London, UK

Sue O'Rourke

Mayflower Services for Deaf People, Alpha Hospitals, Bury, UK

Introduction. Previous research has not taken account of the possibility that deaf people will show greater heterogeneity in how they experience voice-hallucinations due to individual differences in experience with language and residual hearing. This study aims to explore how deaf participants perceive voice-hallucinations and whether the perceptual characteristics reported reflect individual experience with language and sensory input.
Method. A statement-sorting task generated data about perceptual characteristics of voice-hallucinations for exploratory factor analysis. The sample included 27 deaf participants with experience of voice-hallucinations, and a range of hearing loss and language backgrounds.
Results. Perceptual characteristics of voice-hallucinations map closely onto individual auditory experience. People born profoundly deaf loaded onto non-auditory factors. Deaf people with experience of hearing speech, through residual hearing, hearing aids, or predeafness experience, reported auditory features or uncertainty about mode of perception.

Correspondence should be addressed to Joanna R. Atkinson, Deafness, Cognition and Language Centre, University College of London, 49 Gordon Square, London WC1H 0PD, UK. E-mail: Joanna.atkinson@ucl.ac.uk

This work was supported by the Economic and Social Research Council of Great Britain (Grant RES-620-28-6001), Deafness, Cognition and Language Research Centre (DCAL).

http://www.psypress.com/cogneuropsychiatry DOI: 10.1080/13546800701238229

Conclusions. This is the first study to systematically explore voice-hallucinations in deaf people and to advance a model of subvocal articulation to account for such counterintuitive phenomena.

INTRODUCTION

There is controversy about the exact nature of voice-hallucinations reported by prelingually deaf people with psychosis (see Atkinson, 2006, for a review). Several phenomenological studies have been convinced by the auditory quality of hallucinations in deaf people citing examples from qualitative interviews, where deaf people have reported "hearing" voices (e.g., Critchley et al., 1981; du Feu & McKenna, 1999). Evans and Elliott (1981) suggested that true auditory hallucinations were confined to deaf individuals who at some point in their lives had experience of hearing. To date, no study has explored phenomenology specifically in relation to individual differences in experiences with language and residual hearing. Previous research relied extensively on the collection and interpretation of data by non-native signers or hearing researchers using sign language interpreters. Research that applies audiocentric frames of understanding will influence the way in which interrogative questions are framed and responses inferred, increasing the likelihood that sound-based values will be attributed. This innovative study aims to systematically explore the heterogeneity in subjective experiences of how voice-hallucinations are perceived by deaf individuals, and seeks to ensure that findings are understood firmly within a deaf epistemology.

METHOD

A deaf-led research design was employed to maximise cultural and linguistic validity. Particular attention was paid to deconstructing concepts that might be construed as truly auditory to those uninitiated in the subtleties of British sign language (BSL) and/or deaf conceptualisations of sound-based phenomena. Deaf people frequently use signs that can be glossed in English as "HEARD", "SHOUT", "VOICES", or "TALK", without necessarily bestowing the audiological qualities assumed by the English equivalent. These lexical items are frequently used to connote communication acts in general whether it is through speech and lipreading or sign language. Indeed a deaf person may describe being "shouted at" without implying that any audible vocalisation took place at all. Concepts such as "loud" may be understood by many deaf people as being highly intrusive and difficult to ignore rather than meaning high auditory volume, and "quiet" might connote that the voice is not present at all. To avoid ecological fallacy, it is

imperative that questions about auditory phenomena are critically appraised in terms of unique deaf-constructions, and reconstructed in order to tap into a more accurate picture of the perceptual characteristics of their voice-hallucinations. To this end questions about auditory phenomena were parsed into purely auditory and general communicative components. (For example, the statements: "Voice sounds like shouting" and "Voice shouts in my mind" had distinct translations in BSL.) Including these as separate items increases validity and enables a more accurate picture of the deaf experience to emerge. Descriptions of perceptual characteristics of voice-hallucinations, like those of dreams, require introspection that may be difficult to articulate linguistically, particularly for those who have delayed language acquisition. For this reason an interview methodology was rejected in favour of structured card-sorting, which allowed participants to make an intuitive judgement about whether or not statements mirrored their own experiences.

Constructing the statement set

A wide literature search ensured comprehensive sampling of all known perceptual characteristics relevant to deaf people and voice-hearers in general. Sensory domains surveyed included: auditory, visual, olfactory, gustatory, tactile, telepathy, perception of location, voice-identity and language use, reality, and clarity. Sampling each domain produced a set of 140 statements. Statements were illustrated using line drawings to aid conceptual understanding (Figure 1). Care was taken to ensure that the visual representations of the voice were as neutral as possible. The set was reduced to 94 statements by consulting with independent experts about relevance, intelligibility, and omissions. Experts included deaf and hearing voice-experiencers, psychiatrists, and mental health professionals specialising in deafness. Statements were back-sorted by four independent colleagues into the original categories to cross-check category validity and sample representativeness (Stainton-Rogers, 1995). Piloting with two deaf voice-experiencers ensured that the task could be understood and completed with ease.

Participants

Data were collected from 27 participants recruited from two specialist mental health services for deaf people in the UK. All had a primary medical diagnosis of schizophrenia. Demographic information is summarised in Table 1. Inclusion criteria specified permanent deafness and experience of voice-hallucinations within the last 2 years. All participants had experienced voice-hallucinations within 6 months prior to the study and reported being able to remember their experiences clearly. Exclusion criteria included an

TABLE 1
Demographic characteristics of participants defining each factor

Factor	*ID*	*Gender*	*Age (yrs)*	*Time since diagnosis of schiz (yrs)*	*Frequency of voice hallucinations*	*Degree of deafness*	*Cause of deafness*	*Age of onset of deafness (yrs; mths)*	*Age of sign language acquisition*
A	P23	F	61	30	Continuous	Profound	Meningitis	6	6
	P4	M	51	33	Continuous	Profound	Meningitis	1;9	16
	P1	M	43	20	Continuous	Profound	Maternal rubella	0	14
	P3	M	56	23	Continuous	Profound	Genetic (deaf parents)	0	0
	P18	M	38	3	Weekly	Severe sensorineural deafness with central auditory processing deficit overlay	Unknown	0	5
	P14	M	37	14	Daily	Profound	Unknown	0	6
	P19	M	57	25	Lapsed	Profound	Meningitis	0;6	4
B	P10	F	64	3	Weekly	Mild-moderate	Genetic	0	n/a
	P13	M	49	29	Daily	Partial then profound	Progressive deafness	8	unknown
C	P9	F	47	12	Occasionally	Profound	Unknown	0	10
	P20	M	32	unknown	Lapsed	Moderate-severe	Genetic (deaf siblings)	0	7
D	P11	F	50	32	Daily	Moderate	Genetic (deaf parents)	0	0
	P7	F	52	12	Lapsed	Moderate-severe	Maternal rubella	0	n/a
E	P25	F	25	9	Continuous	Profound	Maternal rubella	0	2;6
	P5	F	43	19	Monthly	Profound	Unknown	12	20
F	P24	M	25	8	Daily	Severe-profound	Genetic	0	2*

TABLE 1 (*Continued*)

Factor	*Pt*	*Gender*	*Age (yrs)*	*Time since diagnosis of schiz (yrs)*	*Frequency of voice hallucinations*	*Degree of deafness*	*Cause of deafness*	*Age of onset of deafness (yrs; mths)*	*Age of sign language acquisition*
Other participants	P1	F	39	14	Occasionally	Profound	Unknown	6	7*
	P2	M	39	22	Daily	Profound	Maternal rubella	0	11
	P4	M	30	12	Lapsed	Severe-profound	Unknown	0	2;6
	P12	F	30	5	Weekly	Profound	Maternal rubella	0	8
	P15	M	57	42	Continuous	Moderately deaf until 11yrs then profound	Maternal rubella	0	12
	P16	F	39	4	Monthly	Profound	Maternal rubella	0	5
	P17	F	40	6	Continuous	Profound	Maternal rubella	0	11
	P21	M	26	2	Daily	Profound	Intrauterine infection	0	5*
	P22	M	60	35	Daily	Profound	Maternal rubella	0	5
	P26	F	29	11	Daily	Profound	Genetic	0	4
	P27	F	27	13	Lapsed	Profound	Maternal rubella	0	11
Summary	$n = 27$	14 male 13 female	Range 25–64 yrs	Range 2–35 years (mean 16.8, *SD* 11.4)	Range: continuous to lapsed	Range: mild-moderate to profound	The most common aetiology was prenatal maternal rubella (10), followed by genetic deafness (6) and meningitis (3).	Congenitally deaf (21); postlingually deafened >5yrs (4); prelingually deafened <5yrs (2)	Range 0–46yrs. Native (2); Exposure at preschool (9); Late learners 6–16yrs (12); Adult learners >16yrs (2); Nonsigners (2).

* Acquisition of first sign language other than BSL (e.g., Irish sign language). Pt = Participant; schiz = schizophrenia.

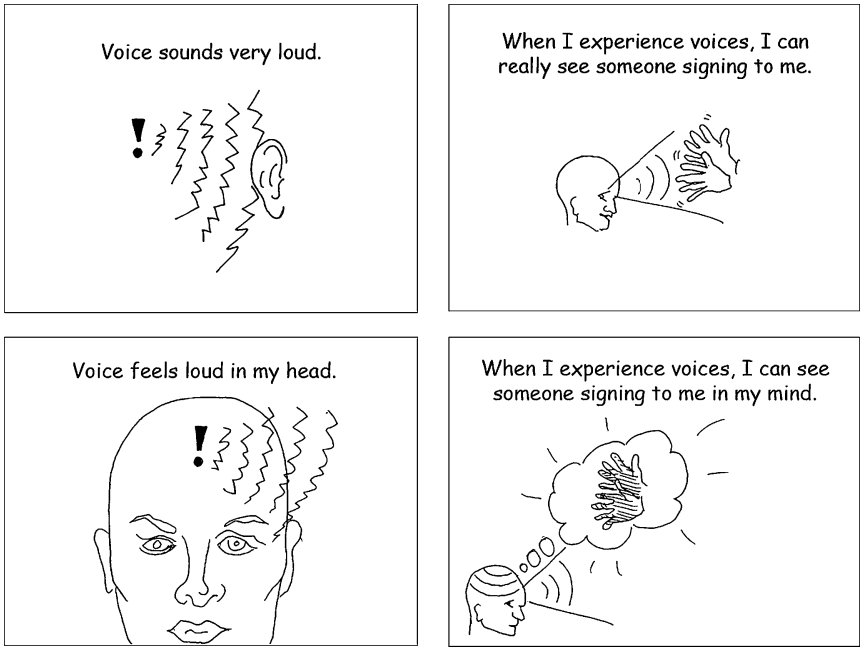

Figure 1. Examples of illustrated statement cards used in sorting task.

inability to provide informed consent or the presence of additional learning disability. Sampling was intended to capture diversity in terms of hearing loss and language background. Information about hearing loss, which ranged from mild to profound, was obtained through self-report, medical notes, and audiological reports where available. The predominant preferred language was BSL which has a distinct grammatical structure, or sign supported English where signs are used in conjunction with English grammar and words. Participants varied substantially in their age of acquisition and fluency. Two were native BSL users from deaf families. Others had their first exposure to sign language on commencing education at 2–5 years, or were late learners, either learning BSL as a second language because they were orally educated in spoken English, or as a delayed first language having previously received inadequate language exposure. Two participants used spoken English and had no knowledge of sign language.

Procedure

Interviews were conducted by a deaf researcher fluent in BSL (the first author). Participants were shown 94 sort cards with statements written in

plain English and illustrations, in random order (Figure 1). The statements were signed by the researcher in BSL or SSE, or provided in spoken English according to participant preference. Participants were asked to sort the cards into three piles according to whether they had ever experienced the phenomenon described: "yes", "no", "don't know/not sure". The participants were asked to consider how often particular phenomena occurred when their voice-hallucinations were present and to sort the "yes" pile into a further three categories: "always", "sometimes", "rarely". This two-stage procedure was designed to reduce suggestibility and to increase reliability (Cuthill, Espie, & Cooper, 2003). Participants were encouraged to review their selection and to make changes at any time. A semistructured interview was conducted in parallel to the sort task allowing participants to elaborate on their responses. This generated qualitative data to facilitate data interpretation.

Analysis

Participants assumed the status of variables and were factor-analysed to obtain clusters of individuals who sorted statements in the most similar way (Stephenson, 1978). The clusters were examined for similarity in participants' language background, degree of deafness, and experience of hearing, either due to harnessing residual hearing with hearing aids or postlingually acquired deafness. Exemplar sorts for each factor were calculated to indicate the dimensions of the phenomenon described and to assist interpretative description.

RESULTS

Principle components factor analysis resulted in six factors, which were rotated to simple structure using varimax criterion. Using an eigenvalue of greater than unity (>1.00), the responses of 27 participants were reduced to six independent response patterns, which accounted for 66% of the variance. Table 2 shows the factor loadings for each participant. Only participants who significantly ($>.5$) and independently loaded onto each factor were taken to define that factor (Stainton-Rogers, 1995). Seventeen participants loaded exclusively onto one of six factors. Ten participants did not distinctly load onto a single factor; although these participants were not used to define the factor, their response patterns were considered during the interpretative process.

Table 1 shows information about the degree, cause, and age of onset of deafness, and age of sign language acquisition, for participants loading on each factor. For each factor, the participant responses that defined each

TABLE 2
Rotated factor matrix

	Factor					
	A	*B*	*C*	*D*	*E*	*F*
PR23	.790*	.153	.031	.151	.012	−.064
PR4	.748*	−.116	.163	−.001	.127	.097
PR6	.743*	.385	.111	.168	−.025	.095
PR8	.731*	−.007	.170	.191	.017	.301
PR18	.726*	−.073	.352	.026	.074	.208
PR14	.709*	−.119	−.014	.075	.168	−.138
PR19	.677*	.166	.306	.026	.062	.253
PR27	.671	.277	−.055	.009	.221	−.384
PR26	.670	.319	−.060	.122	.053	−.140
PR21	.644	.077	.520	−.036	−.057	.126
PR16	.633	.398	.267	−.205	.086	.097
PR22	.569	.294	.254	.082	.316	.210
PR2	.455	−.199	.397	.423	.171	.239
PR10	.020	.664*	−.106	.135	.173	.238
PR13	.190	.623*	.277	.157	−.128	.148
PR17	−.011	.619	.075	.458	.306	−.006
PR15	.265	.546	.216	.287	−.120	−.086
PR9	.193	.138	.789*	−.065	−.099	−.039
PR20	.131	.036	.686*	.196	.164	−.098
PR3	.143	.290	.538	.434	.122	.078
PR11	.102	.278	.000	.753*	−.003	.109
PR7	−.058	.176	.164	.697*	.321	.000
PR12	.459	.107	.023	.556	−.198	.238
PR25	.201	−.065	−.117	.216	.785*	.082
PR5	.207	.297	.306	−.043	.656*	−.016
PR24	.146	.227	−.160	.182	.016	.689*
PR1	.044	.471	.243	.046	.287	.495

*Participants that loaded significantly and independently onto factor.

factor were weighted to reflect their contribution (Brown, 1980). Weightings were applied to each item (statements 1–94) to obtain an exemplar response pattern for each factor. Table 3 shows the exemplar items that most clearly characterise each factor. The most polarised exemplar responses (“always” and “never”) are highlighted in bold for ease of interpretation.

Of the six extracted factors, five could be readily interpreted because more than one participant loaded without having a substantial loading on any other factor (Brown, 1980), allowing description of the most distinct patterns of perceptual characteristics reported by deaf voice-experiencers. Interpretation involved clarifying similarities and differences between factors. Understanding was informed by semistructured interviews

TABLE 3
Summary table showing factor exemplar statements for Factors A–E

Statement	*Factor A*	*Factor B*	*Factor C*	*Factor D*	*Factor E*
1. I experience voices even though I am deaf.	**5**	**5**			
2. I can hear the voice even though I am deaf.	**1**	3	**1**		
3. I experience voices without hearing aids.	**5**	**5**		**5**	**5**
4. I can hear the voice without my hearing aids.	**1**		**1**	**5**	3
5. Voice makes sounds which I can hear.	**1**			**5**	
6. Voice does not make any sound that I can hear.	**5**				
7. When the voice is there, I feel I am hearing something.	**1**				
8. The voice communicates with "VOICE OFF".[i]	**5**		3		
9. The voice communicates with "VOICE-ON".[ii]	**1**		**1**		4
10. Voice is silent.	**5**				
11. Voice sounds like speech.	**1**		**1**	4	
12. Voice sounds very loud.	**1**	**5**	**1**		**1**
13. Voice feels loud In my head.		**5**			
14. Voice is quiet.		**1**	**1**		
15. Voice feels quiet in my head.		4			**1**
16. Voice sounds like shouting.	**1**		**1**		3
17. Voice shouts in my mind.		**5**	**1**		
18. Voice sounds like a whisper.	**1**	4	**1**		
19. Voice sounds about same loudness as my own voice.	**1**	**1**	**1**		
20. Voice sounds louder than my own voice.	**1**	**5**	**1**		
21. Voice sounds quieter than my own voice.	**1**	**1**	**1**		
22. Voice sounds the same volume all the time.	**1**		**1**		
23. The volume of the voice goes up and down.	**1**		**1**		
24. Voice is low pitched.	**1**		**1**		3
25. Voice is high pitched.	**1**		**1**		
26. The pitch of the voice goes up and down.	**1**		**1**		
27. Voice sounds like music.	**1**		**1**		**1**

TABLE 3 (*Continued*)

Statement	*Factor A*	*Factor B*	*Factor C*	*Factor D*	*Factor E*
28. Voice sounds like singing.	**1**		**1**		**1**
29. Sometimes I hear sounds that other people can't hear even if they are hearing.[iii]	**1**				4
30. When I experience voices, I can see someone communicating with me in real space.	**1**		**1**	**1**	
31. When I experience voices, I can see someone's lips moving.		**1**	**1**	**1**	3
32. When I experience voices, I can really see someone signing to me.	**1**	**1**	**1**	**1**	
33. When I experience voices, I can really see someone fingerspelling to me.	**1**	**1**	**1**	**1**	
34. I see things that other people do not see when the voice is not there.			**1**	**1**	
35. When I experience voices, I see a picture of someone communicating with me in my mind.	**5**				4
36. When I experience voices, I can see someone signing to me in my mind.				3	
37. When I experience voices, I can see someone fingerspelling to me in my mind.			**1**	**1**	
38. When the voice starts, an image of the voice appears in my mind.	**5**				**5**
39. The image of the voice moves when the voice is communicating.			**1**		
40. The image of the voice is still when the voice is communicating.			**1**		
41. I can see through the image of the voice.			**1**	**1**	
42. The image of the voice is faint and unclear.					
43. The image of the voice is solid like you could touch it.	**1**	**1**	**1**	**1**	**1**
44. I can see the hands/lips of the voice very clearly.			**1**	**1**	
45. I can see the hands/lips of the voice but they are unclear.		**5**	**1**		4

TABLE 3 (*Continued*)

Statement	*Factor A*	*Factor B*	*Factor C*	*Factor D*	*Factor E*
46. The image of the voice is black and white.					**5**
47. The image of the voice is in colour.					**1**
48. When I have voices I smell a strange smell	**1**	**1**	**1**		
49. Sometimes I smell things that other people can't smell.	**1**	**1**		**1**	
50. When I have voices I can taste a strange taste.	**1**	**1**	**1**	**1**	**1**
51. Sometimes I can taste things that other people can't taste.	**1**			**1**	
52. Sometimes I feel sensations in my body that other people do not feel.		**5**		**1**	
53. When the voice starts I get strange sensations in my body.		**5**	**1**		
54. When the voice starts I feel air currents.	**1**		**1**	**1**	
55. When the voice starts I feel vibrations.	**1**		**1**	**1**	
56. When the voices start I feel electric currents.	**1**		**1**		
57. I just "know" what the voices are saying.	**5**				**5**
58. I can't hear the voice but I still know what it is saying.	**5**		**1**		
59. I understand the voice through telepathy.			**1**		**5**
60. Voice comes from inside my head.					
61. Voice comes from outside my head.			3		**5**
62. Voice comes from outside my head but close to my ears.		**1**			
63. Voice is in front of me.		**1**	**1**	**1**	
64. Voice is above me.			**1**		
65. Voice is below me.		**1**	**1**	**1**	
66. Voice is behind me.		**1**			
67. Voice comes from somewhere in the room.			3		
68. Voice comes from far away.		**1**	3	**1**	
69. Voice comes from nearby.					
70. Voice comes through my eyes.			**1**	**1**	
71. Voice comes through my ears.	**1**				
72. Voice comes through my nose.	**1**	**1**	**1**	**1**	
73. Voice comes through my skin.	**1**		**1**	**1**	

TABLE 3 (*Continued*)

Statement	*Factor A*	*Factor B*	*Factor C*	*Factor D*	*Factor E*
74. Voice comes through my stomach.	**1**		**1**	**1**	**1**
75. Voice comes from inside my body.			**1**		**1**
76. I can look towards where the voice is coming from.		**1**	**1**	**1**	
77. I know whether the voice is a man or a woman.	**5**	**5**	**1**		**5**
78. I know whether the voice is a man or a woman by the way the voice sounds.	**1**		**1**		
79. Voice is deaf.					**1**
80. Voice is hearing.			3	**5**	**5**
81. Voice uses speech.	**5**			**5**	**5**
82. I understand the voice through lipreading.	**5**		**1**		
83. Voice uses sign language.					
84. Voice uses fingerspelling.			**1**	**1**	
85. Voice uses writing.		**1**	**1**		
86. Voice uses gesture.				**1**	
87. The voice feels as real as my own speech or signing.			**1**		**5**
88. Voice feels as real as seeing or hearing.			**1**		**1**
89. Voice feels similar to my own thoughts.			3	**1**	**5**
90. Voice feels similar to a dream or imagination.			3		**5**
91. Voice is hard to understand.		4			
92. Voice is easy to understand.	**5**	4	**1**	4	4
93. Voice is very clear.	**5**		**1**		
94. Voice is unclear.		4	**5**		

1 = never, 2 = rarely, 3 = don't know/not sure, 4 = sometimes, 5 = always.

Bold = factor exemplar "never" and "always".

[i] "VOICE-OFF" indicates that vocalisation is not used during communication. The mouth-patterns that occur during speech or that accompany BSL signs are mouthed silently.

[ii] "VOICE-ON" indicates that vocalisation is used during speech or signed communication.

[iii] This item relates to nonvoice auditory phenomena, e.g., tinnitus or primary auditory hallucinations.

conducted during the sort procedure and recourse to relevant literature. Each of the five factors is described below, together with illustrative examples from individual participants. For clarity and brevity, not all items are discussed in the factor description. Reference is made in brackets to the statements that characterise each factor (e.g., S16, S31). These statements are listed by number on Table 3. Participants are also referred to by number in the text (e.g., P1).

Factor A: Nonauditory voices with subvisual perception of voice-articulators in the mind's eye

Participants who loaded on Factor A (P23, P4, P6, P8, P18, P14, P19) are all profoundly deaf, with the exception of one individual who has severe sensorineural deafness with central auditory processing deficit overlay, which means that he functions as profoundly deaf since he is completely unable to interpret sounds provided by residual hearing. Their deafness was present at birth or had prelingual onset before the age of 2 years, with only one exception: this participant was totally deafened at aged 6 years and subjectively reports no auditory memory of sound.

Voices were reported to be nonauditory (S5–10), clear (S93), and easy to understand (S92). Participants were certain that they did not hear any sound when voices were present. They did not consider questions about pitch, volume, and loudness relevant to their experiences (S12, S16, S18–26). Participants knew the identity and gender of the voice but did not deduce this information from the way it sounds (S77, S78). They reported seeing an image of the voice communicating with them in their mind's eye when voice-hallucinations were present (S35, S38). All participants had experienced seeing an image of the voice signing or lips moving in their mind (S31, S37). Imagery of fingerspelling was also seen but was less common (S38). These images appeared to be subvisual in nature and distinct from true visual hallucinations (S30, S32, S33). They were clearly understood as originating internally and several participants stated that the image could still be perceived with their eyes closed. Only one participant (P14) reported more convincing visual hallucinations occurring in conjunction with the presence of voice-hallucinations. He described seeing lips adorned with God's moustache without any eyes or nose, hanging in free space whilst articulating speech movements. The vision only appeared when the voice was speaking and he described the image staying still as his eyes moved and being able to look back and forth at it. This description was similar to qualitative information given about subvisual imagery, in that usually only the language articulators, namely the hands and/or lips, were seen rather than a whole figure, although there was variation in how clearly the

articulators were perceived (S44, S45). The image was experienced as moving whilst communicating and only more rarely as a static image (S39, S40). The image was generally faint and unclear (S42) and never perceived to be solid. Participants stated that it was transparent, or they were uncertain about this (S41, S43) and that it did not interfere with normal vision. There was less consensus about whether the image of the voice appeared in black and white or colour. Many participants struggled to answer these questions (S46, S47) finding it hard to give qualitative descriptions of the imagery. Participant 6 provided the clearest account:

> All my voices sign to me, deaf school kids and the pope, even though he is hearing. I am not sure how I can communicate but voice is projected into my brain, it moves in my thoughts ... hands and lips move and glow in my mind. It's blurry but I understand it like daydreaming or watching a film ... like a ghost with a camera in my head. (translated from BSL)

Interestingly, whilst participants reported that they could see subvisual imagery, they did not perceive the voice as being located in front of them (S64). The factor was unclearly defined with respect to voice location (S63–69). The voice was more widely believed to originate inside the head than outside (S60, S61). The voice was never perceived through the ears (S71) but responses were more mixed with regards to vision as a channel of perception (S70). There was a sense that they "just knew" what the voices were saying and that they might be understood via a sense of telepathy (S57, S58), which qualitatively conveys that the voices are not physically sensual, in terms of being perceived as seen or heard.

Factor B: Mixed perception and uncertainty about how voices are perceived

Participants who loaded on Factor B (P10, P13) had experience of hearing speech and used hearing aids. Participant 10 was born partially deaf with mild-moderate hearing loss and communicated using spoken English and lipreading. Participant 13 was born hearing but after 8 years of age experienced progressive deafness becoming profoundly deaf in adulthood.

This factor was characterised by confusion and contradiction in description. The participants were uncertain about whether their voice-hallucinations were auditory in nature (S2, S5, S7). Comprehensibility and clarity are variable (S91–94). The voice used speech/lip movements to convey its' message (S81, S82) and occasionally fingerspelling and gesture (S84, S87). The voice was perceived as sometimes being silently articulated and sometimes having sound (S5–12). Participants were uncertain if the voice was mouthing with or without vocalisation (S8, S9). Despite this

uncertainty, Participant 10 was able to make attributions about voice pitch, volume, and loudness (S18–26). No primary visual hallucinations were reported, although Participant 10 described seeing a stationary image of her deceased husband when the voice was present (S30). There was less certainty about whether a visual image was present when the hallucinations occurred but participants agreed that the hands/lips of the voice could be perceived but that they were unclear (S45). Strange sensations were perceived in the body both when the voice was present and not present. These included the perception of air currents, electric currents, and vibrations (S52–56). Participant 10 described her experiences in spoken English:

> I hear him shouting through my stomach. I see black shadowy lips in my mind, but I don't lipread them really. It feels like it is in my mind but I use my sense of hearing. I'm not sure if I hear it or not. It's like I just know.

Factor C: Poorly defined voices

Participants who loaded on Factor C (P9, P20) were born deaf in developing countries and spent their early years without hearing aids or formal language, only acquiring BSL as their first language after moving to the UK after the critical period for language development (Mayberry, 1993).

The voices were poorly defined, hard to understand and unclear (S91, S94), with no definitive statements about exact voice properties but rather a picture of what they were not. There were contradictory responses about whether the voices made sound or not (S5–9). It was not clear whether participants were completely unable to make judgements about pitch and volume (S19–26) because the voices were not auditory in nature, or because they did not possess a sufficiently developed concept of sound-based descriptions. There was a great deal of uncertainty about voice genesis that may have led the participants to speculate that they might be "hearing" something when they were present (S5, S6). This factor is unique because participants did not perceive imagery of the voice articulators during hallucinations (S35–45). The gender and identity of the voice were unknown (S77–80) and there was much more uncertainty about which language or modality the voice used to communicate (S81–86). Participants were unable to articulate voice content but merely described a sense of being persecuted and criticised by an external other. Language deprivation may confound interpretation here, as voice description may not clearly distinguishable from delusional persecutory ideation, and impoverished language ability impedes confirmation that voice-hallucinations are actually present and phenomenologically equivalent. However, although these participants were late-learners, their command of BSL was sufficient to enable convincing dialogue

about the presence of voice-hallucinations, but they were vague about how they perceived them.

Factor D: Auditory voices

Participants who loaded on Factor D (P7, P11) were born moderately or moderately severely deaf and used hearing aids. Participant 11 was a native signer from a deaf family and bilingual in BSL and English. Participant 7 grew up using oral communication and had never learnt to sign.

Voices were auditory and participants report that they could always hear sounds when the voices were present (S4–7). Participant 11 was able to make judgements about auditory properties including pitch and volume (S18–28). Participant 7 was less able to provide qualitative description of acoustic aspects but she was convinced that she could *hear* the voices (S4–9).

> I was just so mad I would hear Peggy Mitchell [from *Eastenders*] talking to me. I don't know how, I was just mad. I didn't lipread her. It was quite clear. I could hear her voice like on the TV. I heard my sister talking to me at night when I was in bed. I definitely heard something, so I put my hearing aids in to check but there was nothing there. It was like it was coming from a transmitter like a radio. It's funny because if someone covers their lips I can't understand them but I can understand the voices. (spoken English)

Interestingly, the bilingual participant (P11) showed a mixed pattern of voice perception. She experienced predominantly auditory hallucinations but also reported silently articulated sign language hallucinations, with concurrent subvisual imagery of the articulators similar to those experienced by participants on Factor A (S35–39):

> Most of the time the devil speaks and I hear him but sometimes he signs to me and I see him looking at me and signing in my mind. (translated from BSL)

Factor E: Voices and true visual, olfactory, gustatory, and tactile phenomena

Participants who loaded on Factor E (P5, P25) were both profoundly deaf. Participant 5 was postlingually deafened at the age of 12. This factor was distinguished by the presence of true visual, auditory, olfactory, and gustatory phenomena, which occurred separately to voice-hallucinations. These included tinnitus (S29), the perception of a black shadow darting through peripheral vision (S34), strange smells emanating from the body (S49), and a petrol taste in the mouth (S51). Other phenomena occurred in conjunction with the voices such as vibrations and electric currents in the

body, which occurred only when the voice was present (P25: S55–56). Participant 25 reported seeing a true visual hallucination of someone signing to her in real space as well as imagery of the voice in her mind's eye (S30, S32–33, S35, S37–38).

DISCUSSION

The results support the notion that the perceptual characteristics of voice-hallucinations map closely onto an individual's real life communication preferences and experience of language and sound. Individuals born profoundly deaf converged on nonauditory Factor A. Of the 17 participants included in the factor definitions, there were no examples of congenitally profoundly deaf individuals responding affirmatively to statements about being able to "hear" auditory voices. By contrast, participants who had experience of hearing speech, either due to acquired deafness or the use of residual hearing converged on Factors B and D. These individuals either felt convinced by the auditory nature of their hallucinations or were uncertain whether they were really hearing sound when the voices were present. The only two individuals able to make extensive attributions about auditory properties (P10, P11) were partially deaf and able to communicate fluently in spoken English. Individuals with late and incomplete language acquisition did not show clear auditory characteristics or perception of subvisual imagery of voice articulation, suggesting the possibility that voice content may not be organised into clear linguistic constructs in individuals who have impoverished language.

The importance of a deconstructionist approach

The deconstruction of deaf conceptions relating to perceptual phenomena was vital in allowing a new less paradoxical understanding of voice-hallucinations in deaf people to emerge. The current findings do not contradict previous reports of auditory phenomena in profoundly deaf people with schizophrenia (e.g., du Feu & McKenna, 1999) but provide clarification of the reasons that these might occur. Deaf people are a highly heterogeneous group and this study demonstrates that by using a methodology that exploits variability, the perceptual characteristics of their voice-hallucinations are shown to reflect this diversity. The observation that auditory phenomena only occur where there is some experience of hearing sound, reduces the counterintuitiveness of the notion of deaf people "hearing" voices. When deaf individuals respond "yes" to the question, "Do you hear voices?" the exact nature of their experiences cannot be assumed. Some may literally mean that they have auditory experiences and

these should not be dismissed, nor considered surprising since few deaf people have no conception of sound at all. Others will perceive the communicative intent of the voices via a sense of being signed or fingerspelt to, of lipreading speech that they cannot hear, or a sense of knowing what is said without a clear perceptual agent.

Subvocal thought hypothesis

The finding that voice characteristics closely match experience with language in a highly heterogeneous population provides support for the subvocal thought hypothesis (Frith & Done, 1988). If voice-hallucinations are really misidentified internal thoughts they will manifest in ways that are unique to the individual. Hearing people are relatively uniform in terms of early acquisition of a spoken language and primarily speech-based subvocal thought processes develop in tandem (see Bates et al., 2002). Rare insight is provided by the study of deaf people, who rely on the visual channel for both speech and sign language perception. Variability in language development and auditory deprivation will influence the mechanisms for forming thoughts, and subsequently the occurrence of more diverse voice phenomena than seen in hearing people.

The subvocal thought hypothesis attributes the perception of "voices" to a breakdown in self-monitoring, which results in an individual failing to recognise their own subvocal thoughts and perceiving them as having an external locus of control (Frith & Done, 1988). Persuasive evidence exists from studies of working memory (Baddeley, Lewis, & Vallar, 1984) and neuroimaging of auditory-verbal imagery (e.g., McGuire et al., 1996) showing that inner speech and language-based thoughts consist of subvocal motor (rather than purely auditory) representations, which are coded in terms of the articulatory gestures that would be required to produce overt speech (Liberman & Whalen, 2000). This involves premotor articulation programmes that usually precede conscious awareness, although during intense concentration or subvocal reading a person may sense internal voicing of their inner thoughts. Neuroimaging studies of subvocal speech show consistent activation of the areas of the brain used for premotor planning and language processing (the left supplementary motor area, dorsolateral prefrontal cortex and the language association cortices of the temporal lobes) (Shergill et al., 2000). Identical regions are activated in participants actively experiencing auditory-verbal hallucinations (Stephane et al., 2000).

It is possible to harness a subvocal thought model to voice phenomena in deaf signers. McGuire et al. (1997) found that internal generation of sign language sentences by healthy deaf participants excited the same neural regions that were activated in subvocal speech by hearing individuals.

Subvocal articulation does not appear to be modality specific and might equally be engaged by speech or sign. There is evidence that sign language closely mirrors speech in terms of its organisation in working memory using an articulatory, rather than a visual code (Wilson, 2001). It differs from speech in that perception involves the direct analysis of the movements made by the language articulators, namely the hands and/or lips. Signs produced by others are perceived as the mirror image of what a signer might produce themselves. Emmorey, Klima, and Hickok (1998) suggest that signers perceive signs in terms of the articulations needed to execute the sign themselves, in a form of analysis by synthesis that echoes the articulatory theories of speech perception (Liberman & Whalen, 2000), albeit in a less covert manner. It is therefore conceivable that faulty source-monitoring in premotor, subvocal circuitry could cause voice-hallucinations in signers that mirror those in speakers. Furthermore a subvocal articulation model can account for the occurrence of sign-based, speech-based, and even gesture hallucinations in deaf people.

Towards an articulatory model of voice-hallucinations in deaf people

There is no need to invoke a separate causal model to explain voice phenomena in deaf individuals; however, there are crucial differences in how hallucinations are experienced.

Deaf people are more likely to report visual or somatic analogues, with 50% of deaf clinical samples reporting visual or somatic hallucinations, compared to only 15% and 5%, respectively, in hearing people with schizophrenia (Cutting, 1985). This study supports du Feu and Mckenna's (1998) observation that these hallucinations often cooccur with voices, indicating the possibility of a direct relationship between these phenomena. This is the first study to provide convincing evidence that many deaf individuals who reported visual phenomena were experiencing a subvisual percept of the voice rather than a true primary visual hallucination. Whilst descriptions of the imagery varied in terms of identity and exact form, it was frequently described as being like a black/grey shadowy figure or face, with hands and/or lips that moved as it communicated and only appeared when the voice was present. These observations fit with the notion that individuals might perceive a vague percept of the articulatory movements of the voice. Percepts could involve lip movements or manually articulated signs, which might be similar to the subvocal imagery generated by a signer asked to imagine a story told in BSL by someone they know.

It is likely that deaf people's thought processes, like those of hearing people, are based primarily on an articulatory code which remains largely

preconscious and closed to introspection. It is possible that thoughts encoded in terms of premotor articulations enter explicit awareness during voice-hallucinations, leading to the perception of articulatory percepts, which are interpreted as alien to the self. These "voices" usually take an auditory-verbal form in hearing individuals because the brain associates speech articulations with audible speech (McDonald & McGurk, 1978). Thus, when hearing people describe "hearing a voice", they may actually be perceiving an auditory trace ancillary to motor subvocalisations, similar to the perceptual feedback loop thought to be component to inner speech (Stephane, Barton, & Boutros, 2001). For deaf people, articulations are associated with the kinaesthetic movements that they would themselves make to produce a sign or speech gesture (Emmorey et al., 1998), or the direct visual perception of articulator productions in their conversational partners. There is no research into how perceptual feedback loops may work in signers, but it is conceivable that, if speakers generate audiological percepts based on expected feedback, the same process may result in reports of visual or kinaesthetic percepts by deaf voice-experiencers. This may, at least partially, account for increased clinical reports of visual and somatic features among deaf people and allow us to reconcile these phenomena with a subvocal articulation model of voice-hallucinations. The exception might be when language acquisition has occurred after the critical period (Newport, 1990) and thoughts may not be organised according to clear linguistic constructs based on an articulatory code. The observation that deaf people with early language deprivation do not show subvisual imagery or clearly organised, language-based hallucinations supports this proposition.

Implications for wider research

This study raises important questions for wider study of voice-hallucinations. It is apparent that diverse phenomena are encompassed within the concept of "hearing voices" in a deaf sample, raising the question of whether the term might also be ambiguous when applied to hearing people. Existing research suggests that voice-hallucinations commonly have a relatively clear-cut speech-based auditory quality (David, 1999) and are perceived as similar to external speech, with variations in loudness, pitch, and linguistic complexity, which closely mirror experience with listening to real speech. Although voice-hearers talk about "hearing" a voice, using language that conveys auditory qualities, descriptions are vague and difficult to elicit (David, 1996). It is not clear whether they experience true auditory perception or merely a "sense" of speech. Since it is known that both auditory verbal hallucinations (Shergill et al., 2000) and watching silently articulated speech (MacSweeney et al., 2002) activate the secondary but not the primary auditory association cortex

in hearing individuals, further research may lead to a notion of a more degraded, vague auditory percept than is currently assumed. Furthermore, it is imperative that questions are posed that go beyond the auditory-verbal realm. No systematic studies have been conducted to establish whether hearing people ever perceive subvisual imagery of the voice articulating speech, or vibrotactile means of transmission similar to phenomena reported in this paper. However, Hoffman and Varanko's (2006) review of three cases of fused visual/auditory verbal hallucinations in hearing speakers suggests that this phenomena is not restricted to deaf signers. Such investigations would advance and refine theory.

CONCLUSION

This is the first study to systematically explore perceptual characteristics of voice-hallucinations in a heterogeneous sample of deaf people. Sampling of phenomena was sufficiently broad to allow diverse descriptions to emerge; however, it is not possible to be certain that the range of perceptual experiences sampled was exhaustive. The findings are explorative, and while they suggest a clear relationship between auditory and language experience and how voice-hallucinations are perceived, a weakness is the lack of precise audiometry and indices of language fluency. Such measures would enable correlational relationships to emerge. Aetiological and organic variables which may influence phenomenological heterogeneity should also be explored in future studies. A strength of this study was that the nature of visual hallucinations in this group was further elucidated and a distinction was made between subvisual voice imagery and true visual hallucinations. It was suggested that deaf individuals who report seeing an image of the voice might be experiencing a visual percept of voice articulations. All data can be accounted for in terms of subvocal articulatory models, which can equally explain voice-hallucinations in hearing and deaf people. The inclusiveness of such models raises the possibility that hearing people may experience a wider range of voice phenomena than is currently assumed. This study should prompt wider theoretical debate about perceptual characteristics of auditory-verbal hallucinations generally.

Manuscript received 27 October 2005
Revised manuscript received 22 January 2007

REFERENCES

Atkinson, J. R. (2006). The perceptual characteristics of voice-hallucinations in deaf people: A review. *Schizophrenia Bulletin*, *32*, 701–708.

Baddeley, A. D., Lewis, V., & Vallar, G. (1984). Exploring the articulatory loop. *Quarterly Journal of Experimental Psychology*, *36*, 233–252.

Bates, E., Thal, D., & Finlay, B. (2002). Early language development and its neural correlates. In S. J. Segalowitz & I. Rapin (Eds.), *Child neurology* (pp. 69–110). Amsterdam: Elsevier Science.

Brown, S. R. (1980). *Political subjectivity: Applications of Q methodology in political science*. New Haven, CT: Yale University Press.

Critchley, E., Denmark, J., Warren, F., & Wilson, K. (1981). Hallucinatory experiences of prelingually profoundly deaf schizophrenics. *British Journal of Psychiatry*, *138*, 30–32.

Cuthill, F. M., Espie, C. A., & Cooper, S. (2003). Development and psychometric properties of the Glasgow depression scale for people with a learning disability. *British Journal of Psychiatry*, *182*, 347–353.

Cutting, J. (1985). *The psychology of schizophrenia*. London: Churchill Livingstone.

David, A. S. (1999). Auditory hallucinations: phenomenology, neuropsychology and neuroimaging update. *Acta Psychiatrica Scandinavica*, *99*(395), 95–104.

David, A. S., Woodruff, P. W. R., Howard, R., Mellers, J. D., Brammer, M., & Bullmore, E. (1996). Auditory hallucinations inhibit exogenous activation of auditory association cortex. *Neuroreport*, *7*, 932–936.

Du Feu, M., & McKenna, P. (1999). Prelingually profoundly deaf schizophrenic patients who hear voices: A phenomenological analysis. *Acta Psychiatrica Scandinavia*, *99*, 453–459.

Emmorey, K., Klima, E. S., & Hickok, G. (1998). Mental rotation within linguistic and non-linguistic domains in users of American sign language. *Cognition*, *68*, 221–246.

Evans, J. W., & Elliott, H. (1981). Screening criteria for the diagnosis of schizophrenia in deaf patients. *Archives of General Psychiatry*, *36*, 787–790.

Frith, C. D., & Done, D. J. (1988). Towards a neuropsychology of schizophrenia. *British Journal of Psychiatry*, *153*, 437–443.

Hoffman, R. E., & Varanko, M. (2006). "Seeing voices": Fused visual/auditory verbal hallucinations reported by three persons with schizophrenia-spectrum disorder. *Acta Psychiatrica Scandinavica*, *114*, 290–293.

Liberman, A. M., & Whalen, D. H. (2000). On the relation of speech to language. *Trends in Cognitive Science*, *4*, 187–196.

MacSweeney, M., Calvert, G. A., Campbell, R., McGuire, P. K., David, A. S., & Williams, C. R. (2002). Speechreading circuits in people born deaf. *Neuropsychologia*, *40*, 801–807.

Mayberry, R. (1993). First language acquisition after childhood differs from second language acquisition: The case of American Sign Language. *Journal of Speech and Hearing Research*, *36*, 1258–1270.

McDonald, J., & McGurk, H. (1978). Visual influences on speech perception processes. *Perception and Psychophysics*, *91*, 169–190.

McGuire, P. K., Silbersweig, D. A., Murray, R. M., David, A. S., Frackowiak, R. S. J., & Frith, C. D. (1996). The functional anatomy of inner speech and auditory imagery. *Psychological Medicine*, *26*, 29–38.

McGuire, P. K., Robertson, D., Thacker, A., David, A. S., Kitson, N., & Frackowiak, R. S. J. (1997). Neural correlates of thinking in sign language. *Neuroreport*, *8*, 695–698.

Newport, E. L. (1990). Maturational constraints on language learning. *Cognitive Science*, *14*, 11–28.

Shergill, S. S., Brammer, M. J., Williams, S. C., Murray, R. M., & McGuire, P. K. (2000). Mapping auditory hallucinations in schizophrenia using functional magnetic resonance imaging. *Archives of General Psychiatry*, *57*, 1033–1038.

Stainton-Rogers, R. (1995). Q-methodology. In J. A. Smith, R. Harre, & L. van Langenhove (Eds.), *Rethinking methods in psychology* (pp. 178–195). London: Sage.

Stephane, M., Barton, S. N., & Boutros, N. N. (2001). Auditory verbal hallucinations and dysfunction of the neural substrates of speech. *Schizophrenia Research*, *50*, 63–80.

Stephane, M., Folstein, M., Matthew, E., & Hill, T. C. (2000). Imaging auditory verbal hallucinations during their occurrence. *Journal of Neuropsychiatry and Clinical Neuroscience*, *12*, 286–287.

Stephenson, W. (1978). Concourse theory of communication. *Communication*, *3*, 21–40.

Wilson, M. (2001). The case for sensorimotor coding in working memory. *Psychonomic Bulletin and Review*, *8*, 44–57.