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NEUROSCIENTIFIC, PSYCHOLOGICAL AND CLINICAL-PHILOSOPHICAL APPROACHES TO VOICE-HEARING: A CRITICAL SYSTEMATIC REVIEW

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A todos os ouvintes de vozes

e particularmente à minha avó.

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Abstract

Tackling the complexity of auditory verbal hallucinations (AVHs) or voice-hearing phenomena in schizophrenia requires an interdisciplinary approach for their better understanding, and ultimately for their treatment. One initial, but far reaching obstacle on the way to an appropriate understanding of voice-hearing is that there is no consensus on how such phenomena are best conceptualised. Given the various dimensions in which voice-hearing experiences can be described (e.g., audibility, personification, relationality) it is not obvious which of them constitute core features of voice-hearing. In the present thesis, it is proposed that the experience of a communication moment is a promising candidate for such a core feature. Moreover, studies from the areas of neuroscience, psychology, as well as clinical philosophy are systematically reviewed in order to examine how voice-hearing is conceptualised and studied in these disciplines. Methodological, as well as conceptual shortcomings of these approaches are critically discussed. Whereas neuroscientific accounts of voice-hearing have focused on self-monitoring accounts, clinical-philosophical accounts of voice-hearing in schizophrenia have focused on general alterations of experience as basis for the occurrence of voice-hearing. Psychological approaches to voice-hearing stress its relational nature. Such accounts have largely been developed separately and their compatibility is not obvious, also because of differing metaphysical assumptions of different disciplines. It is proposed that a phenomenological-ecological standpoint may be valuable for the contextualisation of results regarding voice-hearing from different disciplines, avoiding the pitfalls of reductionist conceptions of voice-hearing. Practical implications for an interdisciplinary research of AVHs are also derived.

Keywords: Voice-hearing, Auditory Verbal Hallucinations, Conceptualisation, Neuroscience, Psychology, Clinical Philosophy

Resumo

A complexidade dos fenómenos de "alucinações auditivas verbais" (AAV) ou "ouvir vozes" na esquizofrenia requer uma abordagem interdisciplinar para a sua melhor compreensão e, ultimamente, tratamento. Um obstáculo inicial, mas de grande relevância, no caminho para uma compreensão adequada de "ouvir vozes" é não haver consenso sobre como tais fenómenos são melhor conceptualizados. Dadas as várias dimensões em que as experiências de ouvir vozes possam ser descritas (p.ex., audibilidade, personificação, relação), não é óbvio quais sejam as principais características de "ouvir vozes". Na presente tese, é proposto que uma experiência de um momento comunicativo seja candidata promissora a para tal característica principal. Além disso, estudos das áreas de neurociência, psicologia, bem como da filosofia clínica são sistematicamente revistos para examinar como "ouvir vozes" é conceptualizado e estudado nessas disciplinas. As deficiências metodológicas, bem como conceptuais destas abordagens são discutidas criticamente. Considerando que as abordagens neurocientíficas de ouvir vozes se concentraram em auto-monitorização, as abordagens clínico-filosóficas de ouvir vozes na esquizofrenia têm como foco as alterações gerais de experiência como base para a ocorrência de ouvir vozes. As abordagens psicológicas salientam que experiências de ouvir vozes são de natureza relacional. Tais abordagens foram amplamente desenvolvidas separadamente e a sua compatibilidade não é óbvia – devido também a diferentes hipóteses metafísicas de diferentes disciplinas. Propõe-se que um ponto de vista fenomenológico-ecológico possa ser valioso para a contextualização dos resultados em relação a ouvir vozes de diferentes disciplinas, evitando as armadilhas das concepções reducionistas de "ouvir vozes". Implicações práticas para uma investigação interdisciplinar de AAVs também são deduzidas.

Palavras-chave: ouvir vozes, alucinações auditivas verbais, conceptualização, neurociência, psicologia, filosofia clínica

Resumo alargado em português

A prevalência da esquizofrenia ao longo da vida é estimada em cerca de 0,5% (Simeone, Ward, Rotella, Collins e Windisch, 2015) da população geral, com uma prevalência estimada de 64% a 80% de alucinações auditivas em indivíduos com esquizofrenia diagnosticada (McCarthy-Jones et al., 2017). Seguindo os sistemas de classificação mais influentes de diagnóstico de transtornos mentais, o ICD (International Classification for Diseases) (Organização Mundial da Saúde, 1992) e o DSM (Diagnostic and Statistical Manual of Mental Disorders) (American Psychiatric Association, 2013), a presença de certos tipos de AAVs, além de um outro sintoma, são suficientes para um diagnóstico de esquizofrenia. No entanto, não é claro em que medida os métodos de tratamento convencionais, como a medicação antipsicótica, são bem sucedidos no tratamento de AAVs (McCarthy-Jones, 2012). Estima-se que cerca de um quarto das AAVs sejam resistentes a medicamentos (Shergill, Murray e McGuire, 1998). Criticamente, a esquizofrenia constitui um tremendo fardo económico com custos anuais associados, que totalizam milhões e até billiões de dólares em diversos países (Chong et al., 2016).

Resulta a necessidade de perceber melhor os fenómenos de "ouvir vozes" para, ultimamente, fornecer um tratamento adequado às pessoas que sofrem com experiências negativas de "ouvir vozes". Consideramos nesta tese que a complexidade destes fenómenos requer uma abordagem interdisciplinar para a sua melhor compreensão. Um obstáculo inicial, mas de grande relevância, no caminho para uma compreensão adequada de "ouvir vozes" é não haver consenso sobre como tais fenómenos são melhor conceptualizados.

Na presente tese, foram sistematicamente revistas publicações sobre AAV ou "ouvir vozes" de diferentes àreas da Ciência Cognitiva (i.e., neurociência, psicologia e filosofia clínica) com o objetivo de identificar quais conceitos são usados em diferentes abordagens para conceptualizar tais fenómenos. No total, sessenta e dois estudos foram incluídos para a revisão sistemática.

Em contraste com revisões anteriores, tais abordagens foram também examinadas relativamente a suposições metafísicas implícitas e explícitas para considerar essas abordagens num contexto mais amplo da Ciência Cognitiva.

Experiências de "ouvir vozes" são melhor conceptualizadas como um grupo de fenómenos. Não é claro se existe alguma característica essencial comum, que se aplique a

todos os fenómenos designados como “alucinação auditiva verbal” ou “experiência de ouvir voz” no contexto clínico. Propusemos que alguma experiência comunicativa possa ser candidata a ser essa característica.

As existentes concepções neurocientíficas de AAVs ignoram largamente os principais aspectos experienciais de AAVs, bem como a grande heterogeneidade desses fenómenos. Em vez disso, encontramos um ênfase em características que parecem ser relevantes apenas para um subgrupo de tais fenómenos, como a audibilidade.

As concepções psicológicas revistas focam-se nas relações dos ouvintes de vozes, com as suas vozes, bem como no seu papel como reacção a eventos de vida stressantes. Existe evidência de que há paralelos entre relações sociais de ouvintes de vozes com as suas vozes e com pessoas próximas na vida social deles (Birchwood et al., 2004; Birchwood, Meaden, Trower, Gilbert, & Plaistow, 2000; Hayward, 2003).

Concepções clínico-filosóficas, por outro lado, propõem que AAVs na esquizofrenia surjam no contexto duma alteração da estrutura da experiência. Uma corrente de abordagens recentes propõe que AAVs podem ser conceptualizadas no contexto da esquizofrenia como perturbação do “Si básico” que assume que na esquizofrenia a experiência pré-reflectiva encontra-se alterada (e.g., Fuchs, 2005a, 2012b; Sass & Parnas, 2003; Stanghellini & Cutting, 2003).

Na literatura neurocientífica e psicológica cognitiva, as AAVs são largamente conceptualizados (implicitamente) seguindo a posição filosófica do “dualismo interacionista”. Ou seja, assume-se que processos neuronais possam causar eficientemente fenómenos mentais, como pensamentos e crenças e vice-versa. As abordagens clínico-fenomenológicas de AAVs, por outro lado, dependem em parte de conceitos que foram criticados por serem vagos (Mishara, 2010).

Em resumo, uma série de conceitos diferentes, em grande parte não sobrepostos, tem sido usado para conceptualizar AAVs nas disciplinas da Ciência Cognitiva consideradas na presente tese. Esses conceitos variam de processos neuronais supostos (p.ex., descarga corolária) sobre construções psicológicas (p.ex., crença) para conceitos fenomenológicos (p.ex., ipseidade). Embora alguns temas comuns dessas abordagens possam ser identificados (p.ex., temporalidade, compensação, memória), estes temas são abordados de forma bastante diferente, por exemplo, no caso da neurociência e da filosofia fenomenológica clínica. Portanto, nenhum paralelo imediato pode ser estabelecido entre essas disciplinas em termos

de homologia estrutural. No entanto, os conceitos de dualidade de aspecto e causalidade circular, como proposto por Fuchs (p.ex., 2013a), foram propostos como um primeiro passo para uma integração de resultados em AAVs de diferentes níveis epistémicos. Esses conceitos permitem integrar resultados de vários níveis epistémicos sem assumir uma posição reducionista.

Pensamos que a consideração de tais quadros constitui uma base necessária para uma integração interdisciplinar frutuosa da investigação de AAVs. Tais considerações são valiosas também para refletir os pressupostos básicos implícitos de diferentes disciplinas em relação à existência humana e à experiência que possivelmente evitam uma conceptualização adequada de AAVs. Uma conceptualização adequada das AAVs, no entanto, é indispensável tanto para a investigação de tais fenómenos como, em última instância, será benéfica para quem sofra com tais experiências.

Em relação aos resultados empíricos revistos, os desenhos dos estudos não permitem conclusões finais. A diversidade metodológica dificulta a comparação de estudos diferentes, mesmo quando o mesmo método de neuroimagem foi aplicado.

No caminho para uma compreensão mais clara sobre AAVs, é crucial ouvir o que os ouvintes de vozes têm a dizer sobre suas experiências. Essas experiências variam substancialmente em várias dimensões, como, por exemplo, na complexidade linguística, conteúdo, ou sensações corporais que podem acompanhar as experiências de vozes ou o papel que uma voz tem na vida duma pessoa específica. Importantemente, a audilibidade nem sempre é uma característica essencial das experiências de vozes, havendo pessoas que, por exemplo, experienciam vozes silenciosas.

Esperamos que o presente trabalho contribua para a discussão interdisciplinar dos limites metodológicos e conceptuais das abordagens existentes para “ouvir vozes” e forneça uma contribuição sobre a integração de diferentes perspectivas, tendo em conta tais limites. Esse passo, propomos, é essencial para uma (re-)conceptualização interdisciplinar destes fenómenos intrigantes.

Contents

List of tables

List of figures

List of abbreviations

AVH	auditory verbal hallucination
VH	voice-hearing
fMRI	functional magnetic resonance imaging
MRI	magnetic resonance imaging
DTI	diffusion tensor imaging
PET	positron emission tomography
MEG	magnetoencephalography
EEG	electroencephalogram
ERP	event-related potential
ERO	event-related oscillation
ICD	international classification of diseases
DSM	diagnostic and statistical manual of mental disorders
SAPS	scale for the assessment of positive symptoms
PANSS	positive and negative symptoms and syndromes rating scale
PSYRATS	psychotic symptom rating scale
STG	superior temporal gyrus
IFG	inferior frontal gyrus
BOLD	blood-oxygen-level dependent

1 Introduction

> It's hard to describe how I could 'hear' a voice that wasn't auditory; but the words the voices used and the emotions they contained (hatred and disgust) were completely clear, distinct, and unmistakable, maybe even more so than if I had heard them aurally. (Woods, Jones, Alderson-Day, Callard, & Fernyhough, 2015, p. 326)

This is how a participant in a recent online survey describes her experience that in the clinical context most likely would be labelled as "auditory verbal hallucination" (AVH). AVHs have been subject of research for centuries (Chaudhury, 2010) and the fascination for such intriguing phenomena has not been lost. Hundreds of papers including the term "auditory verbal hallucination" have been published in the last decade, according to the search engine PubMed. Despite this long-standing interest, AVHs remain poorly understood (e.g., Horga, Peterson, et al., 2014) and there is no consensus regarding how those phenomena are best defined or conceptualised (David, 2004; Larøi & Woodward, 2007).

According to a very prominent view of AVHs, one of its widely accepted defining characteristics is being a sensory experience lacking a corresponding external stimulus (e.g., Woods et al., 2014). A more detailed definition of hallucination was proposed by David (2004) who considers a hallucination "a sensory experience which occurs in the absence of corresponding external stimulation of the relevant sensory organ, has a sufficient sense of reality to resemble a veridical perception, over which the subject does not feel s/he has direct and voluntary control, and which occurs in the awake state" (p.110). However, the aforementioned quote challenges such definitions in posing questions such as: How can someone "hear" a voice that is not heard aurally? What does a person who, from a clinician's perspective, fulfils the criteria for the presence of AVH actually experience? Are these experiences comparable to veridical perceptions? Are they sensory experiences?

The term "hallucination" refers to various phenomena occurring in clinical and healthy contexts (e.g., Larøi, 2012). We may, thus, note at the very beginning, that, when we talk of AVHs, we are dealing with a heterogeneous group of phenomena that may have multiple manifestations (Henriksen, Raballo, & Parnas, 2015). We shall, thus, talk of AVHs or voice-hearing (VH) phenomena in the plural in order to indicate that not all of the phenomena termed "AVH" in the current literature may be "placed under the same umbrella".

Accordingly, one can find numerous different conceptualisations of AVHs in the literature. However, what are these phenomena designated as AVHs, or in patient jargon "voice-hearing"[1] experiences? And how *are* AVHs actually conceptualised in a Cognitive Science context?

It has been argued that in hallucination research experiential characteristics "have been largely ignored or neglected by philosophers and scientists alike […] giving rise to misconceptions and even plain myths about [hallucinations]" (González, 2010, p. 206). It is quite unanimously accepted in the clinical AVH-literature that the consideration of experiential characteristics of AVHs is crucial for providing sound conceptualisations of AVHs (e.g., Upthegrove et al., 2016). By contrast, it has been claimed that there have been, generally, few attempts to define VH and even fewer attempts to provide such a definition taking voice-hearer's first-person accounts as a starting point (Beavan, 2011). Similarly, it has been argued that "in general, the conceptualizations [of hallucinations] encountered in the literature do not do justice to the richness and complexity that the psychological phenomenology actually exhibits" (Shanon, 2003, p.3). Is that the case? And if so, what do these conceptualisations lack?

Hallucinations are experienced both in a variety of modalities and in other clinical conditions besides schizophrenia spectrum disorders[2], as well as in healthy individuals (Chaudhury, 2010). Thereby, it is often assumed that AVHs reported by individuals with schizophrenia spectrum diagnoses and AVHs in healthy individuals lie on a continuum (Johns & van Os, 2001). However, there is evidence that suggests that one should be cautious to place voice-experiences of psychiatric and non-clinical voice-hearers under the same umbrella regarding their experiential features as well as underlying mechanisms (Chhabra, Badcock, & Maybery, 2013; de Leede-Smith & Barkus, 2013; Henriksen et al., 2015; Rojcewicz & Rojcewicz, 1997; Stanghellini, Langer, Ambrosini, & Cangas, 2012). For this reason, in the present work we focus particularly on AVHs in schizophrenia-spectrum disorders. In the same line, although it seems that voices in this population share a range of features with AVHs

[1] Note that the terms voice, voice-hearer and related terms are used in a metaphorical sense throughout the work, as it is clear that voice-hearers' experiences are not explainable as perceptions of voices in a standard perceptual sense.

[2] The usefulness of the term "schizophrenia" itself has been questioned repeatedly (e.g., Bentall, Jackson, & Pilgrim, 1988; Guloksuz & van Os, 2017). The latter estimate that only the "30% poor outcome fraction of a much broader multidimensional psychotic syndrome" (Guloksuz & van Os, 2017, p. 1) is covered by the schizophrenia-concept. Classically, psychotic disorders are considered to be associated with a disconnection of the psychotic individual from reality (Fujii & Ahmed, 2007). According to the DSM-V, psychotic disorders include symptoms from the five domains: delusion, hallucination, disorganised thinking, disorganised or abnormal motor behaviour and negative symptoms such as flattened affect (American Psychiatric Association, 2016). In the present work, as the included studies refer to the concept of schizophrenia, we may refer to schizophrenia spectrum disorders, having in mind that we most likely refer to multidimensional psychotic syndromes.

reported in other psychiatric conditions (Waters & Fernyhough, 2017), it is unclear if they can be considered different kinds of one type. For an overview of the range of diagnoses for which AVHs have been reported, see Figure 1.

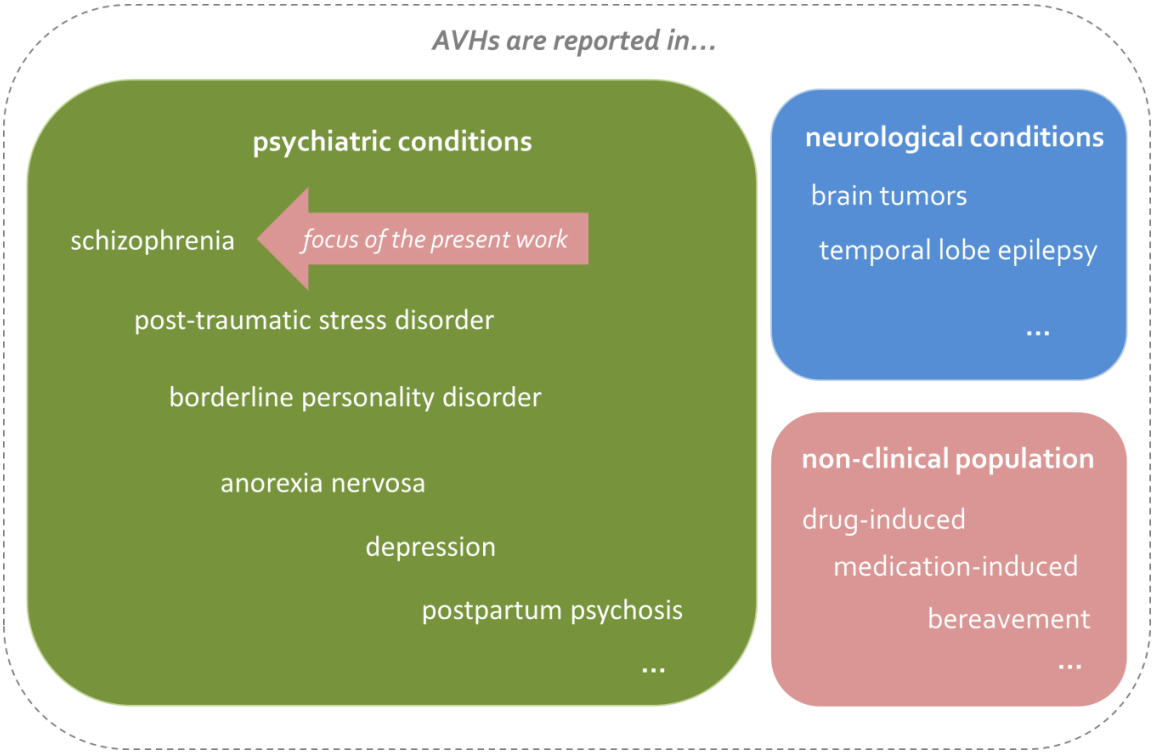

Figure 1 Overview over conditions in which AVHs can occur (as reported, e.g., by Chaudhury, 2010; Waters & Fernyhough, 2017). Note that this list does not claim to be exhaustive. Although there is evidence that AVHs experienced by different populations share a range of common features (Waters & Fernyhough, 2017) it is unclear in how far they are to be considered same or different phenomena. The present work focuses on AVHs in schizophrenia, as they are considered a core symptom of this disease that causes considerable suffering as well as economic burden.

In schizophrenia spectrum disorders, AVHs are characterised by a predominantly negative content (Larøi, 2012) and can go along with considerable suffering. Voices may disrupt individuals' daily lives (Upthegrove et al., 2016; Woods et al., 2015) and even seduce them to self-injury (Rosen et al., 2016). AVHs have also been associated with a heightened risk for suicidal attempts (Fujita et al., 2015; Kelleher et al., 2013, 2014).

Life-time prevalence of schizophrenia is estimated to be around 0.5% in the general population (Simeone, Ward, Rotella, Collins, & Windisch, 2015), with an estimated life-time prevalence of 64%-80% of auditory hallucinations in individuals with schizophrenia-spectrum diagnosis (McCarthy-Jones et al., 2017). Following the most influential classification systems for diagnosing mental disorders, the ICD (International Classification for Diseases) (World Health Organization, 1992) and the DSM (Diagnostic and Statistical Manual of Mental

Disorders) (American Psychiatric Association, 2013), the presence of certain types of AVHs in addition to one further symptom is sufficient for a schizophrenia diagnosis.

In fact, a recent study including a sample of about nine hundred participants diagnosed with a schizophrenia-spectrum disorder found that auditory hallucinations were way more frequent than visual, tactile or olfactory hallucinations in those individuals and the majority of the sample reported to have had only auditory hallucinations (McCarthy-Jones et al., 2017). However, another recent study including a sample of seven hundred and fifty individuals carrying a diagnosis of a schizophrenia-spectrum disorder found that hallucinations in multiple sensory modalities were the most frequently reported among the participants, and those included the auditory modality (Lim et al., 2016). Nonetheless, it is unclear in how far conventional treatment methods, such as antipsychotic medication, are successful in the treatment of AVHs (McCarthy-Jones, 2012). It is often estimated that about one quarter of AVHs are medication-resistant (Shergill, Murray, & McGuire, 1998). Critically, schizophrenia constitutes a tremendous economic burden with associated annual costs amounting to millions and even billions of US-Dollars for individual countries (Chong et al., 2016).

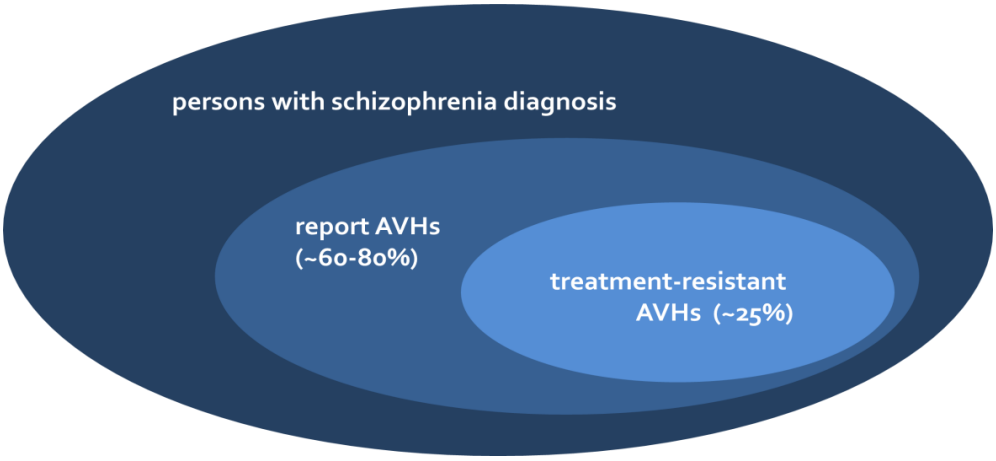

Figure 2 AVHs and schizophrenia diagnosis. It is estimated that around 60-80% of individuals with schizophrenia diagnosis experience voices (McCarthy-Jones et al., 2017). Around a quarter of those AVHs are assumed to be treatment-resistant (Shergill et al., 1998).

From this, it becomes obvious that there is a clear need for the investigation of AVHs, not least in order to provide adequate treatment for those suffering from such experiences.

Here, conceptual issues become relevant. How specific phenomena are conceptualised has far reaching practical consequences (Strik & Dierks, 2008). For example, someone will choose different routes of research into treatment of AVHs depending on whether one conceptualises AVHs as results of a brain disease or rather as being triggered by psychosocial

factors. In that vein, how a specific researcher conceptualises AVHs may indicate theoretical biases and influence how he/she will interpret obtained results (Rojcewicz & Rojcewicz, 1997). In addition, it has been found that differing implicit models of schizophrenia stemming from different disciplines can hamper multi-disciplinary work (Colombo, Bendelow, Fulford, & Williams, 2002), a relevant point in the Cognitive Science context. Multi- and interdisciplinary[3] research into AVHs in the context of Cognitive Science may be hampered due to implicitly, but also explicitly differing concepts used in order to conceptualise AVHs.

There is an increasing body of literature regarding AVHs, dominated by the field of neuroscience (Upthegrove et al., 2016). Schizophrenia has classically been conceptualised as neurodevelopmental or neurodegenerative disease (de Haan & Bakker, 2004). It seems widely accepted that the aetiology of schizophrenia is associated with biological aspects (Liberman & Corrigan, 1992). That justifies the inclusion of a neuroscientific perspective for a holistic conceptualisation of AVHs. However, this perspective is limited. Neuroscientific studies about AVHs are largely restricted to third-person data about the brain.

However, if one lastly aims at explaining and reaching an understanding of the subjective experience of voice-hearing, this experience has to be considered in its own right. Relatedly, the need for a phenomenological philosophical investigation of AVHs, for example, has recently been expressed by influential researchers of AVHs in the areas of psychology and neuroscience (McCarthy-Jones, Krueger, Larøi, Broome, & Fernyhough, 2013). Clinical-philosophical approaches to AVHs goes beyond neuroscientific research in asking what the experience of voices is like from a first-person point of view. However, although the need for a phenomenological philosophical investigation of AVHs is explicitly expressed and welcomed, the authors anticipate conceptual difficulties (McCarthy-Jones et al., 2013). For example, they state that it is unclear how phenomenological philosophical concepts used for the investigation of AVHs map into psychological and neuroscientific constructs used in that context. In order to create a fruitful interdisciplinary research context for AVHs, they call for a clear operationalisation of phenomenological philosophical concepts in the language of neuroscientific and cognitive psychological disciplines "through collaboration with colleagues in such areas" (McCarthy-Jones et al., 2013, p. 6).

[3] Here, it may be useful to distinguish "multidisciplinarity" and "interdisciplinarity". Based on a literature review, it has been proposed that "multidisciplinarity draws on knowledge from different disciplines but stays within their boundaries, [whereas] interdisciplinarity analyzes, synthesizes and harmonizes links between disciplines into a coordinated and coherent whole" (Choi & Pak, 2006, p. 351). They propose to describe the former as additive and the latter as interactive.

Moreover, psychological perspectives on AVHs may prove valuable for their contextualisation in a voice-hearer's life history. In that vein, it has been claimed that, amongst others, conceptual problems regarding hallucination phenomena "call for a multilevel analysis and an interdisciplinary approach" (González, 2010, p. 193) towards such phenomena. Following this author, if such problems are disregarded, there is the risk of misconceptions that can prevent a proper understanding of AVHs.

Here, the consideration of phenomenal features of voice-hearing becomes relevant for philosophy, psychology and neuroscience alike, because before investigating AVHs, both empirically and conceptually, we need to clarify what we actually want to investigate and conceptualise (David, 2004; Wu, 2012). Therefore, in order to probe the appropriateness of a conceptualisation of AVHs, we need to create a basis against which we can compare such conceptualisations. Such a basis may also serve for purposes of differentiating voice-hearing from somehow similar experiences, which may prove helpful in the context of diagnosis. Moreover, it has been proposed that the consideration of contemporary models of consciousness may be valuable in order to contextualise and further clarify existing models of AVHs (McCarthy-Jones et al., 2014).

Starting from this background, we can now specify the research questions and objectives of the present work.

1.1 Research questions and objectives

In order to obtain answers to the general question "what are auditory verbal hallucinations? [4]" this question was broken down into two basic research questions on which this work is based. First, "how do voice-hearers describe their experiences?" This question is addressed by examining available first-person reports from different sources. Based on these sources it is elaborated in which dimensions AVHs are described and a tentative working conceptualisation of AVHs is derived. We will shortly consider how far AVHs are distinguishable from other mental phenomena.

The second question we address is "how are auditory verbal hallucinations conceptualised in the Cognitive Science disciplines of neuroscience, psychology and clinical philosophy?". In order to provide answers to this question a systematic review was conducted. The latter question, in turn, can be broken down into the question "what (different) concepts

[4] Throughout the whole work, we will focus particularly on AVHs in schizophrenia spectrum disorders.

are used in these disciplines in order to conceptualise AVHs and in how far do they overlap?". In discussing these conceptualisations, we will additionally probe on which (implicit) philosophical assumptions such conceptualisations are based. It will also be considered if the retrieved conceptualisations do justice to the phenomenological[5] features of such experiences.

Ultimately, a recent phenomenological-ecological conception of the brain (Fuchs, 2013a) is suggested to provide a framework by means of which findings based on accounts of AVHs from different disciplines can be conceptualised. With this, the work aims at contributing to a process of (re-)conceptualising AVHs. Moreover, such a framework serves to clarify what role different disciplines may play in AVH-research and, thus, facilitate the needed interdisciplinary investigation of AVHs. This step is important, as misconceptions on that level may lead to the formulation of implausible hypotheses (Kotchoubey et al., 2016).

This is, to the authors' knowledge, the first systematic review that attempts to map out the concepts used in clinical-philosophical, as well as psychological and neuroscientific conceptualisations of AVHs. Specifically, a comprehensive overview of available clinical-philosophical approaches to AVHs is currently lacking. Also, in contrast to former reviews of the voice-hearing literature, (implicit) philosophical assumptions at the basis of the reviewed conceptualisations shall be examined in detail, as we have seen that such assumptions may differ between different cognitive disciplines and hamper fruitful interdisciplinary work.

1.2 Structure of the work

Based on these objectives, this work is structured as follows: first, we will examine how AVHs are described on a phenomenal level (chapter 2) and shortly consider how AVHs are different from other phenomena, such as thoughts, illusions or dreams. Thereafter, neuroscientific (chapter 4), psychological (chapter 5) and philosophically-informed perspectives (chapter 6) on AVHs will be systematically reviewed. Methodological issues specific for the different disciplines will be discussed in the respective chapters. In the general discussion (chapter 7), after a summary of the review's findings, conceptual issues will be discussed. Moreover, ideas regarding the integration of conceptualisation of different disciplines will be presented. The thesis ends by a short discussion of its limitations (section 7.4), providing future directions derived from it (section 7.5), and the conclusion (chapter 8).

[5] Note that the term "phenomenological" is ambiguously in the literature: first, as synonym for experiential, and second, in order to refer to phenomenological philosophy. In order to disambiguate, when referring to experiential feature of VH, we will use the term "phenomenal".

2 What is "hearing voices" like?

The question of what the experience of "hearing voices" is like is actually not an easy one. One might even object that for someone who does not experience voices, it is impossible to provide an answer to this question. We might, thus, reformulate and ask: how do voice-hearers[6] describe their voice-experiences? Answers to this question shall be provided by considering qualitative and quantitative studies focusing on verbatim and not-verbatim reports of voice-hearers about their subjective experience, as well as by considering first-person reports of voice-experiences extracted from the "Hearing-Voices-Homepage"[7].

2.1 Some preliminary considerations

Studies that attempt to investigate voice-hearers' experiences without applying pre-defined experiential dimensions, for example in the form of semi-structured interviews, are rare. However, the use of pre-defined dimensions might bias results and may not coincide with the dimensions voice-hearers would choose to describe their voice-experiences. Consequently, there is the risk that studies using standard measures miss important aspects of AVHs (Upthegrove et al., 2016).

Moreover, first-person reports of voice-experiences are necessarily based on language. This means that we only have access to such experiences through language – an indirect means. However, verbal descriptions of voice-experiences may not capture the experience's complexity (Kraus, 2007). A person with schizophrenia-spectrum diagnosis in one study, for example, found "that his native language is not sufficiently precise to express his experiences" (Henriksen, Raballo, & Parnas, 2015, p.170). Likewise, it has been proposed that "hearing voices" for some individuals may "represent […] an inappropriate term to express that their cognitions are not their own" (Moritz & Larøi, 2008, p. 104). We can, thus, regard both the terms "voice" and "hearing" as metaphors that individuals use in order to describe their experiences. Therefore, these terms are to be taken as metaphorical throughout the work.

The difficult challenge of defining what a voice-experience is, is complicated by the fact that AVHs are a group of heterogeneous phenomena. However, it remains to be clarified *what* phenomena are to be subsumed under the notion of AVHs.

[6] For more details regarding the term "voice-hearer" please see (Woods, 2013).
[7] https://www.hearing-voices.org/voices-visions/personal-experiences/

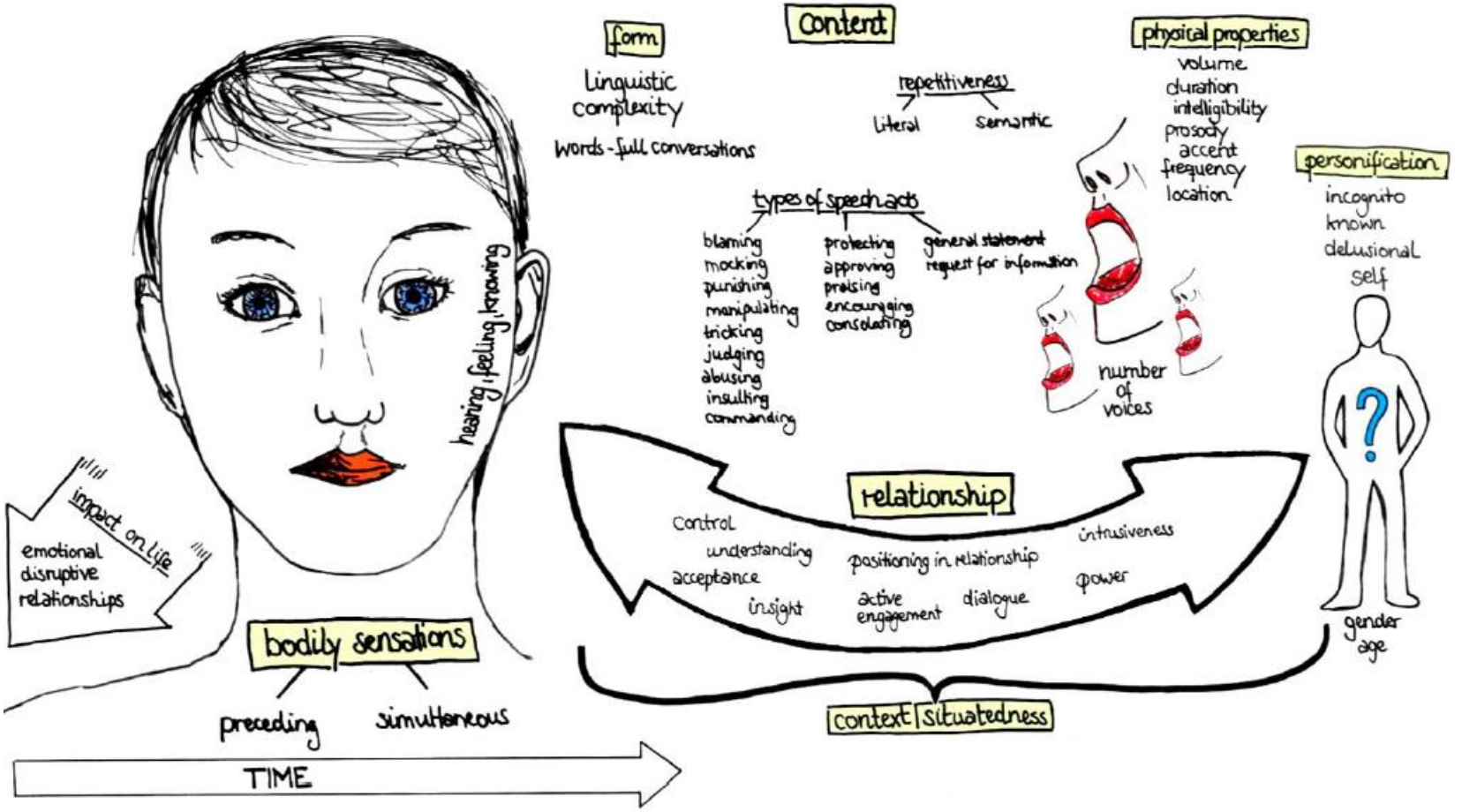

Figure 3 Features of voice-hearing as identified in surveys about voice-hearers' phenomenal experience. As can be seen, experiences of voices can be described regarding various aspects. They may be described as being literally heard, but also as being felt or intimately known. Voice-experiences may both be preceded or accompanied by bodily sensations, such as for example itching. Various types of content have been reported to be transmitted by voices. Content, thereby, may be repetitive either literally or semantically. Different voices may "use" a great variety of speech acts: from negative (e.g., insulting) over "neutral" (e.g., general statements) to positive (e.g., encouraging). Regarding the form, voices may transmit single words up to complex sentences. Voices can also be described in terms of "physical" properties, such as volume, frequency, location or number of voices. Often voices are identified as being associated with specific speakers (e.g., mother, demon), but may also be incognito or experienced as one's own voice. Importantly, VH is often a relational experience, where voice-hearers establish relationships with their voices that may change over time.

There is no consensus regarding which AVH-subtypes are distinguishable and how they relate to each other, as the area of subtyping AVHs is "still in its infancy" (McCarthy-Jones, Thomas, et al., 2014, p. 281). In that sense, we can consider the notion of "AVH" as a "placeholder for a notion yet to be clarified" (Walton, 1990, p. 21).

2.2 Experiential features of voice-hearing

After these preliminary considerations, let us now turn to what we know from voice-hearers' descriptions of the experiential dimensions of voice-hearing (see also Figure 3).

2.2.1 "Physical" properties

AVHs are classically described in terms of "physical" properties. Voices experienced by voice-hearers vary in "physical" properties, such as volume (Demjen & Semino, 2015; Hoffman, Varanko, Gilmore, & Mishara, 2008; Leudar, Thomas, McNally, & Glinski, 1997; Nayani & David, 1996; Upthegrove et al., 2016; Woods, Jones, Alderson-Day, Callard, & Fernyhough, 2015), intelligibility (Larkin, 1979; Leudar et al., 1997; Upthegrove et al., 2016), frequency and duration (Nayani & David, 1996; Rosen et al., 2015), and prosody and accent (Nayani & David, 1996). Although AVHs are usually considered to be intermittent, some patients report hearing voices "[a]ll day, every day" (Upthegrove et al., 2016, p. 93).

Usually, voice-hearers experience multiple voices with different physical (and social) features, as the following quote illustrates: "I hear distinct voices. Each voice has their own personality" (Woods et al., 2015, p. 325). Average numbers of reported voices are around three (Nayani & David, 1996) to around four voices (McCarthy-Jones, Trauer, et al., 2014).

Perceived sources of voices may be located in space (e.g., internal/external) (Nayani & David, 1996). However, voice-hearers sometimes have difficulties in determining if they experience their voices as coming from inside or outside the body (e.g., Upthegrove & al., 2016). In a recent interview study, 69% of the participants reported not to be able to determine whether their voices were external or internal (Jones & Luhrmann, 2016).

Let us consider some examples that illustrate that voice-experiences may vary substantially regarding "physical" parameters. Some individuals ascribe clear auditory qualities to their experiences: "when it's loud it's a booming voice… it's like I struggle not to hear it, it's so loud" (Upthegrove et al., 2016, p. 91). However, there is a range of descriptions that suggest that experiencing voices is largely independent from perceptual experiences: "I could be stone deaf and still hear the voices" (Bleuler, 1950, pp. 110-111, cited in Wiggins & Schwartz, 2007, p.123). A participant of a recent survey reports: "I did not hear the voices

aurally. They were much more intimate than that, and inescapable […]" (Woods et al., 2015, p. 326). In line with that in a recent survey over 80% of the participants reported "quasi-auditory, mixed, thought-like or multisensory voice-hearing patterns" (Jones & Luhrmann, 2016, p. 200) instead of literally auditory voices.

What these reports have in common is that voices are experienced as inescapable: not even being deaf could prevent from experiencing them. They do not allow to close the door or tap the ears in order to stop them. Voices are rather described as being more powerful or potent as voices that exist in the intersubjective space where they are associated to physically present speakers. Most of the individuals experiencing voices seem to know when they are hearing voices and do not take the experience as cases of "normal perception" (Leudar et al., 1997). In a recent survey, about 20% of the participants even considered "voices" an inappropriate term for their experiences (Woods et al., 2015). Some individuals, for example, describe their voices as being "felt" (Demjen & Semino, 2015) or as "pulsating messages in the blood stream" (Karlsson, 2008, p. 367). In an early study, the majority of the interviewed voice-hearers experienced their voices as private and not accessible through others (Aggernaes, 1967). However there are also other cases, as the following quote illustrates: "I only found out that the voices weren't real when I asked people I knew, I said can you hear these and they said no we can't" (Upthegrove, Ives, et al., 2016, p. 91).

2.2.2 Bodily sensations

The experience of voices can be accompanied by bodily sensations (e.g., Cermolacce, Naudin, & Parnas, 2007). In a recent survey, 66% of the sample reported that their voice-experiences are accompanied by bodily feelings (Woods et al., 2015). Some voice-hearers describe bodily sensations preceding or accompanying voice-experiences (Nayani & David, 1996; Woods et al., 2015). Participants of recent surveys report: "[i]t's not even just a voice um it's…I've had like a push on my shoulder um… I've smelt like things which like you wouldn't expect…" (Upthegrove et al., 2016, p. 94). The available studies, hence, suggest that AVHs can arguably not be reduced to linguistic experiences. Similarly, the authors of a recent survey conclude that "[o]verall, there was a real sense that voices forced themselves on participants that in totality resulted in more than an auditory experience" (Upthegrove et al., 2016, p. 92).

One might wonder here whether the term "multisensory hallucination" may be more appropriate to designate these experiences in some of these cases. In fact, the existence of AVHs seems to increase the probability of the occurrence of hallucinations in further modalities (Lim et al., 2016).

2.2.3 Linguistic complexity

In a recent study focusing on the linguistic content of AVHs, the authors found that the AVHs reported by their sample of individuals with psychosis typically consisted in "little more than a noun, verb and object" (de Boer, Heringa, van Dellen, Wijnen, & Sommer, 2016, p. 13). However, utterances of voices can range in syntactic complexity from single words (e.g., de Boer, Heringa, van Dellen, Wijnen, & Sommer, 2016) to complex sentences (e.g., Upthegrove et al., 2016) and full conversations (e.g., de Boer, Heringa, van Dellen, Wijnen, & Sommer, 2016).

2.2.4 Form of address

Voices are usually reported to most commonly "direct themselves" towards the voice-hearer in the second ("you") or third ("he/she") person (e.g., Hinzen & Rossello, 2015). These authors believe that AVHs exhibit a specific "linguistic profile […] without which the phenomenon would not be what it is" (Hinzen & Rossello, 2015, p. 5). According to a recent survey, the most common types of voices in first-episode psychosis are indeed demanding, commenting and threatening voices (Upthegrove et al., 2016). In another recent study, "second-person voices" (97%) have been reported to be the most frequent, followed by "third-person voices" (66%); 42% experienced voices "speaking" in the first person, and the majority a mix (Corstens & Longden, 2013).

A voice-hearer reports how she distinguishes between inner dialogue and her voices in the following way: "I am doing the talking—that is me. The voices are outside me, the voices are directional" (Davies, Thomas, & Leudar, 1999, p. 183). We may hypothetically deduce from this, that voice-experiences include some experience of reference to the voice-hearer. Nonetheless, the role of a voice-hearer in relation to his/her voice may radically differ between different instances of such experiences. Whereas, in some cases, a person may be directly directed to by a voice, in other cases she may be passive in hearing voices talking about her or being "communicated to" by technical means.

However, even if in commenting voices the voices do not directly address the voice-hearer in a second-person perspective, they still refer to the voice-hearer in that they comment his/her activities and only him/her can be meant.

2.2.5 Content

Voice-experiences often differ from experiences of hearing ordinary speech regarding their content. The authors of a linguistic account of psychotic symptoms observe: "voices do characteristically not develop a personal narrative or talk much about themselves in the 1st Person, nor about the world, using the 2nd or 3rd Persons near exclusively" (Hinzen & Rossello, 2015, p. 6).

Different types of speech acts "used by" voices have been identified. These vary from mostly negative content such as blaming (e.g., Upthegrove et al., 2016), abusing (e.g., Leudar et al., 1997), insulting (e.g., Nayani & David, 1996) and commanding (e.g., Demjen & Semino, 2015), to "neutral" content such as general statements (e.g., Demjen & Semino, 2015), or to positive content such as approving or encouraging (e.g., Leudar et al., 1997). The semantic content of voices tends to be consistent over time in the majority of voice-hearers (Hoffman, Oates, Hafner, Hustig, & McGlashan, 1994; McCarthy-Jones, Trauer, et al., 2014) but it may also change depending on the phase of the voice-hearing experience (McCarthy-Jones, Trauer, et al., 2014). The valence of the voice's content has been reported to differ between phases of acute psychosis and psychosis in remission (Larkin, 1979). Whereas the content of voices in acute psychosis in Larkin's (1979) study was mostly negative, individuals in remission tended to report positive voice content.

Negative voices in psychosis have been found to resemble self-critical thoughts as observed in depression (Gilbert et al., 2001). In a recent survey, 50% of the participants endorsed that their voices may reflect thoughts they have had, whereas 33% denied that (McCarthy-Jones, Trauer, et al., 2014). The majority of the participants in that study did not believe that the voices' content consisted of memory "replays". Nonetheless, 39% of participants reported that their voices seemed to be memory "replays". In the same study, 56% of the participants considered it possible that their voices' content may be linked to what an influential person in their life could have said. A participant of a recent survey comments on a voice that says to her:

> 'You fat bitch, you're scarred up, don't nobody want you and you 50 and you ain't shit. How in the hell you think you looking attractive? Ain't nobody looking at you.' They're negative and not self-motivating. They are saying what I already feel about myself.' (Rosen et al., 2015, p. 3)

The same participant reports also positive voices saying things such as "[g]irl you look good" (Rosen et al., 2015, p. 3). We can conclude that the content of voices seems to be generally meaningful for voice-hearers and might explicitly relate to individual personal characteristics of voice-hearers as the following quote shows:

> 'I was a sex addict and I would have very sexual voices in my head; very sensual, very seductive voices. I could be sitting in a room with a woman and the voices would be telling me what they wanted to do to the woman. […]' (Rosen et al., 2016, p. 167).

2.2.6 Identification

Many voices encountered in AVH are ascribed to clear identities (e.g., Stephane, Thuras, Nasrallah, & Georgopoulos, 2003) such as individuals present in the voice-hearers' social context (Holt & Tickle, 2014). In a recent study, a participant reports to hear her dead mother: "[m]y mother is constantly talking to me. Sometimes she yells at me and is quite abusive and at other times when she is quiet she says nice things" (Rosen et al., 2016, p. 167). Voices can also be *incognito* (Leudar et al., 1997) or ascribed to spiritual or stereotyped entities (Woods et al., 2015), as the following quote illustrates: "[t]hey are angels. That's how I look at it. They are protecting me from like all of the horrible things that I have been through and stuff." (Rosen et al., 2016, p. 167). Although voices are usually not experienced as one's own (e.g., Nayani & David, 1996), they might in some cases identified as one's own voice (e.g., Demjen & Semino, 2015). A participant of a recent study reports a "[m]ale voice can use my own voice against me…" (Upthegrove et al., 2016, p. 93). In a sample of one hundred participants, almost 80% reported that their voices represented either a family member, past abusers, other perpetrators, disowned aspects of self, or acquaintances (Corstens & Longden, 2013).

2.2.7 Relationality

Voice-hearers use to engage with their voices in a dialogical relationship (e.g., Holt & Tickle, 2014). This has been associated with voice-content becoming more positive over time (e.g., Fenekou & Georgaca, 2010). Control over voices can vary from complete passivity (Upthegrove, Ives, et al., 2016) to the capacity to at least sometimes stop the voices (e.g., Nayani & David, 1996; Rosen et al., 2015). A participant of a recent survey reports "I got no power, no intention, I can't block it at all" (Upthegrove, Ives, et al., 2016, p. 93). In contrast, a participant of another recent survey reports: "[...] I navigate between ones that I feel like hearing or suggestions that are going to work at that moment. I have to be the one in charge and in control. I listen and choose depending on my mood or my thoughts. [...]" (Rosen et al.,

2015, p. 2). Although voices might be experienced as intrusive (Stanghellini et al., 2012) and be encountered with rejection (Holt & Tickle, 2014), voice-hearers might reach a personal understanding and acceptance of their experiences (Holt & Tickle, 2014). Time seems to be a crucial parameter when it comes to the relationship between a voice-hearer and his/her voices (e.g., Fenekou & Georgaca, 2010; Rosen et al., 2015). Reaching an understanding or acceptance of the voices was described as a gradual process by most of the participants of the latter study. Active engagement, in turn, was associated with a heightened sense of control and influence over the voices (Rosen et al., 2015). Interestingly, participants in this study reported that it is easier to engage and disengage from voices, when they addressed the voices by name.

It is worth noting that relationships to voices have to differ necessarily from relationships one maintains with other individuals. Voice-experiences are not encounters based on principles that characterise ordinary encounters. The voices a voice-hearer deals with are disembodied in the sense that there is no speaker who is corporally present (Rojcewicz & Rojcewicz, 1997). There is no *vis-à-vis* for the voice-hearer. For this reason, voice-experiences have been described as "pseudo-encounter[s]" (Naudin & Azorin, 1997, p. 192). According to the authors, this reduces the quality of reciprocity characterising ordinary encounters. It is illustrated by the quote of a person experiencing voices in a first-episode psychosis: "The way it would reply is no kind of open-ended questions, it'll always be in a statement manner" (Upthegrove, Ives, et al., 2016, p. 93). We might hypothesise that, by giving the voices a name, in the above cited study voice-hearers were able to give their voices a "verbal face". This might help to render the experience more "encounter-like" and to "externalise" the voices in order to engage with them.

2.2.8 Context

AVHs can be considered within the context of the life and culture of a voice-hearer. The occurrence of AVHs, for example, has been associated with traumatic life experiences, such as sexual abuse (McCarthy-Jones, 2011). Voice-hearers have been found to develop explanations for their voice-experiences that are culturally available (Fenekou & Georgaca, 2010). Voices are both experienced in quiet and in noisy environments, as well as when attention is directed both towards the environment and inwardly (Garwood, Dodgson, Bruce, & McCarthy-Jones, 2015). Voice-content has been reported to be usually congruent with the current mood of the voice-hearer (Larøi, 2006). It has recently been hypothesised that states of anxiety may induce some types of voice-experiences (Ratcliffe & Wilkinson, 2016).

Voices can also be considered in the wider context of psychosis. The authors of several phenomenological studies on voice-hearing report:

> "One's entire experience," explained one young woman, "in other words, [one's experience] of the world and of how one is situated in it and of one's self changes. It's like one aspect of [these changes] can maybe get pulled out and described as a "voice," but [such terms] are just explanations. They're just explanations or a way of articulating to other people this kind of fundamental breakdown in everything.
>
> (Jones & Shattell, 2016, p. 2, brackets in the original)

This quote illustrates that voice-experiences may also be an expression of fundamental alterations of experience.

2.2.9 Influence on life

As noted in the introduction voice-experiences are often very disruptive and influence a person's life negatively. Participants of a recent survey reported: "[w]hen they choose to talk to me, they choose to talk to me and they take over the whole situation as it is at the time" (Upthegrove et al., 2016, p. 93) or "[t]he voices were so frightening and disruptive that much of the time I was unable to focus or concentrate on anything else" (Woods et al., 2015, p. 326). We have already seen that what influence voices have over a person's life seems to depend also on the relationship he/she develops with his/her voice (Rosen et al., 2015).

2.3 "Auditory verbal hallucination" - a misnomer?

From what we have seen, we can conclude that AVH is actually a misnomer – or at least an incomplete designation – in many cases, as it does not capture a large part of what person's with "AVHs" actually experience. That AVH constitutes a misnomer has also been proposed by others (e.g., Moritz & Larøi, 2008; Wilkinson & Bell, 2016). The term *auditory* verbal hallucination is probably only appropriate for a subgroup of the phenomena summarised under the term. How large this subgroup actually is remains to be defined. In order to provide appropriate treatment options for person's who report what is called "hearing voices" we need to understand their experiences better[8].

We have seen that there is in many respects more to voice-hearing than the standard definition would suggest. By focusing on audibility it dismisses that voices are not just simple

[8] At least if we do not assume a reductionist or eliminative materialist standpoint, which we do not do here.

sounds, if they are experienced as such at all, which is often not the case. It is not enough to cut or change words, but we also need to reconceptualise AVHs in order to create a basis for the empirical investigation and better understanding of such phenomena.

Before trying to develop a working conceptualisation of voice-hearing experiences, let us shortly consider how we might differentiate AVHs from other mental phenomena, based on the reviewed results.

2.4 Delimitating voice-hearing from other mental phenomena

One may argue that "hearing" someone speaking in the absence of a speaker is actually a very common experience, for example in dreams, "earworms" or when we seem to hear our name spoken when nobody called our name. On the other hand, one may argue that if AVHs are so often *not* auditory in a literal sense, then they may simply be considered "thoughts".

For that reason, a precise conceptualisation of AVHs should allow for delimitating them from those other (idiosyncratic, private) mental phenomena. In the following let us consider how we might distinguish between "voices" and apparently similar phenomena.

2.4.1 Thoughts

It has been put forward that differences between voices-hearing and thought are rather dimensional than categorical (e.g., Humpston & Broome, 2016; Moritz & Larøi, 2008). Thereby, auditory features do not seem to be critical for voice-hearers to discriminate voice-experiences from ordinary thought (Hoffman et al., 2008). In a phenomenological study, the relation between voices and thoughts was often discussed by voice-hearers (Fenekou & Georgaca, 2010). Consider the following example:

> "I was sitting, for example, in my room … and … I was thinking what I would tell my mum … and I heard the answers … it was my thought that simply took the form of my mum's voice […] there are also voices, you know, which are like thoughts that come into your mind … I am in this phase of my life … by now the voices have became something like … like thoughts" (Fenekou & Georgaca, 2010, p. 140).

This person seems to clearly distinguish between voice-like thoughts and thought-like voices. Let us consider an example that illustrates *how* voice-hearers may distinguish between voices and thoughts:

> "The voices don't talk to each other but they talk to me. Like I could be lying in bed and be looking in the sky and I hear a voice hovering above me, talking to me. It kind of shocks me because it would go with my thinking. I could be thinking about something and then all of a sudden I hear an interpretation of what I was thinking from the voice." (Rosen et al., 2016, p. 167)

This person describes that her voices are addressing her, an experience that is superimposed on her thoughts. A study including 46 participants with schizophrenia-spectrum disorder concluded that those individuals clearly differentiate between their voice-experiences from ordinary verbal thought (Hoffman et al., 2008). In this study, the following three features were reported to be the most important in distinguishing voices from thoughts: first, the specific verbal content of voices; second, having less control over voices; and third, a non-self "sound" of the voices. Interestingly, however, clarity and loudness of the voices were not rated as important in distinguishing voices from thoughts. However, there are also cases in which there seems to be dissolved boundaries between voices and thoughts: "I get confused about what's a voice and what's a thought, what's my thought and others' thoughts" (Jones & Luhrmann, 2016, p. 199).

Summarising, although voices are frequently reported to be "thought-like" (Jones & Luhrmann, 2016), individuals usually distinguish between voices and thoughts. Compared to thoughts, voices are experienced as less controllable (Hoffman et al., 2008). Thoughts, on the other hand, do usually not have the quality of directing themselves towards the person thinking them.

2.4.2 Dreams

First, of course, we may note that voice-hearing experiences occur in an awake state, whereas dreams occur while sleeping. However, there are other features that arguably distinguish dreams from voice-hearing. Referring to Sartre, it has been argued that whereas dreams "appear to us as a story" (Rojcewicz & Rojcewicz, 1997, p. 18), AVHs are characterised by a fragmented, intermittent character. Moreover, only a minority of voice-hearers seems to ascribe a "dream-like" quality to their voice-experiences (Aggernaes, 1967).

2.4.3 Illusions and earworms

Let us come back to the example of seeming to hear someone say our name, when there is no corresponding stimulus in the environment. An illusion is usually defined as "the

misperception of a stimulus that is present in the external environment" (Norton & Corbett, 2000, p. 111). In a second step, hallucinations are then used to be distinguished from illusion by stating that hallucinations occur in the absence of corresponding external stimuli.

However, psychotic voice-hearers also describe hearing voices that develop from environmental sounds such as traffic noise or blowing wind (Jones & Luhrmann, 2016). In hypervigilance hallucinations, for example, a person is proposed to be hypervigilant regarding the detection of certain stimuli in his/her environment, as for example "hearing things that confirm current beliefs around fears of persecution" (Garwood et al., 2015, p. 53).

One might argue that this leads to the conclusion that hypervigilance hallucinations actually *are* illusions. However, we argue that there are significant differences between ordinary illusions and what is called hypervigilance hallucinations. First, illusions are usually rapidly recognised *as* illusions and do not go along with the considerable suffering associated with hypervigilance hallucinations: we usually recognise rapidly that it was not us who were meant, when we, for example, have the illusion of hearing our name. However, hypervigilance hallucinations have a compelling character for the voice-hearer. Hence, whereas illusions might be described as "auditory accidents", hypervigilance hallucinations carry a deeper meaning for the voice-hearer that might be deeply related to his/her life-history (Dodgson & Gordon, 2009). Hypervigilance hallucinations, thus, cannot be reduced to ordinary auditory illusions.

Summarising, voice-hearers develop ways of clearly differentiating between their voices and thoughts or voices stemming from physically present speakers (Fenekou & Georgaca, 2010). Over time, voice-experiences tend to be integrated in a voice-hearers' life with a relatively stable relationship between voice-hearer and his/her voice (Fenekou & Georgaca, 2010). Thereby, voice-hearers usually elaborate sophisticated ways of making sense of their voice-experiences. All this does usually not apply to ordinary auditory illusions.

2.5 Summing up – a working conceptualisation

Before outlining a working conceptualisation let us, again, consider some preliminary questions. When many voice-hearers do not actually *hear* their voices literally, why would they then describe their experiences in terms of hearing voices? Coming back to the preliminary considerations, one possibility is that they term their experiences like that as they want to comply with what their psychiatrists want to hear. This possibility is reflected in the quote of the following patient:

> "…it becomes incredibly tempting to resort to easier terms and terms that clinicians understand because [the inability to communicate] gets so frustrating...I often want to—in this kind of negative way—to [instead] resist interpretation, and [instead] say "that's not right" or "that didn't capture it" without necessarily having a positive alternative; no "this is what it's like."
> (Jones & Shattell, 2016, p. 2, brackets in the original)

Another consideration is that meaning is usually conveyed to us by others through language. We may be texted or spoken to, but this meaning is always conveyed in terms of communicational means. So even if some individuals do not experience their voices in an auditory way, to describe their experiences in term of "hearing voices" may allow them to express the sensation of being communicated to (for a similar argument, see Hinzen & Rossello, 2015). This might be illustrated by the following quote: "They're clearly thoughts, but I don't generate them – someone else is communicating with me" (Jones & Luhrmann, 2016, p. 194).

However, in some descriptions it becomes apparent that the experiences are different from usual communications in important ways: "I did not hear the voices aurally. They were much more intimate than that, and inescapable" (Woods et al., 2015, p. 326). Unlike voices of physically present speakers, the voices experienced by voice-hearers do not obey to physical laws of space and time: they may "address" the voice-hearer anytime at any place.

Based on these studies focusing on the subjective voice-experience, we can now outline a working conceptualisation. Coming back to the preliminary considerations, we first have to note that any proposal of a conceptualisation of AVHs has to be preliminary: at the present moment we simply do not have enough data about voice-experiences and its subtypes in order to propose any final, valid conceptualisation. Rather, the conceptualisation of AVHs has to be considered an ongoing research process.

What is called "AVHs" or "voice-hearing" can be conceptualised as multidimensional experiences with each dimension varying both from person to person and over time. We might conceptualise such experiences as meaningful "private/idiosyncratic experiences of communication" that make reference to the voice-hearer. The experience is idiosyncratic in the sense that the specific voices experienced by a voice-hearer are experienced by him/her *alone*. In the moment of the experience, there is no physically present speaker who would

mean to convey the "received communication"[9]. Nonetheless, the experiences are often aligned with a communicator that may be clearly identified and in that sense do not represent ordinary "self-communication". The absence of a speaker renders the communicational situation "unfair" in that there is no immediate possibility to interact with the "voice" vis-á-vis. Moreover, the experience of communication can be auditory to different degrees, but is not necessarily so. Rather, the communication may be experienced as silent or thought-like. The voice-experience may be associated with bodily feelings and be described in such terms. There are several possible forms of addressing a voice, whereby the second-person perspective is the most common (Corstens & Longden, 2013).

Based on the voice's content and the context of the onset of the voice-experiences, we can further distinguish different types of voice-experiences. It has been, for example, proposed that subtypes of AVHs in schizophrenia, include hypervigilance, autobiographical memory, deafferentation and inner speech hallucinations (McCarthy-Jones, Thomas, et al., 2014). The authors further distinguish between obsessional, novel and own thought inner speech hallucinations (Figure 4). Obsessional "voices" may be associated with short, repetitive commands, novel inner speech hallucinations may occur in the form of running commentary, and own thought hallucinations may both be experienced as voices and be recognised as own thoughts (McCarthy-Jones, Thomas, et al., 2014).

Generally, the voice's content is personally meaningful for the voice-hearer and most likely negative in the context of schizophrenia-spectrum disorders (e.g., Larøi, 2012). Just to give some examples, we may hypothesise that, for example, insulting voices may be related to self-critical thoughts or anticipated critique through others.

Commanding voices may correspond to suppressed unwanted impulses. Hypervigilance hallucinations may be related with the shameful fear of others knowing things about oneself that one does not want to know them: "I have come to recognise the voices as expressions of anxiety, perhaps even a recognition of a fear I have about myself that I am not prepared to entertain as being part of my personality" (Ratcliffe & Wilkinson, 2016, p. 53).

[9] That is also true for hypervigilance hallucinations. Although in those cases, there might be physically present speakers, those do not utter the messages meant for the voice-hearer.

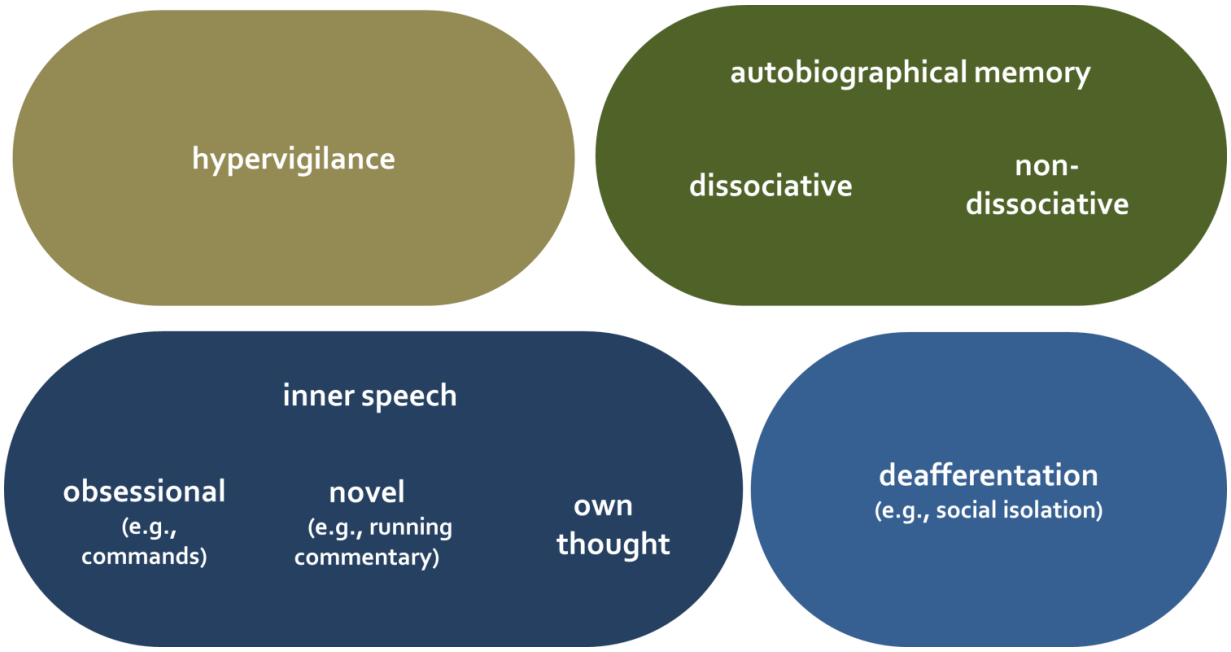

Figure 4 AVH-subtypes proposed by McCarthy-Jones, Thomas, et al. (2014).

There are innumerable possibilities of what exactly a specific voice means for whom and to answer the question of what it is. It has become clear until this point that voice-hearing is much more than "hearing" a sound in the absence of a corresponding stimulus (and in the acoustic sense often less). This diversity and the complexity of voice-experiences have to be taken into account in AVH-research. Based on the individual experience there might be quite different possible best treatments. There is clearly more research needed into the experiential details of individual voice-experiences in order to disentangle different subtypes of voices that might be associated with different neurocognitive processes.

Let us now turn to the second part of this work and see how AVHs are conceptualised in the disciplines of neuroscience, psychology and clinical philosophy and in how far these conceptualisations correspond to their complexity and diversity. Moreover, evidence from neuroscientific and psychological studies concerning AVHs will be examined.

3 Systematic review of neuroscientific, psychological and clinical-philosophical studies about voice-hearing

3.1 Methods for the systematic literature review

The method used for conducting the systematic literature review follows the PRISMA guidelines (Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009) originally developed for studies evaluating health care interventions. These guidelines provide a stepwise selection of relevant articles after a literature research in the relevant database for systematic literature reviews in general.

3.1.1 Search procedure

In order to investigate how AVHs are conceptualised in neuroscientific and cognitive psychological approaches to voice-hearing, PubMed and PubPsych was searched using three search strings[10]. The first referred to auditory verbal hallucinations carrying the following terms: "auditory verbal hallucinat*", "auditory hallucinat*", "verbal hallucinat*", "hear* voice*", "hallucinat* AND voice*". The second search string contained terms regarding neuroscience "brain", "cognition", "neurobiolog*", "neurophysiolog*", "neuropsycholog*", "neurocognit*". The third search string contained terms aiming at obtaining studies concerning the conceptualisation of AVHs: "model", "account", "approach", "perspective", "definition", "theory"[11]. The search terms were connected with an OR-operator and the search sets with an AND-operator, respectively. Moreover, in PubMed the Mesh-Term "Humans" was set in order to get back only studies concerning humans. Titles and abstracts of the resulting studies were scanned by the author, as well as her supervisor (A.P.P.) to extract relevant works. The shortlisted articles were then scanned in order to obtain the final list of included works.

[10] These specific search strings were defined after testing various different combinations of search terms, as they turned out to devolve a great variety of relevant studies.

[11] At this point it may be useful to shortly consider the differences between the terms of this search string. A theory can be considered as a set of concepts that are interrelated and aiming at presenting a systematic view of certain phenomena that also may be explained and predicted by the respective theory (Kerlinger, 1986). Models may be derived from theories and are less general than theories and aim at explaining a specific phenomenon (Wilkinson, 2014). Thereby, models usually focus on certain features of a phenomenon and, thus, represent it in a simplified manner (Bailer-Jones, 2009). A definition can be roughly defined as "a statement expressing the essential nature of something" (Merriam-Webster's online dictionary, 2017a). The terms approach, account, and perspective were intended in the most general way.

For the systematic search of relevant philosophical works an equivalent search was carried out using the database PhilPapers. For this search the "fuzzy filter advanced" was applied. Moreover it was chosen that the search term "hallucinat*" must appear, the search terms "auditory", "verbal", "acoustico-verbal", and "acoustic" are excellent indicators of relevance, and the search terms "philosoph*", "phenomen*" are good indicators of relevance. The search specified in that way resulted in n = 623 hits (18.03.17). The resulting studies were scanned equivalently to the aforementioned search. A large part of the works devolved by the PhilPapers-search did not belong to the area of philosophy. For that reason and because in the area of philosophy "systematic review" is no common research strategy, a slightly different search strategy was adopted for the area of philosophy. In addition to the articles identified through the PhilPapers search, references of those were searched. Works of the authors of the selected studies that would help to clarify their position were also considered in the review.

3.1.2 Inclusion and exclusion criteria

Studies published in the form of journal articles in the English language from 2000 until inclusively 2016 (31.10.) were included based on the searches of PubMed and PubPsych. This decision was based on the fact that the majority of the studies about "auditory verbal hallucination" devolved by PubMed and PubPsych were published after 2000. For this reason the results should not differ significant from the ones that would be obtained by including earlier work. Another reason for the inclusion of more recent studies is grounded on the aim of the present work, which is to analyse which (implicit) assumptions about AVHs are guiding its recent investigation. Studies not dealing (explicitly) with AVHs or not focusing on them, pure reviews, pure meta-analyses, pure case reports, as well as treatment studies and studies only probing healthy participants were excluded. Studies not belonging to the areas defined as relevant for the present work were excluded as well.

For the area of philosophy, in addition to work published in the form of articles, chapters of books were included if relevant. According to Romdenh-Romluc (2009, see also González, 2010), hallucinations are studied in two domains of philosophy: first, in what could be called clinical philosophy or philosophy of psychiatry, and second in philosophy of perception. Whereas the first focuses on hallucinations as "real experiences", the latter is more concerned about the "hypothetical hallucination", that is, the possibility of having hallucinations in the sense of having perceptual experiences lacking external stimulation. To put it differently, the latter "address[es] the topic of hallucination, not for its own sake, but only in the context of some wider issues" (Dorsch, 2010, p. 172). This approach, thus, is

usually not concerned with the question of what a hallucination is, but rather operates with the assumption that hallucinations are indistinguishable from veridical perceptions in order to further examine what that means for philosophy of perception. The studies of interest for the present work belong to the first category. As in the present work we are interested in AVHs how they really occur and that are experienced by individuals, articles that treat hallucinations in the area of philosophy of perception will be excluded. For details regarding the selection process, see Figure 5.

3.2 Results for the literature review

3.2.1 Search results

The search described above resulted in n = 1002 studies. Of those studies n = 199 were identified by searching PubMed, n = 180 by searching PubPsych and n = 623 by searching PhilPapers. Based on the inclusion and exclusion criteria, n = 62 studies were consentaneously classified as relevant for the review by the authors. For a complete list of the included studies please consult the appendix.

3.2.2 Overall summary of selected studies

The selected studies include neuroimaging, behavioural studies, internet surveys, as well as neuroscientific, psychological and philosophical theoretical studies. In the following, the research methods used to approach AVHs in the reviewed studies are briefly described.

3.2.3 Research methods used in the reviewed studies

Each discipline comes with different epistemic approaches, epistemic objects, concepts and methods to investigate them (Kotchoubey et al., 2016). Moreover, different disciplines are regularly, but not necessarily, associated with different (implicit) ontological and metaphysical assumptions (Kotchoubey et al., 2016). Accordingly, different disciplines allow us to investigate different features of AVHs.

Following Northoff and Stanghellini (2016) we can thereby distinguish between a phenomenal, a trans-phenomenal and a pre-phenomenal level. “Phenomenal” refers to the level of subjective experience. “Trans-phenomenal” refers to “those features that underlie and […] constitute subjective experience” (p.3). Processes on the trans-phenomenal level are not

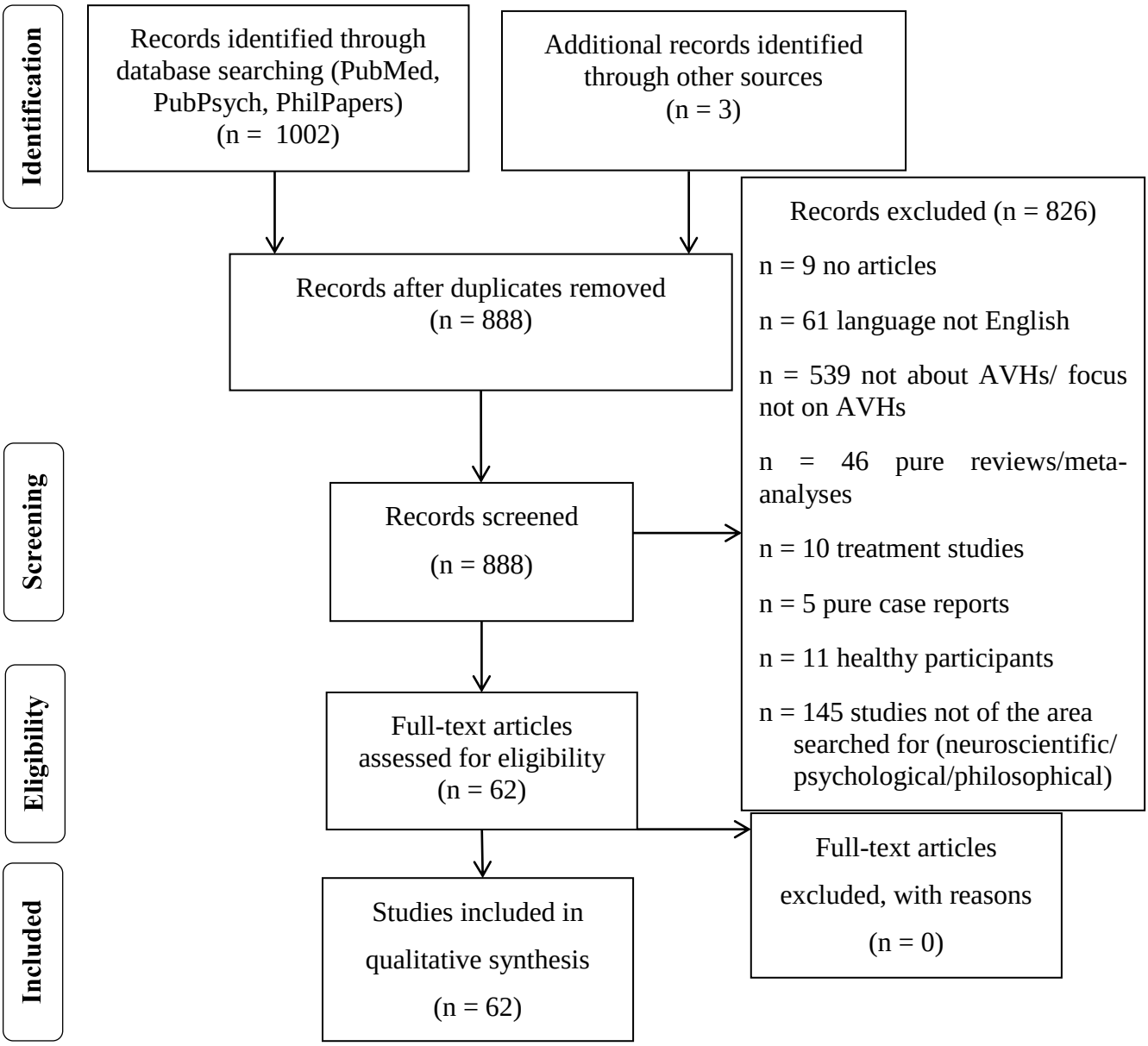

Figure 5 Flow diagram of the search procedure (following the PRISMA guidelines). In addition to the database search, 3 records were identified through the search of references.

subject of direct experience. Nonetheless, one may deduce its characteristics from detailed investigation of phenomenal experience (Northoff & Stanghellini, 2016). Ultimately, the "pre-phenomenal" level refers to the neurobiological level. Just as trans-phenomenal processes, neuronal processes are not subject of direct experience.[12]

[12] It is unclear how exactly those different levels relate to each other. Northoff and Stanghellini (2016) propose that "[t]he "trans-phenomenal" and the "pre-phenomenal" are not two distinct levels of the living organism. They are just *methodologically* distinct" (p.4, italics in the original).

According to this distinction, neuroscientific studies focus on epistemic objects on a pre-phenomenal level and phenomenological philosophical studies focus on the phenomenal as well as trans-phenomenal level. In psychological studies, we can distinguish between two types of epistemic objects: first-person phenomena and behavioural changes, observable from a third-person point of view (Kotchoubey et al., 2016). Here, the former is associated with the phenomenal level, whereas the latter is not concerned with experience, but behaviour.

Different methods, thus, are useful for and at the same time limited to investigate different aspects of AVHs. First-person reports cannot provide us with information about neuronal processes or structure associated with AVHs and a neuroimaging study cannot provide us with information regarding the meaning of a voice-experience.

In the following, we will look more closely on the different methods that are used in the reviewed neuroscientific, psychological and philosophically-informed studies in order to investigate AVHs (see also Figure 6). Thereby we focus on how they may tell us what about voice-hearing and also consider their limitations.

3.2.3.1 What can we learn about voice-hearing with neuroscientific methods?

In each of the reviewed neuroscientific studies we find a combination of two approaches: either first-person reports of voice-hearers or behavioural data are combined with either measures of brain activity or measures of brain structure.

We can distinguish between three different approaches in the reviewed neuroscientific studies. First, in symptom capture studies brain activity during voice-hearing-episodes is recorded. These studies provide us with information about the "neuronal side" of AVHs. Second, in some studies tasks are used that aim at triggering neuronal processes whose dis-function is hypothesised to be related with voice-hearing (state studies). Third, in resting state studies both brain activity in the absence of any tasks and structural brain organisation are investigated – both of which are assumed to be altered in individuals with voice-hearers.

Where can we find heightened brain activation in a voice-hearer's brain?

There are different possibilities for investigating which brain regions are activated during a Voice-experience or a specific task[13]. Functional magnetic resonance imaging (fMRI) studies allow for the localisation of higher blood flow in specific brain regions suggesting higher neuronal activity at that sites (Heeger & Ress, 2002). FMRI, thus, provides indirect evidence

[13] Please note that only because a heightened brain activation may be identified during a voice-experience in a specific part of the brain, that does not mean that it could be localised at there. Such an assumption would amount to a localisatory fallacy (lokalisatorischer Fehlschluss) (Fuchs, 2013a).

for the brain's activation which consists mainly in electrical conduction through neurons (Lodish et al., 2000).

In Positron Emission Tomography (PET) studies, a radioactively labelled substance is injected intravenously into a individuals' body which allows to trace its distribution in the body (van Berckel, Lammertsma, & Boellaard, 2015). In the reviewed study, a form of glucose has been used (Horga, Fernández-Egea, et al., 2014). As glucose-uptake is increased at active brain sites, this technique provides indirect evidence for local heightened brain activity.

What structural alterations can we find in voice-hearers' brains?

By means of structural magnetic resonance imaging (MRI), anatomical images of a voice-hearer's brain can be produced. As water protons behave differently dependent on the characteristics of the tissue they are found in, different tissues may be distinguished with MRI (Berger, 2002).

Diffusion Tensor imaging (DTI), a magnetic resonance imaging technique, can provide further insights into the architecture and connectivity of a voice-hearer's brain. It is based on measuring the distribution of water molecules in the brain as well as their movement rate and direction towards an applied magnetic field (Aung, Mar, & Benzinger, 2013). A widely used measure in DTI-studies is fractional anisotropy, a measure of the directionality of tracts (Alexander, Lee, Lazar, & Field, 2007).

What are the electrophysiological temporal dynamics of a voice-hearer's brain activity?

Electroencephalogram (EEG) studies serve to investigate physiological cerebral processes going along with sensory and cognitive processes in voice-hearers' brains that are thought to be related with voice-experiences.

By means of EEG one can measure both spontaneous and event-related brain oscillations (EROs) as well as event-related potentials (ERPs) within a temporal range of milliseconds. Whereas EROs refer to modulations of ongoing rhythmic neuronal activity,

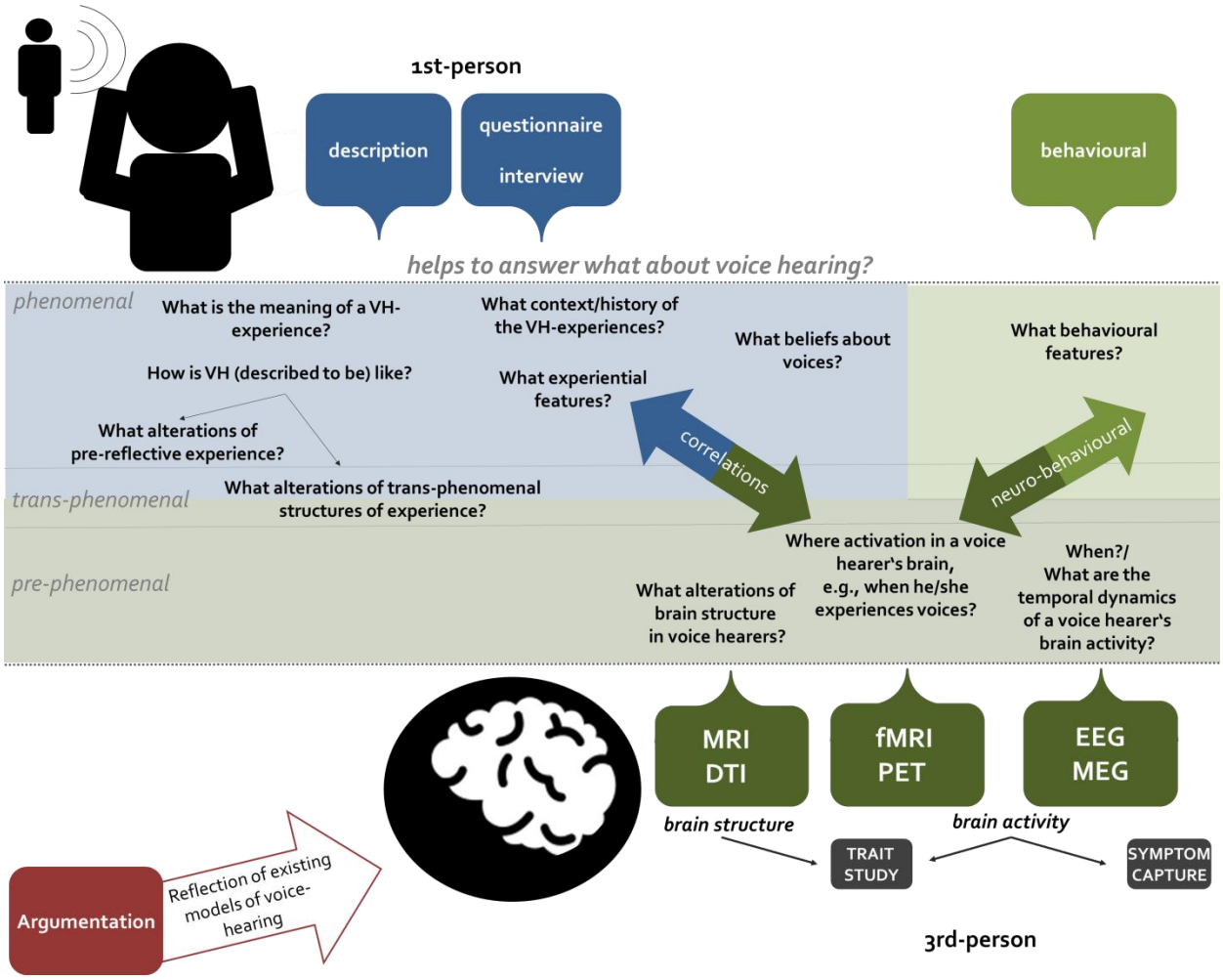

Figure 6 Overview of the methods used in the reviewed neuroscientific, psychological and philosophically-informed studies. Psychological methods are suited to investigate both first-person phenomena as well as behaviour. Questionnaires and interviews are used in order to find out about voice-experiences' contexts as well as beliefs about voices and their experiential features. Voice-hearers' behaviour is studied in order to draw conclusions regarding cognitive underpinnings of such experiences. Behavioural and neurobiological measures are often combined in neuro-behavioural studies about VH. Neurobiological methods allow for studying voice-hearers' brain activation and structure in order to establish which brain regions are activated during Voice-experiences (symptom capture), as well as to investigate trait alterations regarding brain structure and activity that are hypothesised to be related with VH. EEG and MEG are especially suited for investigating temporal dynamics in brain functioning; fMRI and PET for establishing the sites of brain activation; and MRI and DTI for investigating structural brain alterations in voice-hearers. Phenomenological philosophical methods investigate first-person descriptions of voice-experiences in order to identify altered structures of experience (pre-reflective and trans-phenomenal) that might underlie voice-experiences. Phenomenological-hermeneutical approaches aim at identify a voice's meaning within the voice-hearer's life and culture. Moreover, philosophical reflection and argumentation may prove valuable in critically examining the soundness of existing models of VH.

ERPs refer to initially non-existent event-driven neuronal activity in response to specific event or stimuli (Bastiaansen, Mazaheri, & Jensen, 2012)[14].

The EEG-signal relies on voltage fluctuations that are measured at the scalp of a person (e.g., Cohen, 2017). These voltage fluctuations are assumed to result from synchronous rhythmic summed neuronal activity, more specifically postsynaptic potentials (Başar, Başar-Eroglu, Karakaş, & Schürmann, 2000).

ERPs are classified regarding their polarity, that is negative or positive, as well as the time at which they occur related to the stimulus they are associated with (Landa, Krpoun, Kolarova & Kasparek, 2014).

Similarly, magnetoencephalography (MEG) is a technique that allows the measurement of magnetic fields resulting from electric activity of thousands of neurons (which is also the basis for the EEG signal) in a millisecond range (Hämäläinen, Hari, Ilmoniemi, Knuutila, & Lounasmaa, 1993). Analogous to EEG, it can be applied to the study of the resting state or of evoked fields.

Taken together, these methods allow for investigating temporal dynamics of brain activation as well as functional coupling between brain regions in voice-hearers' brains.

Of course, these neuroscientific methods have clear limits in the investigation of AVHs. Neuroimaging studies provide access only to sub-personal, pre-phenomenal aspects of AVHs. Consequently, neuroscientific studies alone are not sufficient for accounting for "the total phenomenon of hallucinations" (Rojcewicz & Rojcewicz, 1997, p. 20). For example, they cannot provide information about or explain the specific content of a voice-experience. Put differently, what we can observe when studying the brain is brain structure, as well as neuroelectrical and neurochemical processes associated with VH, but no semantic aspects of AVHs. Also, as Fuchs (2012a) notes "[n]o imaging of brain activities can provide a psychiatrist with an understanding of what it is like to […] hear voices" (p.335). Note, however, that when studying voice-hearers' brains we are not interested in neuronal processes and structure *per se*, but in if and how they relate to voice-experiences. Therefore the reviewed neuroscientific studies rely on first-person reports of at least the presence or absence

[14] Note that the relationship between both phenomena is not unequivocal (e.g., Andrew & Fein, 2010), nor is it uncontroversial that they constitute completely independent phenomena (e.g., Lu, Doñamayor, Münte, & Bahlmann, 2017).

Spontaneous, as well as event-related brain oscillations range from delta- (~0.5-3.5 Hz) to theta- (~3.5-7 Hz) to alpha- (~8-13 Hz) to beta- (~18-25) to gamma-frequencies (~30-70 Hz) (e.g., Başar, 2013). These frequencies are associated differently with specific cognitive processes, and show varying topographical distributions as well as temporal patterns (Cohen, 2017).

of voice-experiences. Moreover, the reviewed neuroscientific studies often use some type of task and behavioural measures. We will consider these measures that are used in the reviewed neuroscientific in the context of psychological methods in the following section.

3.2.3.2 What can we learn about voice-hearing with psychological research methods?

In psychological studies, we can distinguish between two types of epistemic objects: first-person phenomena and behavioural changes, observable from a third-person point of view (Kotchoubey et al., 2016). These different epistemic objects require different methods that allow for investigating different aspects of AVHs[15].

The mainly used measures for correlating reported voice-hearing experience to brain activity or structure in the reviewed neuroscientific studies are items taken from the Scale for the Assessment of Positive Symptoms (SAPS) (Andreasen, 1984) and the Positive and Negative Syndrome Scale (PANSS) (Kay, Opler, & Fiszbein, 1987).

In the SAPS scale (Andreasen, 1984) the voice-hearing experience is assessed with three items rated on a 5-point scale from none to severe (item auditory hallucinations: "The patient reports voices, noise, or other sounds that no one else hears"; item voices commenting: "The patient reports a voice which makes a running commentary on his behavior or thoughts"; item voices conversing: "The patient reports hearing two or more voices conversing"). In the PANSS rating scale (Kay et al., 1987), voice-hearing is measured by the means of one item that is rated on a 7-point scale from absent to extreme (item hallucinatory behaviour "Verbal report or behavior indicating perceptions which are not generated by external stimuli. These may occur in the auditory visual, olfactory, or somatic realms.").

Another instrument frequently used in the reviewed studies to assess experiential features of voice-hearing are the psychotic symptom rating scales (PSYRATS) (Haddock, McCarron, Tarrier, & Faragher, 1999). In this assessment instrument, voice-experiences are recorded regarding frequency, duration, location and loudness, as well as the voices' content and the distress caused by them. Moreover, beliefs about the origin of the voices are queried.

Taken together, these scales on the aspect of what we have termed "physical properties" of voice-experiences and do not include the aspect of a voice-hearer's relation to

[15] You might wonder why behavioural measures might be relevant for AVH-research, as AVHs are experiential rather than behavioural phenomena. The relevance of behavioural studies for AVH-research is related to theoretical models of AVHs that postulate that AVHs are associated with more general impairments that are also observable on a behavioural level. Therefore, if voice-hearers in a behavioural study would behave systematically differently than non-voice-hearers that could be taken as indication that there might be a (impaired) mechanism underlying both AVHs as well as the observed behavioural differences between voice-hearers and non-voice-hearers.

his/her voices. With exception of the PSYRATS these scales are basically limited to the inquiry of the presence of AVHs and do not capture the fine-grained phenomenology of AVHs. It remains unclear how the response to one item can be mapped to the complex brain organisation (van Tol et al., 2014). These measures, moreover do not allow for the investigation of relational aspects of AVHs.

In order to investigate relational aspects of AVHs and beliefs about voices, specific questionnaires have been developed (Birchwood et al., 2000; Hayward, 2003).

In neuro- as well as psychological sciences, it is often assumed that qualitative experiences can be measured in a quantitative way using those measures (Giorgi, 2005). Apart from this assumption being questionable, it is unlikely that such measures can capture "the essence of qualitative phenomena" (Giorgi, 2005, p. 80)[16]. It is therefore relevant to use methods in AVH-research that allow for the investigation of subjective voice-experience as such. That is where philosophical and especially phenomenological-philosophical methods become relevant.

3.2.3.3 What can we learn about voice-hearing using philosophical methods?

Regarding the methods used in the reviewed philosophical studies, we can roughly distinguish between phenomenological descriptions and analysis and philosophical argumentation.

Phenomenological description and analysis

To put it in the words of the author of some reviewed studies "[p]henomenology helps to explore altered worlds of experience that cannot be elucidated by accumulating data from the 3rd person perspective, e.g., data on brain functions" (Fuchs, 2007, p. 425). In phenomenological philosophical approaches to AVHs in schizophrenia such phenomena assumed to not be understandable in terms of, for example, medical descriptions alone. Rather, referring to early theorists of psychopathology (e.g., Blankenburg, Minkowski), it is assumed that for in-depth descriptions of AVHs in schizophrenia, the inclusion of considerations of the very nature of existence, subjectivity, intersubjectivity is indispensable (Parnas, Bovet, & Zahavi, 2002).

[16] There is, for example, evidence that the personal quality of hallucinatory experiences may differ substantially between individuals that endorse the same item in a questionnaire aiming at the investigation of hallucinatory experiences (Stanghellini, Langer, Ambrosini, & Cangas, 2012).

Phenomenological approaches to AVHs rest on the premise that the study of lived first-person experience can provide us with an understanding of this experience itself (Upthegrove et al., 2016). One objective of phenomenological analysis is to reveal the "essence" or structure of an experience (Upthegrove et al., 2016). Essence, thereby, might be broadly defined as "what makes the phenomenon to be that very phenomenon. That is, the essence or structure illuminates the[…] essential characteristics of the phenomenon without which it would not be that phenomenon" (Dahlberg, 2006, p. 11).

You may now wonder if all researchers who approach AVHs from a phenomenological point of view have first-person experiences of AVHs. Obviously that is not the case. Usually, researchers in this field do not have voice-experiences themselves. For their research of AVHs, instead, they refer to detailed first-person reports of individuals with schizophrenia-spectrum diagnosis. Thus, their approaches are based on data that are obtained by in-depth interviews of individuals with schizophrenia diagnosis either by the respective authors themselves or by others. The so obtained descriptions of first-person experience are then examined in order to try to catch the "essence" of the reported experiences and to reveal the altered structures of experience or the person's existence that might be at the basis of these experiences.

In order to do so, the authors of the reviewed studies fall back on works of influential continental[17] philosophers such as Husserl, Heidegger, and many others. These philosophers themselves have used different methodologies to gain insight into the nature of human experience and existence. It goes beyond the scope of this work to delve into every one of them. However, the "basic" phenomenological method, dating back to Husserl, shall be briefly presented in order to provide the reader with a general impression about the origin of phenomenology.

According to Gallagher and Zahavi (2008), the four basic steps of the phenomenological method comprise the epoché, the phenomenological reduction, the eidetic variation, and the intersubjective corroboration. In the epoché, a person assumes a certain attitude by "bracketing", that is, leaving aside, questions of the world's existence, without thereby negating its existence. This allows describing the phenomena that appear in one's consciousness as they are experienced (phenomenological reduction). The eidetic variation, a type of imaginative variation, then aims at identifying the phenomenon's essence, that is, the

[17] These philosophers are associated with a variety of different phenomenological currents. It is not my concern here to provide a detailed distinction between the specific proposals of different continental philosophers, but to examine how they have been made fruitful conceptualisations of voice-hearing in schizophrenia provided in the reviewed studies.

characteristics of the phenomenon without which it would not be the same phenomenon. In intersubjective corroboration, one can compare one's obtained descriptions with those of others to examine in how far the obtained results are replicated and structures discovered in this process sharable.

In the case of the authors of the reviewed studies that could mean that they put aside "etiological and diagnostic considerations and instead re-focuses on the character and meaning of the patient's experience from their perspective" (McCarthy-Jones, Krueger, Larøi, Broome, & Fernyhough, 2013, p. 3) and in the end check the "appropriateness of [their] findings" (McCarthy-Jones et al., 2013, p. 3) in the clinical context.

There are some possible limitations of this method in the clinical context. Due to cognitive impairments some patients may not be in condition of reliably reporting their experiences, which may render their reports epistemologically unreliable. Moreover, the analyses of first-person reports remain interpretative and may, thus, be biased by the researcher's philosophical position (González, 2010).

Philosophical argumentation

Philosophical argumentation can be defined as a "system of methods, devices, and means, by means of which philosophical systems are based [and] philosophical assertions are demonstrated" (Brutian & Wilson, 1979, p. 77). In a general way and argument can be said to be a "claim-reason complex" which includes some type of conclusion based on certain premises (Hitchcock, 2007). As we will see in the reviewed studies based on philosophical arguments (Gregory, 2016), there are many different types of possible arguments.

Philosophical reflection, moreover, can provide useful for evaluating the plausibility of existing models of AVHs.

3.2.4 Data abstraction

In order to extract conceptualisations of AVHs relevant for the present review the selected works were grouped regarding the constructs and concepts[18] in context of which AVHs were conceptualised in the respective studies (for an overview of the identified concepts, see

[18] At this point it may be useful to shortly consider the difference between the notions "concept", "construct" and "models". The notions of "concept" and "construct" are often used interchangeably (Markus, 2008). They can be roughly defined as theoretical abstractions (Hox, 1997). Often, constructs are regarded as operationalised concepts (Watt & van den Berg, 1995). Concepts and constructs in turn can be considered the "building blocks" of theoretical models (Smith & Albaum, 2005). A theory can be considered as a set of concepts that are interrelated (Kerlinger, 1986).

Figures 12 and 14). Neuroscientific, psychological and clinical-philosophical approaches to voice-hearing have been designed and interpreted based on various constructs and concepts assumed to be related with or to explain AVHs. These include neurobiological concepts, such as (altered) neuronal connectivity, (altered) neuronal synchronisation, predictive processing and auditory processing, auditory cortex hyperactivity and self-monitoring. In other neurocognitive approaches AVHs have been conceptualised by means of the concept of memory. In the context of neuroscience as well as in philosophical accounts, AVHs have also been conceptualised as compensatory phenomena. In addition AVHs have been associated with a concept referring to motor action, namely subvocalisation. Moreover, concepts referring to cognitive dispositions, such as cognitive biases and beliefs about voices have been related to AVHs. The so far mentioned concepts focus on AVHs as auditory experiences that are experienced as not being produced by oneself.

Psychological approaches to AVHs, in contrast, focused on the relational phenomenology of such experiences, as well as the context of their development. These concepts have also been taken into account in clinical-philosophical approaches to AVHs.

Clinical-philosophical approaches towards voice-hearing included in the review phenomenological concepts such as ipseity, and passive synthesis amongst others that refer to the structure of experience.

We will probe in how far the used concepts for approaching voice-hearing overlap and if and how those different approaches can be used fruitfully for an interdisciplinary conceptualisation of voice-hearing.

Moreover, in a first step studies focusing directly on the brain's activity during voice-experiences will be reviewed.

4 Neuroscientific and cognitive psychological approaches to voice-hearing

4.1 What happens in the brain when someone "hears a voice"? – Symptom capture studies of voice-hearing

Among the brain regions activated during voice-experiences, there are regions that have been found to be active during speech (e.g., Broca's area), memory (e.g., hippocampus), and emotion processing (e.g., insula). Most of the reviewed symptom capture studies focused on language brain areas in their analysis[19].

4.1.1 Brain regions associated with language processing

The following brain regions associated with language processing were found to be activated during voice-experiences in individuals diagnosed with a psychotic disorder and frequently experiencing voices in fMRI studies: bilateral inferior and middle frontal areas, as well as predominantly left-sided superior temporal gyrus (Looijestijn et al., 2013). In another fMRI study, higher activation of the left superior temporal sulcus, a part of the auditory cortex, was found during hallucinations as compared to blank trials in voice-hearers with a schizophrenia diagnosis (Horga, Peterson, et al., 2014). This area contains a voice-selective region, that is, a region that has been found to be selectively activated in response to vocal sounds (Belin, Zatorre, & Pike, 2000).

Looijestijn et al. (2013) report a higher activity in the left planum temporale for individuals that reported hearing voices as coming from external space as compared to those that report experiencing their voices as coming from inside. The planum temporale is situated in the surface of the temporal lobe, coinciding partly with the Wernicke's area (Shapleske, Rossell, Simmons, David, & Woodruff, 2001). The authors propose that these structures are involved in mediating the externalisation of experienced voices in AVHs.

In yet another fMRI study, in a sample of five participants diagnosed with schizophrenia and AVHs, uni- or bilateral activation of parts of the Heschl's gyrus was found during voice-experiences in some, but not all, participants (van de Ven et al., 2005). During acoustic stimulation, auditory cortex activation was found for all participants.

[19] Please note that the one brain region might be associated with a great range of different functions. Therefore the division into, for example, language and emotion brain regions must be regarded as simplifying.

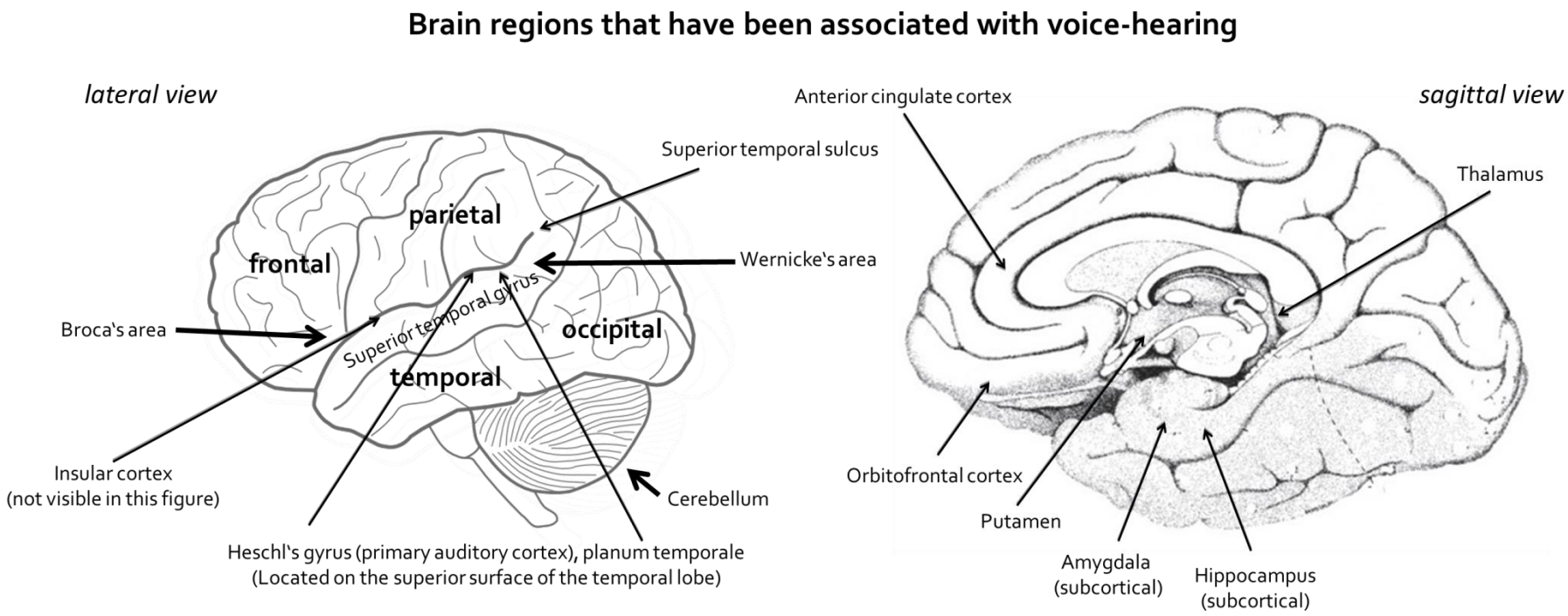

Figure 7 Brain regions that have been related to voice-hearing in symptom capture and trait studies. Left side: overview of the brain's lobes (frontal, temporal, parietal, occipital) as seen on the left side of the brain (lateral view). Broca's area, Wernicke's area, the superior temporal gyrus (STG), insula, Heschl's gyrus, planum temporale, cerebellum have all been found to be active during the experience of voices. Right side (sagittal view of the right hemisphere): the anterior cingular cortex has also been found to be active during the experience of voices. Structural and functional alterations in voice-hearers have also been reported. A reduced gray matter concentration, for example, has been reported for the amygdala, hippocampus and putamen amongst others.

(brain images taken from free websites: http://www.clker.com/clipart-brain-sketch.html; http://humandiagram.info/blank-brain-diagram/).

The detection of an auditory component of interest was associated with the duration of the hallucination experience, which the authors interpret as an indication that only longer lasting hallucinations may be detectable using fMRI. Moreover, in this study, analysis of the temporal pattern of the hallucinations revealed a large variability of the BOLD responses of the components of interest within individual voice-hearing episodes.

In an *EEG*-symptom capture study, an increased alpha-band coherence between the left and the right temporal cortices (Broca's area and Wernicke's area and their homologues) was observed in individuals with a schizophrenia diagnosis who were hallucinating as compared to when they were not (Sritharan et al., 2005). No changes in coherence between Broca's and Wernicke's area were observed *intra*hemispherically. Additionally, the authors found an increased alpha-band power in the left auditory cortex during AVHs, which is somewhat contradictory to the fMRI symptom capture studies, as increased alpha-band power is associated with decreased activity in a brain region (Klimesch, 2012).

In a MEG symptom capture study, a decreased beta-band power in the left middle and superior temporal gyrus (where the Wernicke's area is located) was observed during voice-hearing (van Lutterveld et al., 2012). Decreases in beta-band power have been associated with dis-inhibition (Neuper & Pfurtscheller, 2001) meaning that the superior temporal gyrus is activated in AVHs, which is in line with the fMRI symptom capture studies.

4.1.2 Brain regions associated with emotion processing

Besides brain regions associated with language processing, brain areas associated with emotion processing, amongst others, have been found to be active during the experience of voices. These include the bilateral insula, as well as the anterior cingulate gyrus (Looijestijn et al., 2013). The anterior cingulate cortex is connected with the frontal, temporal, as well as parietal cortex and its activity has been associated with anxiety, but also with movement (Grunwald, Kurthen, & Elger, 2008). As we have seen that AVHs in schizophrenia are predominantly of negative content, we could speculate that activity in this region might go along with anxiety elicited by this content. Moreover, the anterior cingulate cortex has been associated with speech processing (Wilson, Molnar-Szakacs, & Iacoboni, 2008).

4.1.3 Brain regions involved in action

In a fMRI symptom capture study the left motor cortex and right cerebellum have been found to be activated amongst other brain regions (Looijestijn et al., 2013). In the same study, a higher activation in the premotor cortex was reported for voice-hearers who reported to

experience their voices as coming from the external space (vs. internal). Looijestijn et al. (2013) propose that the activation of the motor cortex and the cerebellum observed in their study is due to the participants' motor act of pressing a balloon to indicate the onset of a voice-hearing experience.

However, it has also been proposed that both voices that comment on the voice-hearer's actions and voices that command to perform an action go along with activation in motor brain regions associated with the respective action (Badcock, 2010). The cerebellum has also been proposed to play a role in voice-hearing by monitoring if an action is self-generated (e.g., Seal, Aleman, & McGuire, 2004). Therefore, its activation may not be merely a confound of the action of pressing a button. Moreover, the premotor cortex has been found to be active during speech processing (Wilson et al., 2008).

4.1.4 Brain regions associated with memory processing

Looijestijn et al. (2013) also report higher activity in parts of the right prefrontal cortex for voice-hearers who reported to experience their voices as coming from the external space. Activity in the right prefrontal cortex has repeatedly been associated with episodic memory retrieval (Buckner & Petersen, 1996). This in line with studies indicating that a subgroup of voice-hearers reports that their voice's content resembles memories.

A *MEG* symptom capture study revealed a decrease in alpha-band power in the right inferior frontal gyrus (where Broca's homologue is situated) during AVHs (van Lutterveld et al., 2012). As alpha-band synchronisation as expressed by increase in alpha-band power has been associated with inhibition of brain regions (Klimesch, 2012), the observed reduction in alpha-band power might indicate increased activity in this region associated with episodic memory processing.

In a MEG study, a decrease in theta-band power (thought to be generated in the hippocampus) was found in the right hippocampus during AVH-onset, which the authors interpret as evidence for the role played by abnormal theta band activity in memory-related brain regions in AVHs (van Lutterveld et al., 2012).

Taken together, the reviewed symptom capture studies indicate that during voice-experiences a wide cluster of brain areas is activated. These area include the secondary auditory cortex, as well as the primary auditory cortex in some cases (van de Ven et al., 2005). However, brain activation patterns seem to be highly individual (van de Ven et al., 2005). It is also important to note that activation in speech processing areas during AVHs does not imply

that voices are experienced in an auditory way. It has, for example, been shown that voice-selective brain regions are also activated when one reads direct speech (Yao, Belin, & Scheepers, 2011), which does not necessarily go along with an auditory experience. That van de Ven et al. (2005) found activation in the primary auditory cortex in some but not all voice-hearers participating in their study fits with the fact that some but not all voice-hearers experience literally auditory voices. Given the often "social" phenomenality of voice experiences that imply voices "acting" on the voice-hearer by means of different speech acts (e.g. judging, commanding) future symptom capture studies could provide different brain activation patterns for different content or speech acts of voices.

4.2 Voice-hearing as characterised by altered connectivity and synchronisation

The construct of connectivity is crucial for recent conceptualisations of the brain's activity and its alterations related to pathology (Decker, Fillmore, & Roberts, 2017). The idea that dis-connectivity in the brain is related to schizophrenia, and thus to voice-hearing, is as old as the term itself (Friston, 2002). The dis-connectivity theme is still widely present in neuroscientific studies concerning voice-hearing, whereby no consensus exits if there is a decreased or a heightened connectivity. One can distinguish between functional and structural connectivity, the relation between them not being fully understood (Damoiseaux & Greicius, 2009).

Functional connectivity is assumed to exist between different neurons if they are activated in a temporal coherent pattern (e.g., Friston, Frith, Liddle, & Frackowiak, 1993). If recorded oscillatory waveforms from different locations resemble each other, this is termed neuronal synchrony or coherence, and assumed to indicate interdependence between neuronal assemblies (Sritharan et al., 2005). This is usually interpreted to reflect functional connectivity between neuron populations (Bowyer, 2016). Synchronisation in this context can be defined as the phase-locking of neural oscillations (Rodriguez et al., 1999). The idea is that neuron populations in different places of the brain ("oscillators") synchronise during the execution of cognitive or sensory tasks (Cohen, 2017).

Structural brain connectivity refers to the brain's anatomical connectivity, as for example connections of distant brain regions by white matter fiber tracts (Honey et al., 2009).

Table 1

Overview over the brain regions found to be involved in the experience of voices in the reviewed symptom capture studies.

Authors (year)	**Participants**	**Type of study**	**Brain regions with increased activity in relation with AVHs/tasks (if not otherwise noted)**
Horga, Peterson, et al. (2014)	N= 10 schizophrenia patients with AVHs (DSM-IV) N= 10 healthy controls most patients: antipsychotic medication	fMRI Symptom capture/ task-related	- superior temporal sulcus & middle temporal gyrus in right AC (voice-sensitive area) more active AVH vs. blank trials
Looijestijn et al. (2013)	N= 52 psychotic patients with AVHs (DSM-IV) schizophrenia (77%) schizoaffective disorder (4%) psychosis not otherwise specified (13%); personality disorder (6%)	fMRI Symptom capture	- bilateral inferior and middle frontal areas - bilateral insula - anterior cingulate gyrus - predominantly left-sided superior temporal gyrus - medial left-sided planum temporale - right dorsolateral prefrontal cortex & premotor cortex with a higher activity in these regions in the external AVH group - left motor cortex and right cerebellum
van de Ven et al. (2005)	N = 6 schizophrenia patients with AVHs (DSM-IV) all on antipsychotic medication	fMRI Symptom-capture/ task-related	for N=3 patients: 1 COI that encompassed primary and secondary AC - pat. A: COI comprised clusters in left Heschl's gyrus; - pat.D: bilateral Heschl's gyrus - pat.E: right anterior & lateral Heschl's gyrus & posterior superior temporal gyrus)
Sritharan et al. (2005)	N = 7 schizophrenia patients with AVHs (DSM-III-R) all on antipsychotic medication	EEG Symptom-capture	- increased alpha-band coherence between the left and the right temporal cortices (Broca's area and Wernicke's area and their homologues) - increased relative alpha-band power in the left auditory cortex
van Lutterveld et al. (2012)	N =10 schizophrenia patients with AVHs N = 2 psychosis not otherwise specified with AVHs (DSM-IV) all but 4 on antipsychotic medication	MEG Symptom-capture	- decrease in alpha-band power in the right inferior frontal gyrus (where Broca's homologue is situated) - decreased beta-band power in the left middle and superior temporal gyrus (where Wernicke's area is situated) - decrease in theta-band power was found in the right hippocampus during AVH-onset

4.2.1 Altered functional connectivity in voice-hearers

Reduced connectivity between Wernicke's and Broca's area in schizophrenia patients with AVH compared to controls without a diagnosis has been found in a fMRI study using dynamical causal modelling (a method for investigating the strength of connectivity between populations of neurons) (Ćurčić-Blake et al., 2013). This reduced connectivity was found during a phonological task, assumed to require inner speech, in which participants had to decide if words were stressed on their first or their second syllable. Moreover, a reduced connectivity between Broca's and Wernicke's homologues in the right hemisphere and Broca's area was found during this task. However, the group of patients with voice-experiences did not differ significantly from the patient group without voice-experiences in connectivity strength, which in turn did not differ significantly from the control group. The authors contextualise their study within the dis-connectivity hypothesis of AVHs which states a reduced connectivity between language-related brain areas in schizophrenia patients, especially those experiencing voices.

In another fMRI study comparing schizophrenia patients, both with and without AVHs, and healthy controls, a reduction in functional connectivity strength in fronto-parietal-temporal brain areas was observed for the patient group as a whole in a task that required listening passively to emotional words mirroring AVH content (Escartí et al., 2010).

In EEG-studies, altered coherence between neuron populations has been reported for different frequency-bands in several studies focusing on voice-hearing. A reduced gamma-band synchrony in schizophrenia patients between the left and the right primary auditory cortices as compared to healthy controls in response to periodic auditory stimuli has been reported (Mulert, Kirsch, Pascual-Marqui, McCarley, & Spencer, 2011). The sensory cortex, in this case, is assumed to act as a "tuned oscillator", since a synchronisation of the oscillatory frequency-phase with the phase of the stimulus can be observed.

Alterations in the synchrony of brain oscillations, hence, are not only observed during voice-experiences themselves but also related to sensory processing in individuals with AVHs per se. However, although a reduced gamma-band synchrony in individuals reporting voice-experiences was observed as compared to individuals without psychiatric diagnoses, *within* the group of individuals with voice-hearing experience, those reporting more severe AVHs (as measured by the SAPS) showed a *higher* oscillatory synchrony between the primary auditory

cortices as individuals reporting less severe AVHs when presented with periodic auditory stimuli (Mulert et al., 2011).

This result has been hypothesised to indicate that a certain preserved degree of synchronisation might be necessary for an activation of sensory cortices that, in turn, might give rise to AVHs (Cho & Wu, 2013).

Even in resting state, oscillatory brain activity has been observed to be altered in voice-hearers with schizophrenia diagnosis when compared to individuals with a schizophrenia diagnosis but without AVH. More precisely, heightened beta 1 and beta 2 frequency amplitudes in individuals with voice-hearing experiences were found, which were identified to be generated in left inferior parietal lobule and left medial frontal gyrus (Lee et al., 2006). Moreover, a significant correlation of gamma and beta (2 and 3) frequencies was observed in this group. The authors conclude that AVHs reflect altered beta oscillations that have generators in brain areas related to speech. Critically, the authors did not control for the occurrence of voice-experiences during EEG-recording. For that reason, it is unclear whether their study reflects rather trait or state-alterations in brain oscillations in individuals with voice-hearing experience.

What can we learn from those studies? Neuronal oscillations in different frequency bands occur superimposed and it is unlikely that one specific frequency range is associated with one specific cognitive phenomenon in an exclusive manner (Engel & Fries, 2010). In a general way we might hypothesise that Mulert et al.'s (2011) study hints at an altered (neuronal) responsivity to environmental stimuli. How this might correspond to AVHs specifically remains a speculation.

In connection with Lee et al.'s (2006) study, evidence from a study investigating predictive processing is interesting. In that study, it has been found that when an auditory stimulus did not correspond to the stimulus that would have been predicted after the presentation with a visual cue, a coupling of beta- and gamma oscillations was observed (Arnal, Wyart, & Giraud, 2011). Supposing that the participants in Lee et al.'s (2006) study were really experiencing AVHs during recording, it could be that the observed correlation between beta- and gamma-oscillations might reflect that the AVHs were not anticipated by the participants. We will consider the idea that AVHs might be mental events that are faultily predicted later on in this work (section 4.8).

The concepts of synchrony and coherence have not only been used to conceptualise voice-hearing studies measuring neural oscillations. Van Lutterveld et al. (2012) transfer the concept of coherence from a neuronal level to the level of conscious experience: based on the assumption that theta-band waves coordinate gamma band waves that are, in turn, associated with the "coherent line" of conscious experience, they hypothesise that the observed theta-band aberrations during AVH-onset may disrupt the coherence of conscious experience and therefore result in an increased focus on memory representations during voice-hearing.

4.2.2 Altered structural connectivity in voice-hearers

In terms of brain anatomy, a lower gray matter volume of the left superior temporal gyrus in individuals diagnosed with schizophrenia as compared to healthy controls was found in a MRI study, irrespective of them reporting voice-experiences or not (van Tol et al., 2014). In the same study, individuals with AVHs showed a decreased gray matter volume in the following brain regions: left inferior frontal gyrus and right hippocampal gyrus (compared to the healthy controls) and left putamen (compared to the patients not reporting voices). Reduced gray matter concentration in voice-hearers in the left inferior frontal gyrus was also found in another study comparing voice-hearers with schizophrenia diagnosis and healthy controls, along with a reduction in gray matter concentration in amygdala, insula, STG, and right postcentral gyrus (Aguilar et al., 2008). In line with these findings, a progressive decrease in gray matter volume in the left STG and right orbitofrontal cortex has also been observed in a longitudinal study in individuals with schizophrenia diagnosis as compared to healthy controls (Mané et al., 2009).

As we have reviewed before, frontal cortices and the STG are implicated in speech processing and the hippocampus is related with memory processing. Regarding the putamen, a recent meta-analysis found that in tasks that require language processing the putamen is regularly co-activated with a range of other brain regions associated with speech processing, such as the inferior frontal and superior temporal gyrus (Viñas-Guasch & Wu, 2017). The putamen has also been proposed to be implicated in motor and emotional processing (Groenewegen, 2003) and working memory (Sefcsik et al., 2009).

Regarding white matter volume, an *in*crease was found in patients experiencing AVHs compared to those that do not in the postcentral gyrus (van Tol et al., 2014). In that vein, a higher directionality of the white matter in the lateral arcuate fasciculus, a white-matter fibre bundle connecting temporal and frontal cortical brain areas (Rilling et al., 2008), and the corpus callosum, a fibre bundle connecting the brain's left and right hemisphere (Hofer &

Frahm, 2006), in voice-hearers with schizophrenia diagnosis as compared to individuals with the same diagnosis but without voice-hearing experience and healthy controls has been found (Hubl et al., 2004). However, Catani et al. (2011), using the same method (DTI), found the opposite effect: a reduced directionality in the lateral arcuate fasciculi, bilaterally in voice-hearers with schizophrenia diagnoses.

4.2.3 Alterations in structural and functional connectivity united

Van Tol et al. (2014) speculate that reduced neuronal density goes along with lower inhibitory activity and thus leads to functional *hyper*connectivity between the structures associated with voice processing and language production, increasing, together with abnormalities in memory-related structures, the probability of experiencing voices. Likewise, Hubl et al. (2004) propose that heightened white matter directionality in the arcuate fasciculus might give rise to abnormal activation in brain areas related to acoustic processing of external stimuli in individuals experiencing voices. More specifically, it has been hypothesised that a higher white matter directionality observed in the arcuate fasciclus in voice-hearers may enable the co-activation of the primary auditory cortex, for example, during the generation of inner verbal material and thus contribute to a voice's auditory quality (Strik & Dierks, 2008). They propose that a structural increase of connections between the frontal and the temporal lobe might goes along with a functional dis-regulation between frontal brain areas associated with the generation of speech and temporal brain regions associated with the perception of speech.

Taken together, it is suggested that deficient coordination between different brain regions may be at the root of AVHs.

However, given the phenomenal richness and individuality of voice-experiences, as well as the range of brain regions implicated in VH and their functions, it seems unlikely that one specific pattern of structural and functional alterations can be determined for all voice-hearers.

4.3 Voice-hearing as symptom of a brain disease

In neuroscientific literature, AVHs have also been conceptualised as a symptom of the "brain disease" (p.434) that schizophrenia represents (Aguilar et al., 2008). In this sense, Strik and Dierks (2008) attempt to describe AVHs in terms of neurobiological events and argue that they should be redefined in a "neurobiologically meaningful way" (p.66). In order to achieve that, they aim at translating the "psychiatric symptom" of voice-hearing into brain dis-functions. They base their argumentation of what they take as the foremost paradigm in psychiatry, namely that psychiatric symptoms are based on brain dis-regulation.

Table 2

Overview over studies regarding brain connectivity and synchronisation in voice-hearers reviewed in the present work.

Authors (year)	**Participants**	**Type of study**	**Brain regions with increased activity or structural changes in relation with AVHs/tasks (if not otherwise noted)**
Mulert et al. (2011)	N = 18 schizophrenia patients with AVHs (DSM-IV) (all on antipsychotic medication) N = 16 healthy subjects	EEG task-related (auditory steady-state paradigm)	- reduced interhemispheric phase-locking in the gamma-band frequency range - positive correlation between phase synchronisation between the primary auditory cortices and auditory hallucination symptom score and
Lee et al. (2006)	N = 25 schizophrenia patients with AVHs N = 23 schizophrenia patients without AVHs (DSM-IV) (all on antipsychotic medication)	EEG Resting state/ symptom capture (?)	- significantly increased beta activity in left inferior parietal lobule (beta 1) & left medial frontal gyrus (beta 2) in AVH vs. non-AVH patients - greater beta activation in left anterior and posterior regions in AVH-patients as compared to non-AVH patients - significant correlations between gamma and beta powers in AVH-patients
Ćurčić-Blake et al. (2013)	N=30 schizophrenia patients with AVHs N=17 schizophrenia patients without AVHs N=31 healthy subjects	fMRI task-related (phonological task assumed to require inner speech)	- reduced connection Wernicke's and Broca's area - trend towards reduced connection Broca's area + its homologue, as well as Wernicke's area's homologue
Escartí et al. (2010)	N=27 schizophrenia patients with AVHs N=14 without AVHs (DSM-IV) (all on antipsychotic medication) N=31 healthy subjects	fMRI task-related (emotional word paradigm)	- reduction in functional connectivity strength in fronto-parietal-temporal brain areas for the patient group as a whole

Table 2
continued.

Aguilar et al. (2008)	N = 11 schizophrenia patients with AVHs (DSM-IV) N = 10 healthy subjects	fMRI (emotional vs. neutral word paradigm)	- enhanced activation of limbic and frontal brain areas patients (inclusive the frontal lobe, temporal cortex, insula, cingulate gyrus, amygdala) - reduced gray matter concentration in patients in left inferior frontal gyrus, amygdala, insula, STG, and right postcentral gyrus
	N = 18 schizophrenia with AVHs (DSM-IV) N = 19 healthy subjects (all patients on antipsychotic medication)	MRI (voxel-based morphometry)	
van Tol et al. (2014)	N=31 schizophrenia patients AVHs N= 20 schizophrenia patients without AVHs (DSM-IV) (N = 41 on antipsychotic medication) N=51 healthy subjects	MRI resting-state	- patients: lower STG gray matter volume (independent of hallucination presence) - voice-hearers vs. healthy controls = lower gray matter volume of left IFG & right hippocampal gyrus - voice-hearers vs. non-voice-hearers: lower volume of left putamen - voice-hearers vs. non-voice-hearers: higher white matter volume in postcentral gyrus (extending into superior parietal lobule & medial precuneus)
Hubl et al. (2004)	N = 13 schizophrenia patients with AVHs N = 13 schizophrenia patients without AVHs (ICD-10) (all but 2 on antipsychotic medication) N = 13 healthy subjects	DTI	- AVH-patients: significantly higher white matter directionality in lateral parts of temporoparietal section of arcuate fasciculus and parts of anterior corpus callosum
Catani et al. (2011)	N = 17 schizophrenia patients with AVHs N = 11 schizophrenia patients without AVHs (DSM-IV) (all but 3 on antipsychotic medication) N = 59 healthy subjects	DTI	- schizophrenia patients: bilateral reduction of fractional anisotropy in the arcuate fasciculi (specific to connections between posterior temporal & anterior regions in inferior frontal and parietal lobe) - AVH patients: reduction in FA in these tracts = highest + bilateral patients without AVH: reduction only reported on the left

Aguilar et al. (2008) take into account genetic factors proposing that specific genetic polymorphisms, that is, different forms in which a gene may exist, may dispose some individuals genetically to hear voices. Specifically, a gene related to the neuronal language system is proposed to be linked to temporal lobe abnormalities, which are assumed to increase the likeliness to experience voices. In addition, abnormal functioning of serotonin, a neurotransmitter related to the modulation of emotional responses that acts in the limbic system and frontal lobe, is assumed to modulate the emotional responses of voice-hearers to their voices. This abnormal functioning, the authors suggest, is due to a polymorphism of the serotonin gene which predisposes an individual for abnormal emotional responses to such experiences. Without explaining further how, the authors propose that cultural factors, moreover, influence the content of a voice. Taken together, Aguilar et al. (2008) claim that certain genetic polymorphisms make humans vulnerable to language disorders and abnormal emotional responses. Those vulnerabilities together, according to the authors, may be at the basis of voice-experiences that are further shaped by cultural influences.

Similarly, Strik and Dierks (2004, 2008) assume that AVHs result from pathological functioning of functional brain systems related to language. They assume that AVHs can directly be attributed to a language loop spanning frontal and temporal brain regions including Broca's area, Wernicke's area, Heschl's gyrus and the arcuate fasciculus, the fibre bundle connecting those regions. They propose that the conscious experience of voice-hearing results from an abnormal activation of the primary auditory cortex usually only occurring in response to "external" auditory stimuli. More specifically, they propose that in voice-hearers, besides the activation of Broca's and Wernicke's area, the additional activation of the left Heschl's gyrus leads to the experience of inner speech as an external acoustic stimulus, for example. Remember, however, that the Heschl's gyrus is not activated in all voice-hearers when they experience voices (van de Ven et al., 2005). Moreover, this proposal relies on the conceptualisation of voice-hearing as being "similar to a real perception and [having a] subjective sense of being externally generated" (Strik & Dierks, 2008, p. 68), which is not true for all voice-experiences.

4.4 Voice-hearing as compensatory phenomenon

Strik and Dierks (2004), amongst others, have also proposed to conceptualise AVHs based on the concept of compensation. They regard deficits of receptive speech caused by a "structural weakness of the sensory speech area" (p.373) as the primary deficit in voice-hearing. They

assume that such a structural weakness of Wernicke's area is caused by either genetic, environmental or genetic factors. In the case of AVHs, Strik and Dierks (2004) postulate, structural and functional impairments of the Wernicke's area (an area of "speech reception") are tentatively compensated for by an overstimulation of this area. This overstimulation, according to the authors, is realised by the activation of the Broca's area (an area of "speech production") that is connected with the Wernicke's area.

Referring to studies examining neural oscillations in voice-hearers with schizophrenia diagnosis, it has also been proposed to conceptualise voice-hearing as a compensation mechanism of the brain (Sperling, Bleich, Maihöfner, & Reulbach, 2009). This proposal is based on previous findings of a general slowing of delta-theta activity in the temporal lobe in individuals with schizophrenia diagnoses, but increase of beta-activity in the temporal lobe during auditory hallucinations. AVHs, according to these authors, would then be a consequence of a self-healing mechanism of the brain, and in that sense adaptive processes and actually no sign of illness, but secondary to it.

However, both proposals lack a specific proposal of *how* the putative compensation mechanisms compensate for the "primary" deficit and why they are appropriate for compensating for them. Moreover, the conceptualisation of voice-hearing as a result of a brain disease or compensatory neuronal activity does neglect the personal meaning voices have for voice-hearers. Therefore it must be critically assessed that AVHs are merely epiphenomena of brain activity. Structural brain alterations, for example, do not constitute a necessary condition for the occurrence of a voice carrying a specific meaning for a voice-hearer.

4.5 Voice-hearing as associated with impaired auditory processing

As AVHs are often taken as auditory experiences lacking corresponding external stimulation, it has been probed whether abnormal auditory processing could be associated with those experiences. In these studies AVHs are conceptualised as resulting from or at least being associated with altered auditory processing.

The reviewed studies provide some evidence for altered auditory processing on a neuronal level. During sound processing, reduced gamma-band synchrony between the left and the right primary auditory cortices (Heschl's gyri) was observed in schizophrenia patients when compared to healthy controls (Mulert et al., 2011). In the same study, a positive correlation between participants' scores on a measure of auditory hallucinations and phase synchronisation between the primary auditory cortices is reported. Considering neuronal oscillatory synchrony as reflecting functional coupling of brain areas, these results indicate a weakened coupling of

the left and right primary auditory cortex in voice-hearers with a schizophrenia diagnosis as compared to healthy controls. Within the voice-hearers group, those reporting more severe voice-experiences showed higher gamma-band synchronisation (Mulert et al., 2011).

Also, differences in neuronal auditory processing of *emotional* stimuli were found between individuals diagnosed with chronic schizophrenia (and AVHs vs. no AVHs) and healthy controls in fMRI- and PET studies when they were presented with emotional words (Aguilar et al., 2008; Escartí et al., 2010; Horga, Fernández-Egea, et al., 2014). In a fMRI study, increased activity in the amygdala and hippocampal gyrus was found in voice-hearers with schizophrenia diagnosis when listening to emotional words when compared to the two control groups (Escartí et al., 2010). Additionally, in this study voice-hearers with a schizophrenia diagnosis showed a lack of activation in the insula compared to the other two groups. In another fMRI study, voice-hearers listened to emotional words, mimicking their voices' content as well as non-emotional words (Aguilar et al., 2008). Heightened activation during listening to emotional as compared to non-emotional words was found predominantly in the middle and superior temporal gyri.

Likewise, heightened cerebral activity in limbic and paralimbic brain areas including the amygdala, hippocampus and superior temporal gyrus was reported for voice-hearers who listened to personalised auditory stimuli mimicking their voices' content (Horga, Fernández-Egea, et al., 2014). Furthermore, they reported heightened interactions between the amygdala and auditory brain regions in this group (as compared to healthy controls), as well as weakened connectivity between amygdala and prefrontal regions. This, according to the authors, could indicate an impaired top-down regulation of the amygdala by prefrontal cortices in voice-hearers, which in turn might lead to an abnormal amygdalar modulation of auditory brain regions.

It remains to be clarified if these results really point to a general emotional auditory processing abnormality in voice-hearers, or if they simply mirror the heightened emotional impact that hallucination-related speech has for voice-hearers. One should also be careful with inferring that a heightened activity of the amygdala is responsible for the emotional significance a voice-like stimulus carries for a voice-hearer. This emotional significance, of course, must be due to a personal meaning that a voice-experience has for a voice-hearer – a meaning that cannot be found on a subpersonal level of analysis. It does not seem to be surprising that due to this personal significance voice-hearers differ from non-voice-hearers in their response to stimuli resembling their voices.

Altered auditory processing has also been integrated in theoretical models of AVHs. Badcock (2010) proposes a parallel auditory pathways framework of voice-hearing which is based on the assumption that AVHs represent cases of false perceptions. The base of this framework is a model of "normal" auditory perception stating a "what" (ventral) and a "where" (dorsal) pathway for auditory perception in the brain. Whereas the former is thought to be relevant for identifying sounds (e.g., specific voices), the latter is thought to be implicated in their localisation. The author proposes that abnormal activity in those pathways may be related to specific phenomenological features of AVHs. First, an abnormal activation of the "what" pathway is proposed to be at the origin of an experience of auditory perception when corresponding external stimulation is absent. Impaired basic auditory processing is further proposed to result from impaired processing of prosody and therefore resulting in the prevalence of male voices reported by voice-hearers, as they are assumed to be acoustically less complex than female voices. On the other hand, altered functioning of the "where" pathway is proposed to be related with the perceived source of a voice.

Taken together, the approaches reviewed in this section are based on the assumption that a deficit in auditory processing, concerning speech in particular and auditory stimuli in general, might be related to the occurrence of AVHs.

However, attempts to conceptualise AVHs in terms of auditory processing deficits pose several problems. First, it is unclear how exactly such deficits might be related with AVHs. Second, given the rich experiential features of voice-experiences, it seems unlikely that AVHs are simply a problem of "hearing". Such an account would neglect the personal "message-like" meaning voices use to carry for voice-hearers. Not lastly, there is evidence that a large part of voice-hearers does not literally have experiences of "hearing" when they experience voices (e.g., Jones & Luhrmann, 2016).

Table 3

Overview over the reviewed studies regarding speech processing in voice-hearers.

Authors (year)	Participants	Type of study	Main results
Escartí et al. (2010)	N=27 schizophrenia patients with AVHs N=14 without AVHs (DSM-IV) (all on antipsychotic medication) N=31 healthy controls	fMRI task-related (emotional word paradigm)	- increase of activity in the parahippocampal gyrus and the amygdala during passive listening of emotional words in voice hearers - controls & schizophrenia patients without AVHs: increased activation in insula

Table 3
continued.

Aguilar et al. (2008)	N = 11 schizophrenia patients with AVHs (DSM-IV) (all on antipsychotic medication) N = 10 healthy subjects	fMRI (emotional vs. neutral word paradigm)	- enhanced activation of limbic and frontal brain areas in patients during listening to emotional words (inclusive the frontal lobe, temporal cortex, insula, cingulate gyrus, amygdala)
Horga, Fernández-Egea, et al. (2014)	N = 9 remitted schizophrenia patients with previous AVHs (DSM-IV) (all on antipsychotic medication) N = 8 healthy subjects	PET (personalised auditory stimuli mimicking voice's content)	- heightened cerebral activity in limbic and paralimbic brain areas including the amygdala, hippocampus and superior temporal gyrus in the voice-hearers - heightened interactions between amygdala and auditory brain regions in remitted patients -weakened connectivity between amygdala and prefrontal regions in remitted patients

4.6 "Bottom-up", "top-down" – when there is an imbalance a voice slips in?

Voice-experiences have also been conceptualised as resulting from altered "bottom-up" processes, "top-down" processes or an interaction of both by various authors. The terms "bottom-up" and "top-down" are quite vague and although widely used in neuroscientific and psychological literature, a definition of these terms is rarely provided and they are not used in a unique sense (Rauss & Pourtois, 2013).

The terms' proposed significance for AVHs is partly due to the widespread assumption in neurocognitive approaches to AVHs that they constitute cases of (abnormal) perception. It is assumed that usually a smooth interplay of "bottom-up" and "top-down" processes warrant "normal" perceptual experiences (Krishnan, Fivaz, Kraus, & Keefe, 2011; Nazimek, Hunter, & Woodruff, 2012; Waters et al., 2012).

An overview of the "bottom-up" and "top-down" factors proposed to play a role in AVHs is provided in Table 4. We will look at them closer now.

4.6.1 Biological dis-regulations as starting point for voice-hearing

It has been proposed that auditory signals produced by specific brain areas including the auditory cortex are at the origin of and assumed to provide the "raw material" for voice-experiences (Hugdahl, 2009; Waters et al., 2012), rather than inner speech or memories (Hugdahl, 2009). Voice-experiences here are thus considered inner hearing experiences rather than misattributed inner speech experiences (Hugdahl, 2009). Some authors, however, assume that if the auditory signal takes the form of inner speech or intrusive memories, there is an increased probability of it becoming a voice-hearing experience (Waters et al., 2012). The latter

propose that emotions may act as a trigger for and contribute to the maintenance of voice-experiences.

Similarly, but yet differently, it has been proposed that voice-experiences – besides an impairment of primary sensory processing of irrelevant auditory stimuli – might emerge due to spontaneous activity of the primary auditory cortex that can also be found healthy individuals (Alba-Ferrara, Fernyhough, Weis, Mitchell, & Hausmann, 2012). In both cases, by means of the STG, auditory signals are proposed to be "integrated into a common percept" (Alba-Ferrara et al., 2012, p. 248). Hyperactivity of the secondary auditory cortex has also been proposed to be related to voice-hearing (Allen, Larøi, & Mcguire, 2008).

Alba-Ferrara et al. (2012) focus explicitly on emotional prosody processing, and proposed that a failure of regulation of the amygdala (a brain region associated with emotion processing) by the prefrontal cortex might contribute to the negative valence prevailing in the voice-hearing experience of individuals diagnosed with schizophrenia by drawing attention to negative aspects of prosody. It has also been proposed by others that hyperactivity of brain regions involved in emotion regulation may account for the emotional features of the voice-hearing experience (Allen et al., 2008). Hugdahl (2009) and Waters et al. (2012) attempt to propose more complete models of how (faulty) "top-down" processing on the "source" auditory signal might contribute to the development of voice-experiences.

The supposed auditory signals are assumed to be failed to be controlled due to a faulty functioning of brain regions related to cognitive control processes – the prefrontal and anterior cingulate cortex (Hugdahl, 2009). A shift of attention towards the auditory signal or voice, mediated by the parietal cortex, is then assumed to lead to a self-perpetuating loop of rumination strengthening voice-experiences. Altered glutamate transmission is proposed as a possible mediator for the disturbance of "bottom-up" and "top-down" balance in processing (Hugdahl, 2009). Building on this amongst other proposed models, it was further proposed that a range of "top-down" processes produce a voice-hearing experience's complexity regarding content, form and meaning. Waters et al. (2012) assume that the likelihood of detecting and accepting a signal as real is heightened in individuals with voice-hearing experience: the therefore detected signal is then failed to be inhibited by the voice-hearer, and assumed to become autonomous.

Table 4

Overview of "bottom-up" and "top-down" factors proposed to play a role in voice-hearing.

"Top-down" factors and processes	Failure of inhibitory cognitive control due to altered functioning of prefrontal and anterior cingulate cortex (Hugdahl, 2009; Waters et al., 2012)
	Attention shift (towards the voice) mediated by the parietal cortex (Hugdahl, 2009)
	Heightened perceptual sensitivity (Waters et al., 2012; Vercammen et al., 2008)
	Expectations (Seal et al., 2004): Perceptual (Waters et al., 2012)
	Hypervigilance bias (Waters et al., 2012)
	Impaired emotional prosody processing due to a lack of prefrontal inhibitory control of the amygdala (Alba-Ferrara et al., 2012)
	Delusions/delusional beliefs (Heinks-Maldonado et al., 2007; Seal et al., 2004; van der Gaag, 2006; Waters et al., 2012)
	Response biases (Seal et al., 2004): Positive / liberal acceptance (Moritz & Larøi, 2006; Vercammen et al., 2008) Externalising
	False metacognitive beliefs about the controllability of thoughts (Moritz & Larøi, 2006)
	Gain from illness and self-serving biases (Moritz & Larøi, 2006)
"Bottom-up" and primary factors and processes	Auditory cortex hyperactivity (Hugdahl, 2009; Waters et al., 2012): "Hyperactivation in functional networks involving the auditory cortex" (Waters et al., 2012, p.688) Perception caused by activity in speech regions in the left hemisphere (Hugdahl, 2009)
	Spontaneous auditory cortex activity (Alba-Ferrara et al., 2012) Neurotransmitter dysregulation (van der Gaag, 2006)
	Neurophysiological defices (Heinks-Maldonado et al., 2007)
	Impaired verbal self-monitoring (Seal et al., 2004)

The authors additionally propose that the content of a voice is formed by factors such as perceptual expectations and knowledge. The meaning of the voice-experiences is further assumed to be determined by a complex system of delusional and other beliefs. Over time, expectations about such experiences and a hypervigilance bias are assumed to turn it more likely that such experiences will re-occur (Waters et al., 2012).

The role of delusional beliefs in the formation of voice-experiences and their maintenance has also been put forward by others that propose different "bottom-up" processes as the basis for voice-experiences (Heinks-Maldonado et al., 2007; van der Gaag, 2006). Whereas some claim that the interaction of delusional beliefs with abnormal neurophysiological (and associated cognitive) functioning ultimately leads to the misperception of inner experiences as stemming from external sources (Heinks-Maldonado et al., 2007), others argue that delusional beliefs *go along* with an "overinvolvement" in voices and are in that sense secondary (van der Gaag, 2006). Van der Gaag (2006), furthermore, proposes that a "bottom-up" biological dis-regulation leading to a hyperdopaminergic state in mesolimbic pathways is at the origin of voice-experiences. This is assumed to lead to a perception of (aspects of) the world as more "salient" and personally significant and to trigger hallucinations. These aberrant experiences, according to the model, are then tried to be explained in a meaningful way by "top-down" thinking processes. However, due to a range of cognitive biases, such as an externalisation bias – the tendency to ascribe events to external entities rather than to oneself – these attempts are assumed to be impaired. Then, these (impaired) thinking processes may ultimately make a voice-hearing experience a voice-hearing experience. Although the author refers to the role of inner speech in AVHs, it remains open how this fits into the model.

4.6.2 Empirical evidence for "bottom-up"-"top-down" models of voice-hearing

In fact it has been found that voice-hearers with schizophrenia diagnosis have a higher perceptual sensitivity to speech stimuli than individuals with schizophrenia diagnosis but without AVHs (Vercammen, de Haan, & Aleman, 2008). In this study, voice-hearers in a task, where they had to indicate if they heard a certain word that was presented in background noise so that it was hardly perceptible but still audible, indicated more often to have heard this word. Both groups with schizophrenia diagnosis in this study, however, showed lower perceptual sensitivity than healthy participants. Moreover, voice-hearers tended to state more often with a high degree of confidence that they had heard a certain word in the noise, when this specific word was not presented in the noise, which was interpreted as a positive response

bias or liberal acceptance of the presence of a stimulus (Vercammen et al., 2008). The authors propose that their results might be accounted for by an attentional bias in speech perception.

In that vein, it has been proposed that an imbalance between "bottom-up" and "top-down" factors in the sense of a prevalence of "top-down" factors, such as perceptual expectations, leads to a reduction of influences from "bottom-up" sensory information and consequently may trigger voice-hearing perceptual experiences, in which no one is speaking (Daalman, Verkooijen, Derks, Aleman, & Sommer, 2012). However, the authors found evidence for the influence of "top-down" semantic expectations only in *healthy* voice-hearers, but not in voice-hearers with schizophrenia diagnosis. As compared to healthy controls, non-clinical voice-hearers indicated more often to have heard a (due to a sentence's context) predictable word, where an unpredictable word was presented or no word was presented at all in the sentence. That was not the case for voice-hearers with schizophrenia diagnosis who did not differ from either of the groups in terms of such "top-down" errors. Thus, this study indicated that abnormal "top-down" processing might play a role in voice-hearing in non-psychotic but not in psychotic individuals and there might be different cognitive mechanisms underlying voice-hearing in psychotic and nonpsychotic individuals (Daalman et al., 2012).

Using a different methodology, others have also proposed that "top-down" factors play a critical role in AVHs (Moritz & Larøi, 2008). By means of an online survey they compared sensory (e.g., loudness) and cognitive (e.g., control) features of thoughts, intrusions and voices. Interestingly, they found that only a minority of (self-reported) schizophrenia patients experience their voices as being as loud as external voices. Additionally, they report various similarities between reported sensory and cognitive features of thoughts, intrusions and voices. The authors therefore conclude that AVHs are unlikely a "pure" disorder of input or "bottom-up" processes (e.g., auditory cortex hyperactivity), although voice-hearers in their study reported more vividness and loudness also of intrusions and "normal" thoughts, which, they propose, might contribute to the vulnerability for AVHs. Moritz and Larøi (2008) propose that "top-down" processes including "false metacognitive beliefs about the controllability of thoughts, liberal acceptance, gain from illness and self-serving biases" (p.105) contribute to the experience of voices. Thus, voice-hearers may, in varying combinations, not take their thoughts as controllable, and more readily attribute internal events to external agents. To accept that their experience stems from an external agent, the authors hypothesise, might be a more appealing choice for a voice-hearer than to conclude to "suffer[…] from voice-hearing" (p.104).

Table 5

Overview over the reviewed studies regarding "top-down"/"bottom-up" factors in voice-hearing.

Authors (year)	Participants	Type of study	Main results
Vercammen et al. (2008)	N = 15 schizophrenia patients with AVHs N = 15 schizophrenia patients without AVHs N = 17 healthy subjects (DSM-IV)	Behavioural (speech discrimination task)	- lower perceptual sensitivity in schizophrenia patients as a whole - patients with AVHs (vs. without AVHs) indicated more often to have heard a word in background noise - patients with AVHs tended to state more often with a high degree of confidence that they had heard a certain word in the noise, when this specific word was not presented in the noise
Daalman et al. (2012)	N = 40 psychotic patients with AVHs (most on antipsychotic medication) N = 40 non-psychotic individuals with AVHs (one on antipsychotic medication) N = 40 healthy subjects. (of patients: 62.5% paranoid schizophrenia, 15% schizoaffective disorder 22.5% with psychosis not otherwise specified)	Behavioural (semantic expectation task)	- evidence the influence of "top-down" semantic expectations only in healthy voice-hearers - compared to healthy controls, non-clinical voice-hearers indicated more often to have heard a (due to a sentence's context) predictable word, where an unpredictable one or no word was presented
Moritz and Larøi (2008)	N = 45 subjects with schizophrenia diagnosis, N = 55 subjects with obsessive–compulsive disorder diagnosis N = 60 healthy subjects	Online survey (comparison of sensory & cognitive features of thoughts, intrusions & voices)	- minority of schizophrenia patients report their voices as being as loud as external voices - various similarities between reported sensory and cognitive features of thoughts, intrusions and voices - individuals with AVHs reported more vividness and loudness of intrusions and "normal" thoughts

Although the proposed "bottom-up"-"top-down" models go beyond conceptions of AVHs as a "brain-disease" by including processes on a phenomenal level, such as delusional beliefs, they are unsatisfactory regarding several points.

It is, for example, to be questioned if there is an "auditory signal" on an experiential level that is first shaped and filled with content and attributed to someone else. We might argue that this is not the case, as the experience of a "voice" can rather be assumed to be immediate and not a "raw" auditory signal that is shaped until becoming a voice.

One may argue that the misattribution process occurs on a subpersonal, unconscious level, and only when the sound is misattributed it is experienced as an "alien" voice, but this explanation would bring with it other problems: on a subpersonal level, we will not find any

subject that could misattribute a "signal". There arguably is no homunculus in a voice-hearer's brain that interprets auditory signals and decides if they are self-generated or not.

Also, why a voice's content is emotional for a specific voice-hearer can arguably not be explained in terms of amygdala activity, but only by taking into account his/her life events and the meaning he/she ascribes to them.

Likewise, we might ask: where does this postulated hyper-activation of the auditory cortex come from? And if it is spontaneous, why are voice-experiences not random?

4.7 Self-monitoring accounts of voice-hearing

Self-monitoring accounts are amongst the most popular attempts to explain voice-experiences. Seal, Aleman, and McGuire (2004) assign impaired self-monitoring to a type of "bottom-up" role in the generation of voice-experiences in the sense of forming the basic deficit at the origin of voice-experiences[20]. In contrast, Allen, Larøi, & Mcguire (2008) consider faulty monitoring as associated with abnormal functioning of anterior cingulate, premotor, prefrontal and cerebellar brain areas as a "top-down" influence on hyper-activation of the secondary auditory cortex in voice-hearers.

Self-monitoring refers to the ability to distinguish between sensations that result from self-generated actions and those that are not generated by oneself (e.g., Sapara, ffytche, Cooke, Williams, & Kumari, 2015). It is generally assumed to occur at a preconscious level, that is, usually we do not have to wonder reflectively about the origin of a sensation. The basic idea is that sensory feedback due to self-initiated acts is predictable and thus anticipated. Furthermore it is assumed that, as sensory feedback resulting from self-initiated acts is predicted, becomes irrelevant and is therefore attenuated. Put differently, predicted sensory feedback is proposed to be subtracted from received sensory feedback (e.g., Blakemore, Smith, Steel, Johnstone, & Frith, 2000). Self-monitoring accounts of voice-hearing are probably the most prominent approaches to voice-hearing in neuroscientific literature about AVHs.

Applied to AVHs, the idea is that motor commands (e.g., during speech production) in the nervous system are accompanied by efference copies – "messages" to sensory brain regions causing a corollary discharge signalling that a motor act is self-generated, and thus

[20] Note that verbal self-monitoring *itself* as a kind of a predictive coding process can be conceptualised as a "top-down" process on the monitored action. "Bottom-up", thus, in this context is used in the sense of primary or at the basis of the formation of voice-experiences.

allowing to distinguish self-generated actions from actions that are not self-generated (Feinberg, 1978). In consequence, neural activity in sensory brain regions processing speech is assumed to be attenuated (Figure 8). Under the premise that thoughts can be considered motor acts (as first proposed by Frith & Done, 1988), in neuroscientific approaches to voice-hearing, this explanation is widely transferred to the level of thought and used to explain how own thoughts or inner speech can be experienced as voices. Self-monitoring accounts of voice-hearing are usually centered around the impairment of the prediction of a specific type of mental phenomenon, namely inner speech (Figure 9). That is why self-monitoring accounts of voice-hearing are often referred to as "inner-speech" models of voice-hearing.

Before reviewing results from empirical studies about self-monitoring in voice-hearers, we will examine some recently proposed variants of self-monitoring models of voice-hearing.

4.7.1 Variants of self-monitoring models of voice-hearing

Seal et al. (2004) propose that faulty self-monitoring during inner speech production constitutes the primary neurocognitive deficit, accounting for the "generation of AVHs, as opposed to the experience of AVHs" (p.64). More specifically, they propose that schizophrenia patients are predisposed to experience voices as a result of psychosocial factors, such as isolation or high levels of stress. "Some trigger event" (p.66), they further assume, leads to AVH-generation and consequently to the issueing of motor commands and production of inner speech. While self-monitoring is assumed to be a preconscious process, it is suggested that it can be influenced by "top-down" processes, such as a bias to attribute "unfamiliar or unrecognized material" (Seal et al., 2004, p. 60) to an external source, delusional beliefs and expectations. Voice-hearing is, hence, conceptualised as misinterpretation of a breakdown of the self-monitoring system. Seal et al. (2004) propose that voices are usually experienced as unintended as the "feed forward information" (p.64) consisting of an efference copy about the issued motor command (of e.g., inner speech production) does not reach the comparator, which they assume to consist of a parietal-cerebellar network. Consequently, the "sensory information" (p.64) fails to be modulated so that the person ultimately perceives self-generated actions as not self-generated. When experienced, the voice if further assumed to be subject to the voice-hearer's appraisal.

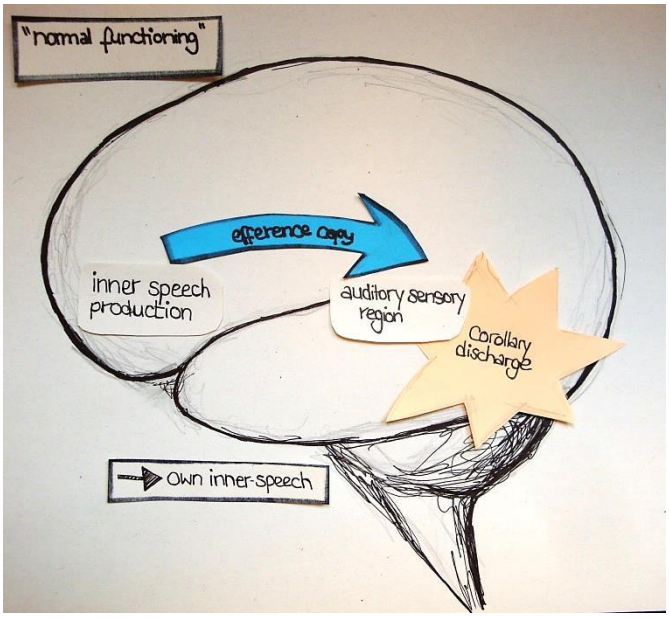

Figure 8 Schematic illustration of a "normal" neuronal self-monitoring of inner speech according to the proposed efference copy/corollary discharge mechanism of self-monitoring.

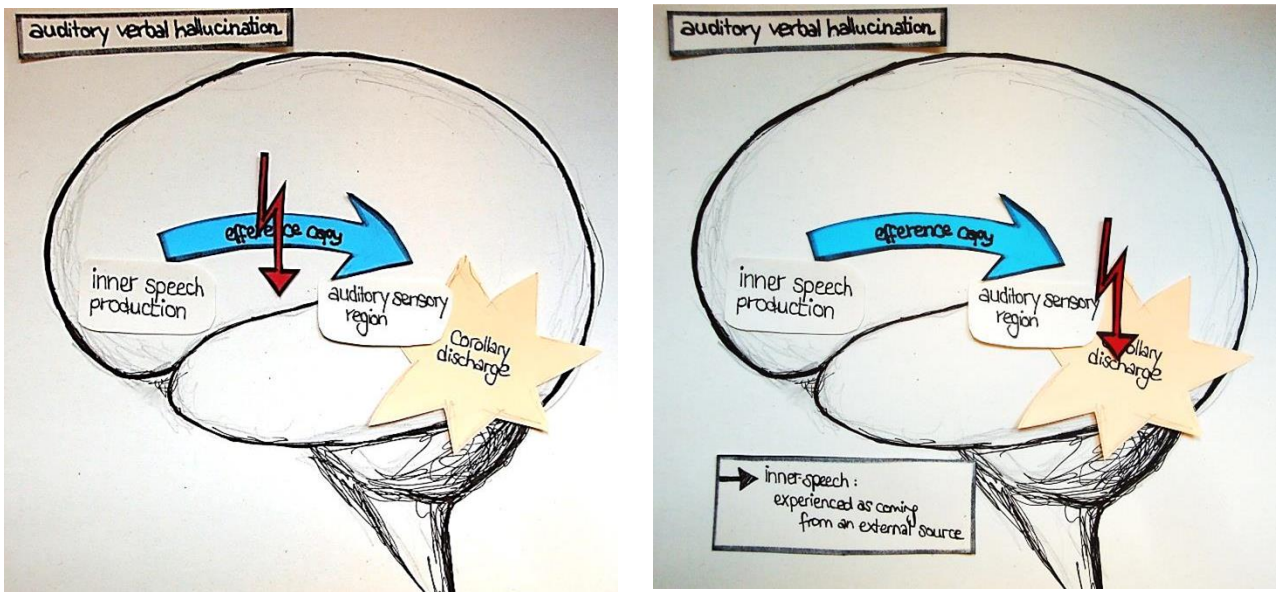

Figure 9 Schematic illustration of the proposed efference copy/corollary discharge mechanism of self-monitoring described in the text. In auditory verbal hallucinations, the efference copy/corollary discharge mechanism of self-monitoring is assumed to go awry. There are various possibilities how this proposed mechanism could be malfunctioning: the efference copy could be absent or late (left picture) or the corollary discharge itself could be impaired (right picture).

Jones and Fernyhough (2007b) propose a different application of the comparator-model to AVHs in which no feeling of unintendedness that needs to be resolved is required. They propose that, based on a motor command for inner speech, "the brain either produces a degraded predicted state or fails to produce a predicted state at all" (p.394). They suppose that due to the lack of the predicted state and the resulting lack of contiguity between predicted action and actual action, no self-authorship emotion is felt. At the same time, this mismatch between predicted state and actual state, according to the proposed model, would lead to the experience of an emotion of other-authorship.

The same authors propose a Vygotskian approach to inner speech in order to explain voice-hearing phenomena (Jones & Fernyhough, 2007a). Following Vygotsky, they assume that inner speech and thought develop as a kind of verbal self-regulation that is derived from dialogues taking place in the social world. Before reconstructing dialogues as inner speech or thought on the "intrapsychological plane" (p.147), in an intermediate step children in the form of private speech lead dialogical communications with themselves. However, it is assumed that characteristics of external dialogue are preserved in inner speech. The ability to use inner speech, thus, goes along with the ability to take the positions "of others" towards themselves. Consequently, inner speech phenomena are not only assumed to have social origin but also to retain dialogical characteristics, allowing for the occurrence of AVHs.

4.7.2 Empirical evidence for self-monitoring models of voice-hearing

Self-monitoring accounts of voice-hearing have been the target of both behavioural and neurophysiological research (Figure 11). In behavioural studies, participants usually listen to spoken language and have to decide whether they have heard their own or someone else's voice. In these tasks, participants listen to speech stimuli consisting either of their own or someone else's voice, whereby the voice's pitch is sometimes altered. The participants are instructed to identify their own voice as their own even when it is altered.

Johns et al. (2001) instructed their participants to read adjectives aloud and at the same time played back either their own or someone else's (distorted or non-distorted) voice uttering the same adjective. In their study, they compared schizophrenia patients with delusions and AVHs, schizophrenia patients with delusions but without AVHs and healthy controls. They found that patients as a whole attributed their own distorted voice more often to someone else or were unsure about its source. Patients with AVHs, in particular, attributed their voice more

often to someone else and did so more often when the heard adjective was of derogatory content.

Similarly, Ilankovic et al. (2011) found that schizophrenia patients with delusions and AVHs mistook their own altered voice more often as produced by others than healthy controls. They did not include schizophrenia patients without AVHs. Also, in contrast to Johns et al. (2001), participants in Ilankovic et al.'s (2011) study listened to *recorded* stimuli and were not actively speaking during the task. Note that due to these methodological differences it cannot be excluded that the two studies examine different forms of self-monitoring. In the first study (Johns et al., 2001), participants have to monitor sensations resulting from actions they are carrying out at the moment (speaking), whereas in the second study participants have to monitor sensations stemming from actions that they have carried out *in the past* (speech recordings) (Ilankovic et al., 2011).

Table 6

Overview over the reviewed studies regarding verbal self-monitoring in voice-hearers.

Authors (year)	Participants	Type of study	Main results
Johns et al. (2001)	N = 10 schizophrenia patients with AVHs & delusions N = 8 schizophrenia patients with delusions but no AVHs (DSM-IV) all on antipsychotic medication N = 20 healthy subjects	Behavioural (participants actively speaking)	- patients as a whole attributed their own distorted voice more often to someone else/were unsure about its source - patients with AVHs attributed their voice more often to someone else + did so more often heard adjective of derogatory content
Ilankovic et al. (2011)	N = 23 schizophrenia with AVHs & delusions all on antipsychotic medication N = 23 healthy subjects	Behavioural (recorded voice)	- schizophrenia patients with delusions & attributed their own distorted voice more often to someone else
Heinks-Maldonado et al. (2007)	N = 20 schizophrenia patients (DSM-IV) all on antipsychotic medication N = 17 healthy subjects	EEG behavioural	- schizophrenia patients and especially those with AVHs experience, made more errors (e.g. classifying an alien voice as one's own).
Ford et al. (2007)	N = 24 patients with schizophrenia or schizoaffective disorder (DSM-IV) all on antipsychotic medication N = 25 healthy subjects	EEG	greater intertrial coherence preceding talking than listening (in both groups, but stronger in controls)

Neurophysiological research regarding self-monitoring has focused on the N1-component of the auditory ERP. This component refers to the voltage observable approximately 100ms after

the occurrence of an auditory stimulus. Remember that ERPs have been assumed to go along with specific cognitive processes. In fact, ERPs have been shown to be altered in individuals with schizophrenia diagnosis reporting voice-hearing. Specifically, the N1-component has been proposed to reflect the effects of expectation, with its amplitude being enhanced (i.e., more negative) in response to an unexpected (compared to expected) stimulus (Sur & Sinha, 2009). Thus, it should be dampened for self-generated stimuli such as self-produced speech, as they can be expected (Figure 10).

In fact, the N1-component of the auditory ERP has been shown to be smaller during talking (and simultaneously listening) compared to passively listening to the own (recorded) voice feedback (uttering the syllable "ah") as well as conditions in which an alien voice is played back or the own voice feedback is altered in healthy participants (Ford, Roach, Faustman, & Mathalon, 2007; Heinks-Maldonado et al., 2007). Interestingly, although this effect was not absent in schizophrenia patients with AVHs, it was significantly smaller, that is, the N1-component of the auditory ERP during talking was less dampened in that group and this effect was more pronounced in the left hemisphere (Heinks-Maldonado et al., 2007). These group differences were not observed when participants listened to their own or to an altered or non-altered alien voice, *without* speaking, that is, when the stimulus could *not* be expected due to concurrent speech production. Moreover, when judging if the heard voice was one's own or an alien voice, schizophrenia patients, especially those with AVHs, made more errors (e.g., classifying an alien voice as one's own).

The authors interpret the N1-dampening observed during talking as compared to listening in individuals without psychiatric diagnoses as a sign of a well-functioning forward-model system, and consequently voice-hearing as associated with a dis-function of the forward-model system.

The concept of synchrony has also been discussed in the context of self-monitoring theories. It has been hypothesised that neural oscillatory synchrony preceding an action is related to sensory suppression going along with sensations resulting from self-generated actions, that are thought to be reflected by the N1 suppression effect (Ford et al., 2007). The reasoning behind this hypothesis is that the supposed forward-model system requires "communication" between motor and sensory brain regions and this "communication" is proposed to be associated with synchronous oscillations between those regions.

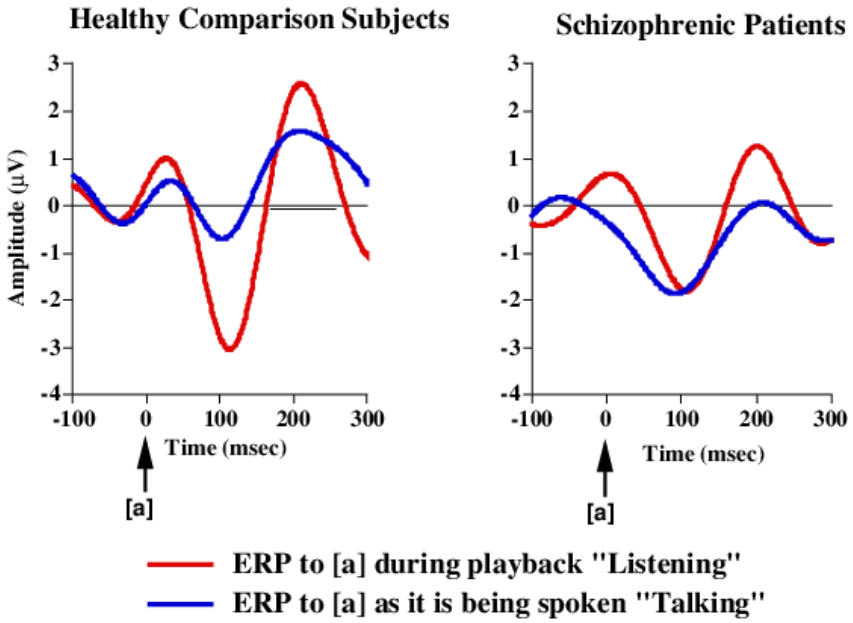

Figure 10 (Taken from Ford & Mathalon, 2005). N1-component of the event-related auditory potential while talking as compared to listening in healthy controls and schizophrenia patients. While healthy controls show a dampening of the N1-component during talking as compared to listening, no dampening of the N1- component during talking as compared to listening was observed for schizophrenic patients.

Ford et al. (2007) provided support for this hypothesis by showing that pre-speech synchrony in the lower frequency range (inter-trial oscillatory phase synchronisation before speech utterances) was associated with the dampening of the N1-component during talking as compared to listening to the own recorded voice in individuals without psychiatric diagnoses. Although voice-hearers with schizophrenia diagnosis also showed pre-speech synchrony, this synchrony was reduced as compared to individuals without psychiatric diagnoses and not related to N1-suppression.

In a recent proposal (Whitford, Ford, Mathalon, Kubicki, & Shenton, 2012), the aforementioned concept of synchrony is used in yet another sense, the authors referring to temporal synchrony of a corollary discharge and the event at its origin. The authors suggest that in individuals experiencing voices, corollary discharges occur asynchronously with the neuronal event being at their origin. They propose that this temporal dis-coordination occurs due to abnormal frontal myelination resulting in conduction delays. As a consequence (augmented) activity of dopaminergic neurons in the midbrain are used to explain why insignificant events become salient and may give rise to hallucinations.

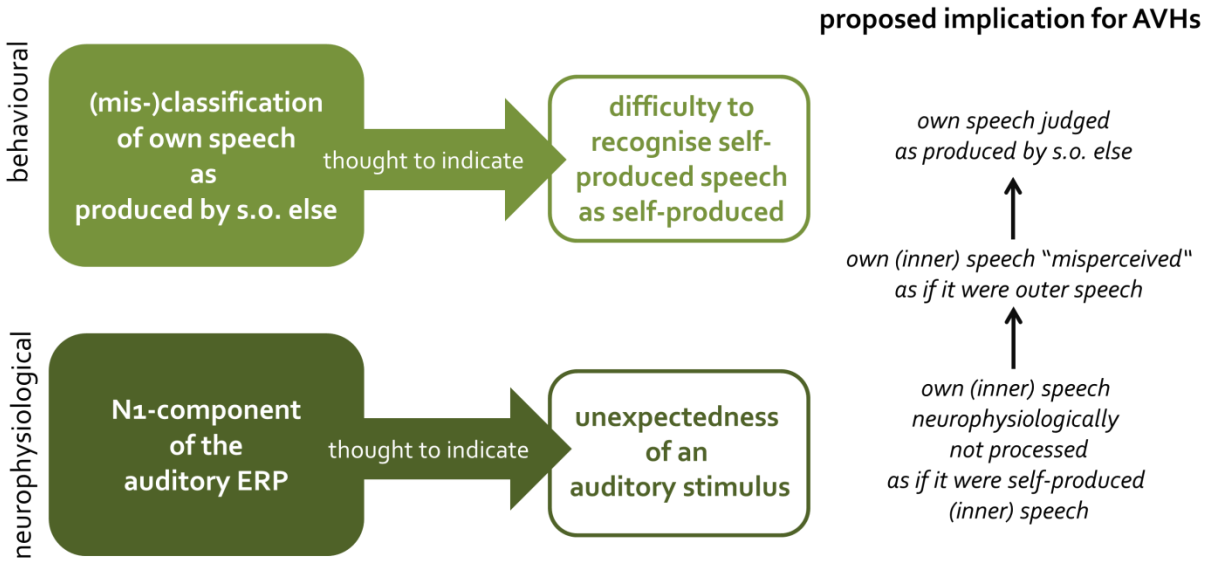

Figure 11 Investigation of self-monitoring in voice-hearers on different levels of analysis. On a neurophysiological level, faulty self-monitoring of self-produced (inner) speech is assumed to be indicated by a diminished dampening of the N1-component of the auditory ERP in response to hearing one's own voice. On a behavioural level, the self-monitoring hypothesis of AVHs has been tested by asking voice-hearers to classify heard speech as self-produced or produced by someone else. The (mis-)classification of own speech as produced by someone else is considered as an indicator for mal-functioning self-monitoring. Applied to AVHs it is proposed that voice-hearers due to an impaired neurophysiological self-monitoring mechanism experience their own inner speech as speech of, for example, an external agent.

Summarising, the reviewed studies provide some evidence for altered verbal self-monitoring in voice-hearers with schizophrenia diagnosis at different levels of analysis (see Figure 11). In self-monitoring accounts of voice-hearing, voice-hearing is conceptualised as being, at least partly, due to the absent or delayed prediction of self-generated stimuli.

Although such accounts offer interesting points of departure, they are certainly not sufficient for conceptualising AVHs. Also they raise a series of questions. Self-monitoring accounts of voice-hearing seem to implicitly suggest that if only the perceived voice would be recognised as one's own, if only the supposed corollary discharge would take place at the right time and inner speech would be predicted, the problem of voice-hearing would be solved. Is that the case?

Arguably, it is not that easy. In fact, there is reason to assume that a substantial group of individuals experiencing voices actually *do* consider their experiences as generated by themselves, which is not contrary to them experiencing voices as coming from an external source (Leudar, & al., 1997). That leads us to the question: why should we, due to a lack of sensory attenuation resulting from an abnormal self-monitoring mechanism, experience inner speech as coming from an external entity? Moreover, if we adopt the controversial assumption that inner speech has acoustical properties and that these properties are similar to our own

voice, why do individuals experiencing voices usually report hearing *other* person's voices and not themselves speaking out loud?

Moreover, it is now widely acknowledged that reducing distress caused by voice-experiences is not so much a question of eliminating this experience *per se,* but of integrating it into the person's life in a meaningful way (e.g., Pérez-Álvarez, García-Montes, Perona-Garcelán, & Vallina-Fernández, 2008), as illustrated by the quote of the following person: "The turning point, for me, came when I recognised that the voices carried messages about my past and present experiences […] I was actually finding ways of interacting with parts of myself that I had spent a lifetime blocking out and denying" (Waddingham, 2012). Therefore, it has to be questioned if postulated self-monitoring deficits per se should constitute a core role in a conception of voice-hearing or put differently, if such a conception implies practical consequences for individuals suffering from their voices.

Whereas self-monitoring accounts focus on the prediction of stimuli that result from self-generated actions, other predictive coding accounts of voice-hearing assume predictive coding as a general operation principle of the brain, not restricted to self-generated stimuli.

4.8 Predictive processing accounts of voice-hearing

Nazimek, Hunter, and Woodruff (2012) attempt to explain voice-hearing within a hierarchical predictive-coding framework, in order to "fill the gap" (p.804) between self-monitoring and auditory-perceptual models of voice-hearing. They propose that an exchange of information between the prefrontal cortex and the auditory cortex ultimately leads to a voice-hearing experience. More specifically, it is proposed that a preconscious vague "prediction of an auditory object" (Nazimek, Hunter, & Woodruff, 2012, p.808) is generated by the prefrontal cortex which is then transmitted to the thalamus and auditory cortex, thus biasing their activity. In turn, the thalamus is thought to send information that matches the received prediction to the auditory cortex and prefrontal cortex. This would strengthen the initial prediction, which would again be sent back by the prefrontal cortex in a more concrete form to thalamus and auditory cortex. Random activation in the auditory cortex in addition to its anticipatory activity is further proposed to play a role in triggering a voice-hearing experience. More specifically, the activation of particular auditory cortex association areas is proposed to account for specific features of a voice-hearing experience, such as for example the perceived gender of a voice. Such processes, in turn, are proposed to contribute to the

concretisation of the prediction and, together with the anticipatory activation of the auditory cortices, might lead to a final percept, that is, the voice that is ultimately heard.

Krishnan, Fivaz, Kraus, and Keefe (2011) propose a model of voice-hearing within their general theory of brain functioning. They attempt to account for AVHs in terms of a general deficit of neuronal hierarchical temporal processing in psychosis. The proposed hierarchical temporal processing deficit is assumed to manifest itself in disturbed communication between cortex layers. This deficit is assumed to be a trait of individuals with psychosis. The disturbed neuronal communication, in turn, is assumed to hinder "memory-based prediction of perception" (p.136). More precisely, Krishnan et al. (2011) propose that in the course of perception the input is stepwise passed on to the next higher cortical layer comparing this input with stored memories, and, in turn passes back expectations about the subsequent experience until a match is achieved. Additionally, with new experiences new memory representations are assumed to be created and stored in higher cortical layers. This process is assumed to be deficient in AVHs: as the generation and storage of memory representations is deficient the interpretation of an incoming stimulus is faulty and that is what is assumed to open up the "opportunity for arbitrary internally generated interpretations of reality to intrude on perception and thought" (p.136). Consequently, "an accumulation of inaccurate but internally meaningful perceptions" (p.136) may occur, creating the foundation for voice-experiences. A range of biological processes that could be at the basis of these impairments is proposed by the authors. An explanation of how exactly, in the end, voice-experiences come about, is not provided.

Another author states that AVHs are explainable within a predictive processing framework (Wilkinson, 2014). In his opinion, the brain's principal task is to identify the source of incoming signals. It does so, he further proposes, based on a hypothesis about the incoming signal, its match with the incoming signal and the statistical likelihood of the hypothesis about the incoming signal being true. If a hypothesis is kept, in this framework depends on its utility of predicting incoming signals. Suppose that the brain's hypothesis does not match the actual input, that is, a prediction error occurs, then it will be discarded. Taken together, the brain's job is then to minimise prediction errors and the hypothesis minimising prediction error, is what constitutes conscious perception and experience in general.

Applying this framework to AVHs, the "voice heard" would be the conscious percept and thus a voice-hearer's brain best hypothesis, that is, the one best minimising prediction error, or to put it in the authors words: "applied to AVHs, your experience will have auditory

phenomenology if your brain has had to adopt the hypothesis that you are hearing something in order to minimise prediction error" (Wilkinson, 2014, p.149). This account, as Wilkinson (2014) emphasises, does not necessitate the assumption of the transformation of a "raw material" such as inner speech in order to account for AVHs. Within this framework, Wilkinson (2014) proposes to account for inner speech, memory and hypervigilance hallucinations.

Put simple, Wilkinson (2014) proposes that in the case of inner speech and memory AVHs due to errors in predictive processing the voice-hearer's brain follows an erroneous hypothesis. It is proposed that when actually neuronal activity associated with inner speech or episodic memory is going on, the voice-hearer's brain hypothesises that there is no inner speech or memory going on, but something different, namely hearing a voice, is going on (Wilkinson, 2014). As in the proposed framework it is exactly this hypothesis that constitutes conscious experience, the person will, then, hear a voice. In this framework, hypervigilance hallucinations that, in contrast to inner speech and memory hallucinations are assumed to result from misinterpretations of *external* events, are explained in terms of a biased selection of a hypothesis of the brain. The brain of a voice-hearer that is hypervigilant regarding insults, for example, might be biased to select the hypothesis of hearing an insult to account for incoming sensory input in a noisy environment even if there is no one who in fact insults the voice-hearer. Consequently, if the brain selects the (erroneous) hypothesis of hearing an insult, the individual will have the experience of hearing an insult.

Horga, Peterson, et al. (2014) found hints for a deficient predictive coding related to voice-hearing in a fMRI study comparing voice-hearers with schizophrenia or related diagnoses and healthy controls. This conclusion was derived from the analysis of brain activity during a task designed to elicit differences in predictive coding mechanisms at a neuronal level. In this task, participants had to decide if they heard speech or not, whereby the probability and thus the predictability of hearing speech was manipulated. In order to interpret the obtained data, the authors applied a predictive-coding algorithm, which they compared to a feature detection model. As the predictive coding algorithm (based on the premise that neural activity results from a weighted activity of prediction and prediction error signals (Egner, Monti, & Summerfield, 2010) explained more variance as a feature detection model (based on the assumption that neuronal signals consist in passive reactions to stimuli), the authors conclude that deficient predictive coding may account for the observed (hyper-)activity in the auditory cortex during voice-experiences in the participants with AVHs – observed in the same study – and that it may be this activity that leads to voice-hearing. The

predictive coding algorithm explained 27% of the variance in voice-hearing related brain activity, whereas the feature detection model explained 19% of it.

Taken together, the reviewed predictive coding accounts of AVHs vary substantially in how they conceptualise such phenomena: whereas Nazimek et al. (2012) attempt to integrate self-monitoring accounts of voice-hearing into their model, Wilkinson (2014) explicitly contrasts his account to self-monitoring accounts of voice-hearing. Whereas Krishnan et al. (2011) assume that inaccurate internally stored perceptions might constitute the material for AVHs, Wilkinson's (2014) framework does not need the transformation of raw material, proposing that it is the brain's hypothesis about what is going on what constitutes a conscious experience.

The reviewed predictive coding accounts, very much like self-monitoring accounts, rely on the assumption that AVHs are a consequence of a mal-functioning brain. So, is it the brain that produces voices? What do voice-hearers' brains predict and do they predict anything at all? We will come back to these questions in the general discussion.

4.9 Memory-models of voice-hearing

A different approach to AVHs conceptualises these experiences as consisting of unintentionally activated memories of speech (Waters, Badcock, Michie, & Maybery, 2006) or at least partly being due to impaired memory processes (Brébion, Bressan, Ohlsen, & David, 2013). Note, that memory hallucinations have also been attempted to be explained by other reviewed models (see, for example Wilkinson, 2014, last section).

Based on the existing literature and their research, Waters et al. (2006) propose that AVHs are a consequence of a failure in intentional inhibition, which they regard as the deliberate suppression of activated cognitive contents that are decided to be irrelevant. Voices, they propose, are at least to some extent constituted by memories of speech that are failed to be inhibited. However, the authors suppose that at least one other factor is necessary for the formation of AVHs. More specifically, they propose that individuals with schizophrenia have difficulties to access context information of the memories and these difficulties are at the basis of their hallucinations. Taken together, AVHs are proposed to be unintentionally activated auditory memories that are not recognised as one's own due to an impaired context memory.

In fact, it has been reported that voice-hearers with schizophrenia diagnosis have an impaired context memory as compared both to healthy controls without voice-hearing experience (Brébion et al., 2013) as well as healthy controls prone to hallucinate (Chhabra et al., 2013). However, the latter study found impaired memory binding as not being specific of

voice-hearers, as this deficit was also present in individuals with schizophrenia diagnosis who did not hear voices. Chhabra et al. (2013) used a memory-binding task, in order to investigate memory binding and its relation to voice-hearing in both schizophrenic and non-clinical voice-hearers as compared to schizophrenic and healthy non-voice-hearers. They presented the participants with auditory stimuli, namely two different words spoken by two different voices. Later in the task, participants had to decide if a spoken word they were now presented with corresponded to one of the *formerly* presented. Thus, participants had to bind content (word) and context (voice) in memory in order to successfully solve the task. In this study schizophrenia patients in general (irrespective of the presence of voice-experiences) performed worse than healthy controls. This pattern was not found for healthy voice-hearers.

In Brébion et al.'s (2013) study voice-hearers with schizophrenia diagnosis showed an impairment in binding contextual features of memorised items, both temporally and spatially (i.e., if a word had been presented in the first and the second list and at which site at a table a picture had been presented) when compared to healthy controls. In addition to abnormal context memory, Brébion et al. (2013) suggest that in schizophrenia patients there are more general impairments in source monitoring, which they define as remembering the origin of given information. In their studies, voice-hearers with schizophrenia diagnosis "remembered" more often items of a list that actually had not been presented. The authors interpret their results as indicating a reality-monitoring deficit in schizophrenia and corroborating self-monitoring accounts of voice-hearing.

In a neuroimaging study reported above, in which voice-hearers with schizophrenia-spectrum diagnoses were actively experiencing voices during data collection, these experiences were found to be associated with oscillatory activity in the hippocampus, a memory-related structure (van Lutterveld et al., 2012). Specifically, an aberration in the theta-band in the hippocampus was observed *before* hallucination-onset, which was interpreted by the authors as a trigger for voice-hearing. Unfortunately, the authors do not indicate if the participants reported predominantly memory-related voice content.

Taken together, the reviewed studies provide some evidence for impaired memory processes in voice-hearers with schizophrenia diagnosis. However, these impairments do not always seem to be specific of voice-hearers and are not evident in non-clinical voice-hearers. Moreover, there is tentative support for the implication of a memory-related brain region in voice-experiences.

Conceptualisations of AVHs in terms of memory seem to be plausible if one considers them as related with a voice-hearer's life history and, for example, stressful life events. However, only a subgroup of AVHs have "memory-content" (McCarthy-Jones, Thomas, et al., 2014). Moreover, it appears that we often do not know the exact "source" of a memory. Why then are we not hallucinating in such cases? Therefore, it is implausible that memory-AVHs are simply memories of which the context is not remembered.

The studies reviewed until now largely focus on neuronal and cognitive processes within a particular individual. Most of them, regarding the experiential features of VH elaborated in chapter 2, focus on "physical" aspects of AVHs (i.t. consider them as perceptual phenomena). They constitute rather "incomplete stories" of AVHs as they seem to fail to take into account what we have hypothesised to be a core feature of voice-experiences: the experience of being communicated to or about which constitutes a relational character of such experiences. These relational aspects have been taken into account by psychological approaches to AVHs, as we will shortly see. Before let us discuss some methodological issues of neuroscientific approaches to AVHs.

4.10 Methodological discussion neuroscientific approaches to voice-hearing

4.10.1 Sampling

Nearly all participants in the reviewed studies were on antipsychotic medication but nevertheless experiencing voices. In that sense their AVHs can be described as medication-resistant. From that follows that participants of the reviewed studies may not constitute a representative subgroup of schizophrenia patients with AVHs, if we consider the hypothesis that there might be differences between "medication-resistant" voice-experiences and those that are treatable by medication. This does not seem to be critical, if we suppose that it is particularly important to understand medication-resistant voice-hearing in order to develop more effective treatments for it. What is maybe more worrying is that antipsychotic medication might have effects on how a specific task is carried out (Brébion et al., 2013). Therefore, it is desirable to include medication-naive voice-hearers in future studies to control for possible confounding effects of medication.

Moreover, the considerable differences between individual AVHs, although widely acknowledged, are also widely neglected in sample selection. This may be one reason for the inconsistent results of the reviewed studies. Likewise, one voice is not like another and, thus, group means may not mirror the experience and associated cognitive and physiological

processes of every participant (Shallice, Burgess, & Frith, 1991). In one reviewed study, for example, the proposed effect of suppression of the N1-component of the auditory ERPduring talking as compared to listening to one's own voice could not be found in "many patients" (Ford et al., 2007, p. 462), although the group mean indicated such an effect. Therefore, it might be useful to inquire the features of the voice-hearing experience of potential participants of a study with more detail, which in turn would allow to collect more homogeneous samples, ultimately leading to more consistent results. Subtypes of AVHs (McCarthy-Jones, Thomas, et al., 2014) could serve as guide for the composition of study samples. Another point that might contribute to inconsistent results of the reviewed studies is that voice-hearers might be captured at different points in their voice-hearing history (Ćurčić-Blake et al., 2017). For that, it is important to consider a voice's wider temporal context in future studies. Moreover, due to unequal sample sizes in the reviewed studies the detection of brain activity considered as significant may have varied between the studies, further hampering consistent results.

4.10.2 Neuroimaging

If one wants to investigate phenomena that supposedly involve hearing experiences in a scanner, one must consider the scanner noise, which constitutes an acoustic stimulus. The scanner noise may, for example, interfere with brain activity associated with a voice-hearing experience (van Lutterveld et al., 2012). One might argue that this factor is negligible, as controls are exposed to the same noise. However, voice-hearers and non-voice-hearers may react differently to it

Another important point is that results regarding activation strength and localisation vary substantially depending on the method of data analysis chosen (Carp, 2012a), which hampers the comparability between the reviewed studies. This fits into the big picture of fMRI research – as Carp (2012b) showed, analysis methods reported in recent fMRI studies vary almost from study to study, which is also true for the above reviewed fMRI and neuroimaging studies in general.

The most critical point here is that there is no *a priori* valid form of the interpretation of data obtained through neuroimaging methods (e.g., Logothetis, 2008). Neuroimaging studies cannot provide a direct window into the brain and even less into the mind, in the sense that the interpretation of obtained data through scanning always relies on theoretical assumptions and the same set of data can be analysed in an infinite number of ways (e.g., Garcia-Marques & Ferreira, 2011). Ultimately it is the researcher's choice which

interpretation he/she considers appropriate and this interpretation is most likely in line with the theoretical position the interpreter defends and one yielding significant results and therefore allowing to publish (see also Asendorpf et al., 2012). Horga, Peterson, et al.'s (2014) interpretation of the data as reflecting predictive coding deficits serves as an example: they compare two different algorithms – chosen based on theoretical assumptions– in order to account for the obtained fMRI data. However, it is conceivable that there are ways to describe the data that explain more variance. It becomes apparent that problems related with neuroimaging studies are rather due to interpretational issues than due to technical issues (Logothetis, 2008). That is why conceptual issues are important not only for the sake of conception per se, but also for practical reasons.

4.10.3 Subjective experience measurement

AVHs are experientially rich and complex experiences – a fact that the reviewed neuroscientific studies widely neglect. It is impossible to capture their richness by using only one to a few items that are not adequately fine-grained to capture it. It is doubtful that the items used to measure voice-experiences in the reviewed studies can capture "the essence of [such] qualitative phenomena" (Giorgi, 2005, p. 80). The only reviewed study differentiating between distinct experiential voice-hearing features (Looijestijn et al., 2013) categorises AVHs as internal and external concordant with their subjective source. However, individuals reporting voice-experiences find it sometimes difficult to determine where the voice comes from (Nayani & David, 1996; Upthegrove, Ives, et al., 2016). After all, can someone know how a voice sounds like that is heard from inside the body? It is only our own voice that we may hear from inside (and simultaneously from outside) of our body. In that line, it has been claimed that the distinction between internal and external voices is insignificant, for example, in the clinical context (Copolov, Trauer, & Mackinnon, 2004).

One may get the impression that a voice-experience in the reviewed neuroscientific studies is reduced to a sensory experience in the absence of a corresponding external stimulus captured by the use of a single or few questionnaire items. Form, content and meaning of the messages conveyed by voices are widely neglected in the reviewed studies, although voice-experiences and a voice's content are generally meaningful to voice-hearers (Corstens, Longden, McCarthy-Jones, Waddingham, & Thomas, 2014).

However, taking into account precise descriptions of voice-experiences is indispensable in neuroscientific AVH-research as "in order to reach real biological correlates

it is imperative that we go back to fundamental psychopathological symptoms and use them as a primary basis in all investigations" (Telles-Correia, Moreira, & Gonçalves, 2015, p. 8).

4.10.4 Correlational study designs or: correlation is not causality

Although most of the studies that have been reviewed are of correlative nature, the results are continuously interpreted as pointing towards causal relations in greater or lesser extent. In the reviewed studies, "brain" correlates are usually interpreted causally, in the sense that they are responsible, or at least contribute to the pathogenesis of AVHs (e.g., Hubl et al., 2004). However, to interpret correlations as causal relations is rather a philosophical than a scientific claim (Kotchoubey et al., 2016). Also, measures correlated with AVHs are always possibly not specific of AVHs, as for example Ćurčić-Blake et al.'s (2013) results indicate. The limits of correlational study designs for the understanding of AVHs have, thus, to be taken into account.

Even *if* a causal explanation of AVHs could be provided, this would likely not be sufficient for understanding these phenomena as their understanding arguably also depends on "some kind of familiarity or experience with it" (Le Moal & Swendsen, 2015, p. 597).

Let us now examine what more psychological accounts of AVHs can offer for a conceptualisation of such phenomena.

5 Psychological approaches to voice-hearing

5.1 Voice-hearing as relational experience

As experienced voices are often identified as being associated with specific individuals (e.g., Nayani & David, 1996), voice-experiences often imply a relational moment. These relational aspects of AVHs have been used in a range of psychological studies.

For example, Bell (2013) – without going into greater detail – proposes that AVHs may be due to abnormal internalisation of other people's voices. He assumes that a voice-hearing experience is constituted by misidentified imagined voices rather than misattributed thoughts. He conceptualises AVHs as primarily social and embedded in the voice-hearer's social world, which in turn is assumed to influence a voice's appearance. More specifically, he proposes that voices commonly act as "internal models of social actors" (Bell, 2013, p.2).

In fact, results of a range of questionnaire studies indicate that patterns of relationships to voices are closely linked to relationship patterns that individuals who experience them have in their shared social lives.

Studies included in the present review have focused on the following relationship aspects: power (Birchwood et al., 2004, 2000; Hayward, 2003), social rank (Birchwood et al., 2004, 2000), and proximity (Hayward, 2003). All participants in those studies had a schizophrenia or related diagnosis.

The overall picture provided by the reviewed studies is that voices are experienced as powerful. In Birchwood et al.'s studies (2000, 2004) voice-hearers in general reported experiencing their dominant voices as being more powerful than themselves. Applying a different measure of power, Hayward (2003) obtained somewhat contradictory results: voice-hearers who related to their dominant voice from "below" tended to experience more benevolent voices with less negative content, to relate with their voices from a position of closeness and to engage with their voices.

This difference might be due to the use of different "power" measures as well as due to different samples: a more powerful voice may have very different effects depending on the voice's content and the voice being perceived as malevolent or benevolent. It might be that in Birchwood et al.'s (2000, 2004) samples powerful voices were experienced as rather persecutory and malevolent, and in Hayward's (2003) sample as rather benevolent supernatural powers, and thus participants related differently to powerful voices, for example.

In terms of coping strategies, voice-hearers that reported to experience their dominant voice as powerful and malevolent tended to "resist" to their voices, that is, refuse to do what they say, whereas individuals describing their dominant voice as benevolent voices tended to engage with them, for example, try to make contact with their voices (Birchwood & al., 2004).

Table 7

Overview over the reviewed studies focusing on relational aspects of AVHs.

Authors (year)	**Participants**	**Type of study**	**Main results/thesis**
Bell (2013)	-	Theoretical	- voice-hearing experiences as primarily social and embedded in the voice-hearer's social world, - voices commonly act as "internal models of social actors" (Bell, 2013, p.2)
Birchwood et al. (2000) **Birchwood et al.** (2004)	N = 59 schizophrenia or schizo-affective disorder patients with AVHs (ICD-10) (all except one: neuroleptic medication) N = 125 schizophrenia patients with AVHs (ICD-10) (over 98% on neuroleptic medication)	Questionnaire measures of power and social rank difference between voice & voice-hearer + social relationships	- dominant voices experienced as being more powerful than voice-hearers - perception of powerlessness linked to degree of depression - patterns of relationships to voices linked to relationship patterns with significant others - reported voice frequency and volume higher, when high power and higher social rank ascribed to the dominant voice
Hayward (2003)	N = 26 schizophrenia patients with AVHs, N = 1 manic depressive psychosis patient with AVHs (all: on antipsychotic medication)	Semi-structured interview: based (amongst others) on You to Voice (YTV); individuals relating to others questionnaire; revised beliefs about voices questionnaire	- VH as "relating to an interpersonal other" (p.369) - relating to voices from a dominant position associated with a low voice frequency - relating to dominant voice from "below" associated with experiencing more benevolent voices with less negative content as well as relating with the voice from a position of closeness and engage with it

The "power relationship" between voice-hearer and voice was predicted by the perceived "power relationship" to significant others in the voice-hearer's life (Birchwood et al., 2000; Hayward, 2003). That led Birchwood et al. (2004) to conceptualise the experiences of voice-hearers with their dominant voice as a mirror of their general social relationships in which they use to feel subordinate. However, there is reason to assume that not all aspects of relationship patterns with significant others can be generalised to the relationships with voices. Some relationship features seem to be unique to relationships to voices: Hayward

(2003) reports that voice-hearers generally related to their predominant voice in a distant manner, which was not true of their relationship to significant others.

Taken together, in the just reviewed studies we find a shift away from the focus on audibility towards voice-hearing's social aspects. In the context of these studies AVHs are not simply conceptualised as auditory experiences without corresponding stimuli, but as "constructed as that of relating to an interpersonal other" (Hayward, 2003, p.369).

There is evidence, that the voice-hearing experience may be shaped by social patterns occurring in a person's life and that voice-hearers employ similar interaction patterns when they relate to their voices and significant others in their lives.

The just reviewed studies are based on the assumption that beliefs about voices are a crucial factor in how a voice is experienced. However, it can be questioned if the concept of belief is the right concept for describing voice-hearer's experiences of a voice's power or proximity. Put differently, we may ask: is it a matter of belief if a voice-hearer experiences his/her voices as malevolent, powerful, and so on.

5.2 Voice-hearing as response to stressful life-events

In other psychological studies, AVHs have also been conceptualised in the context of traumatic life events. That is, AVHs are assumed to be triggered or at least be influenced by, for example, sexual abuse in childhood or other traumatic life events. One study, including both schizophrenic and non-clinical voice-hearers, found heightened rates of reported traumatic events in both groups (Andrew, Gray, & Snowden, 2008). This was the case although both groups appraised their voices quite differently: whereas schizophrenic voice-hearers experienced their voices as malevolent, the non-clinical voice-hearers in this study reported their voices to be benevolent. The voice-hearers with schizophrenia diagnosis in this study specifically reported more often that they had experienced sexual abuse in childhood.

5.2.1 Hypervigilance and voice-hearing

Dodgson and Gordon (2009) propose a model for a specific type of AVHs which they designate as hypervigilance hallucinations. The authors embed their model in the context of the evolutionary theory which postulates that hypervigilance might be adaptive in threatening situations.

In this model, it is proposed that an "immediate precipitator" (p.331) evokes an emotional state of distress. Stressful live events could be such a precipitator. It is further

assumed, that unsuccessful coping strategies used to cope with the distressing emotional state is what ultimately leads to a state of hypervigilance. More specifically, the authors propose shame and fear to be emotions particularly likely to be associated with hypervigilance hallucinations. That reasoning is due to the assumption that shame and fear are emotions that are particularly likely to be coped with in an ineffective way. For example, an individual might avoid coping with those feelings by talking about them with others, as this would be shaming for the individual. Instead, ineffective coping strategies regarding emotional distress could be applied such as emotion suppression and avoidance, as well as social isolation. Taken together, emotional state and unsuccessful coping strategies may lead the individual to become hypervigilant to stimuli related to a distressing event. Once a person has become hypervigilant, cognitive biases, such as a heightened perceptual sensitivity, are further assumed to increase the probability of hallucinations of hypervigilance or the detection of "false positives" (p.332). Taken together, those hallucinations, distressing emotions, ineffective coping strategies and cognitive biases are assumed to constitute a self-reinforcing vicious circle. The authors present a case study in order to illustrate the proposed model (Dodgson & Gordon, 2009).

In a similar vein, Behrendt and Whittingham (2005) propose that social problems or interpersonal conflicts might be triggers for AVHs. Such conflicts, according to the authors, may be responded to with anxiety, in turn, increasing the attention of an individual to social cues in his/her environment.

5.2.2 Subvocalisation and voice-hearing

The same authors discuss the role of subvocalisation in voice-hearing phenomena (Behrendt & Whittingham, 2005). They propose that this bias to direct attention to the social environment in combination with proprioceptive input from subvocal speech might lead to the experience of an AVH. This, according to the authors, is possible as neuronal processes that underlie perception become uncoupled from afferent sensory input. Through subvocal speech, Behrendt and Whittingham (2005) propose further, voice-hearers might unconsciously influence form and content of their voices. Summarising, they propose that AVHs may be conceptualised as unconscious subvocalisation that are experienced as stemming from others due to an enhanced focus on voices in a voice-hearer's environment.

The role of subvocalisation for AVHs has also been proposed by Evans, Mcguire, and David (2000). More specifically, they focus on the concept of "inner imagined speech" (p.137), postulating that voice-hearers might have difficulties in distinguishing between

imagined and external speech and therefore take imagined as external speech. They propose that inner speech is a variation of auditory-verbal imagery. In that sense, inner imagined speech would not be self-monitored correctly in AVHs. In order to test if voice-hearers subvocalise and thereupon "hear" speech images resulting from that subvocalisation they carried out a range of behavioural experiments. However, they found no impairments in schizophrenia patients with AVHs in tasks that are thought to require intact speech imagery as compared to schizophrenia patients without AVHs. The authors conclude that problems with the "inner voice" are unlikely to be at the basis of AVHs. However, they rightly note that inner speech might be associated with AVHs even if voice-hearers use to experience "normal" inner (imaginative) speech that is assumed to be acquired for the inner speech tasked used by their group. In that vein, support has been provided for the assumption that voice-experiences and experiences of auditory imagery are associated with the activation of similar brain regions at least in nonclinical voice-hearers (Linden et al., 2011).

Therefore it is dubious if this study provides convincing evidence against the possible role of imagined speech and subvocalisation for AVHs.

5.3 Methodological discussion psychological approaches to voice-hearing – is experiencing one's voices as malevolent (merely) a question of belief?

It seems unlikely that if a voice-hearer experiences his/her voices as, for example, malevolent or benevolent is reducible to or can be broken down in terms of beliefs about voices. Rather, one might assume that voice-hearers experience their voices as, for example, malevolent or powerful *immediately*, that is, prior to forming any beliefs about their voices. In analogy, it has been proposed that "the concept of reality testing may not pertain to a modular and specific psychological function but rather to a general reflective capacity of a subject and her anchoring in the intersubjective world" (Škodlar, Henriksen, Sass, Nelson, & Parnas, 2013, p. 251).

Thus, we may wonder, what exactly the scales about beliefs about voices used in the reviewed studies measure? Do they really measure beliefs? Or rather more direct experiential features of AVHs? In order to tackle these questions, it seems necessary that qualitative studies precede the development of quantitative measures of beliefs about voices. This would allow to evaluate if what such scales measure are really beliefs.

Before moving on to philosophical approaches towards AVHs, let us shortly summarise the approaches reviewed until this point in the form of a schema (Figure 12).

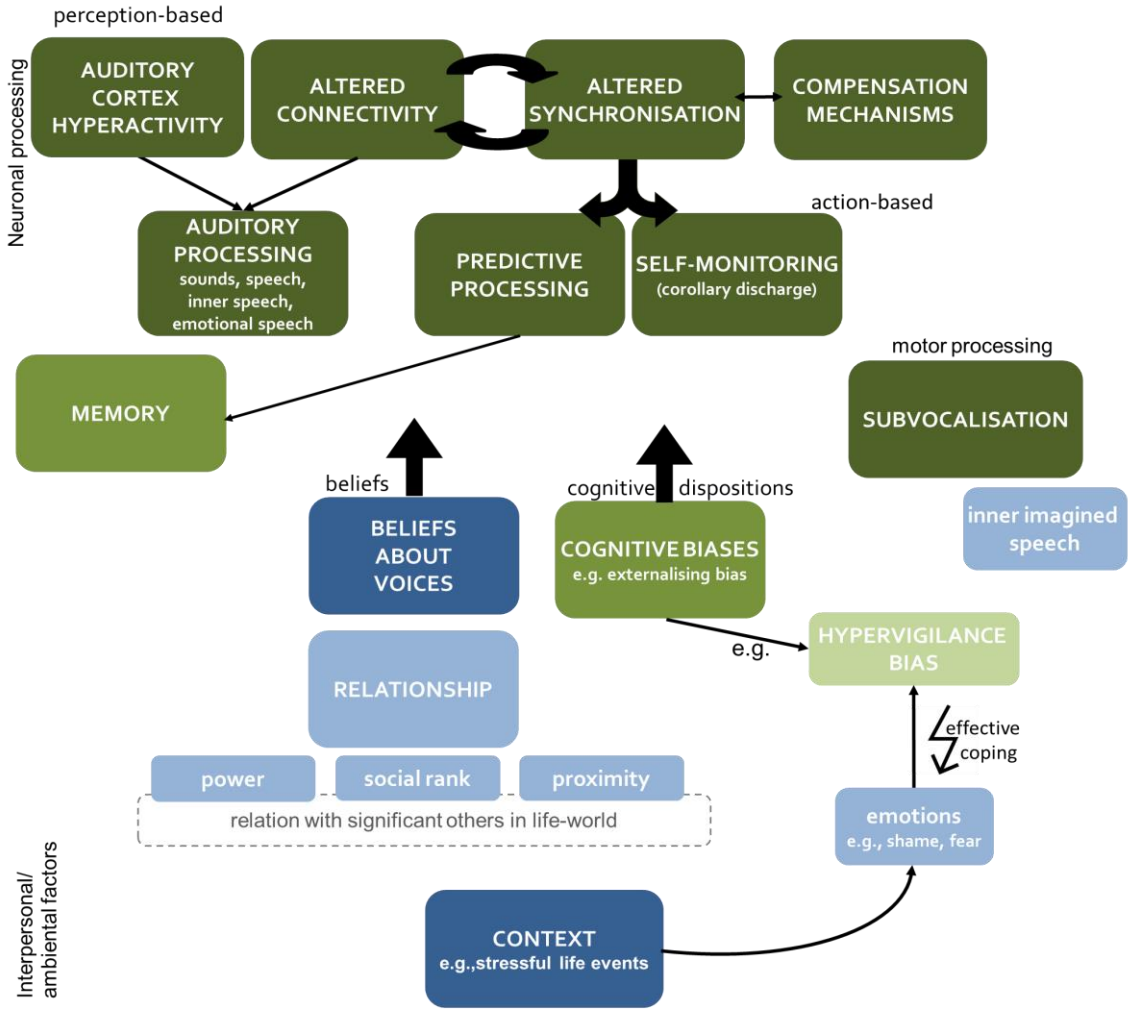

Figure 12 Concepts in which context AVHs have been conceptualised in neuroscientific and psychological studies. Note that all connections have to be considered hypothetical. Different colours indicate different levels of analysis. (Note that, for example, emotions, besides on a self-report level (blue) could also be investigated on other levels of analysis (e.g., neuronal, dark green). Neuronal activation patterns on a pre-phenomenal level are accessible by means of 3rd-person neuroscientific methods (dark green). Similarly, subvocalisation might be investigated by means of electromyography. Memory and cognitive biases have been investigated in behavioural studies (light green). Beliefs about voices, e.g., regarding the relationship of voice-hearers with their voices, as well as the context have been investigated by means of first-person reports, e.g., in questionnaires. At the top of the figure neuroscientific concepts used to explain AVHs are pictured. Starting at the top left corner, it has been proposed that (hyper-)activity of the auditory cortex might lead to AVHs. We might call such approaches perception-based as they propose as they focus on the (auditory) "perception" of AVHs. Auditory cortex hyperactivity has also been proposed to be influenced by "top-down" factors, such as e.g., cognitive biases. On a pre-phenomenal level, it has been proposed that altered structural connectivity, going along with altered neuronal functional connectivity and synchronisation might disturb postulated self-monitoring or/and predictive processes, which in turn might contribute to the formation of AVHs. Self-monitoring and subvocalisation approaches to AVHs could be described as "action-based" as they propose that self-initiated actions (e.g., inner speech, subvocalised speech) is attributed to a non-self source. Heightened oscillatory neuronal activity observed during AVHs has been interpreted as compensatory for slowed state-oscillatory activity in voice-hearers (e.g., Sperling, Bleich, Maihöfner, & Reulbach, 2009). On the bottom half of the figure, proposed "top-down" factors increasing the probability of experiencing voices, as well as shaping the experience of a specific voice are displayed. These include a voice's context in a voice-hearer's life history and a voice-hearer's beliefs about voices (as related in self-reports). Cognitive biases, in the reviewed studies, have been investigated in behavioural studies with mixed results. It has also been proposed that ineffective coping of specific emotions (e.g., shame) in addition with a hypervigilance bias might increase the probability of experiencing voices. In another line of reasoning, some AVHs have been proposed to consist in unintentionally activated memories (Waters et al., 2006). "Memory" AVHs have also been attempted to be explained in a predictive processing framework (Wilkinson, 2014).

6 Philosophically-informed approaches to voice-hearing

We can divide the reviewed approaches towards AVHs from philosophical perspectives roughly in two different approaches. First, there are accounts that explicitly refer to previously reviewed models of AVHs, especially models based on erroneous monitoring of inner speech and either propose altered (Gregory, 2016) or alternative models of voice-hearing (Cho & Wu, 2013, 2014; Wu, 2012). Given the range of open questions that self-monitoring accounts of AVHs imply the critical examination and proposal of alternatives is to be welcomed. Second, there are approaches developed independently from the previously reviewed approaches. Some of them explicitly criticise the philosophical grounds on which, for example, self-monitoring accounts of voice-hearing are built (Thomas, Bracken, & Leudar, 2004). These approaches differ also in the applied methodology, although they may not be completely separable in these terms. For a short overview, please see Table 8, as well as Figure 14.

Table 8

Overview of the reviewed philosophically informed approaches to AVHs.

Authors (year)	Relevant concepts	Main theses
Wu (2012) **Cho and Wu** (2013, 2014)	Spontaneous auditory cortex activity Passivity	- AVHs are better conceptualised as resulting from spontaneous auditory cortex activity than inner speech that is faultily self-monitored
Gregory (2016)	Imagined speech Self-monitoring	- AVHs as faultily self-monitored imagined speech
Sass and Parnas (2003)	Ipseity Self-affection Hyper-reflexivity	- inner speech and other mental processes assumed to "no longer [be] permeated with the sense of selfhood" (p. 432). - AVHs as "normal" cognitive phenomena that are experienced in a transformed manner.
Stanghellini and Cutting (2003)	Disembodiment Ipseity	- disturbance of ipseity ultimately leads to AVHs in the form of morbid objectification of inner dialogue
Henriksen et al. (2015)	Ipseity/primordial presence	- AVHs as arising from "inner speech dialogues between thoughts that have acquired quasi-acoustic qualities" (p. 175).
Wiggins and Schwartz (2007)	Passive synthesis	- AVHs as manifestation of impaired passive syntheses
Fuchs (2005a, 2013b)	Ipseity (Dis-)embodiment Temporality	- AVHs as inner speech no longer pervaded by "mineness" - AVHs as experienced as alien due to micro-gaps in conscious experience (impaired passive synthesis of inner time consciousness)

Table 8
Continued.

Rojecwicz and Rojecwicz (1997)	Being-in-the-world Intentional arc	- AVHs as attempts to "re-establish a connection with the outside world" (p. 33) that has been rejected
Naudin and Azorin (1997)	Intersubjectivity	- AVHs as manifestation of an "anticipation of others' intentional possibilities" (p. 190)

6.1 Evaluation of existing models of AVHs

6.1.1 Voice-hearing as automatic auditory experience – Wu's (2012) account

Wu (2012) proposes an "automaticity account" of AVHs. He refers explicitly to hearing a voice as being in an auditory state. In his opinion, AVHs are perceptual states. Thereby, he excludes a range of phenomena that are reported by individuals under the name of "hearing voices". Put it differently, he does not take voice-hearing as a metaphor for the description of patients' experiences, but literally. Besides the feature of having audible properties, the author argues, there are two other "outstanding" features of AVHs in schizophrenia: they are involuntary and have an alien quality. This alien quality, the author proposes, is due to two circumstances. First, voice-hearers experience voices different from their own. Second, voice-content is often incongruent with the voice-hearer's thoughts.

He argues that inner speech and AVHs differ clearly regarding their experiential features, and self-monitoring accounts of AVHs fail to account for these differences. More specifically, he proposes that such accounts fail to account for the specific auditory phenomenology of AVHs. Alternatively to self-monitoring accounts, he proposes that AVHs are genuinely passive phenomena, that is, they are not subject of some kind of "top-down"-modulation of the voice-hearer. AVHs are, thus, conceptualised as automatic auditory experiences instead of misattributed inner speech.

In a subsequent paper, Cho and Wu (2013, 2014) argue for a "spontaneous activation account" of AVHs, which they think should be the "default account" of AVHs instead of self-monitoring accounts of AVHs. Additionally, they argue, that *if* one wants to maintain a self-monitoring account of AVHs it would be more reasonable to assume that what is faultily monitored in AVHs is *imagined* speech and not inner speech. This point, as we will shortly see, was taken up by another author (Gregory, 2016).

What the authors propose is, basically, that the spontaneous activation of auditory and memory brain networks constitutes a sufficient cause for the occurrence of AVHs. Through such activation of "specific auditory representation[s] of voices" (Cho & Wu, 2013, p. 3), AVHs would result. They consider a neural stimulation study as a "proof-of-concept" study for their account. However, at closer inspection, this study they mainly substantiate their argument with turns out to be no convincing evidence for their claim. In this study, the temporal cortex of epileptic patients was stimulated via an electrode while they were undergoing brain surgery. What the authors found was that, when asked, some of the patients reported hearing voices.

If we look closer at this study, however, we note that "all of these patients were subject to temporal lobe epilepsy which did, no doubt, make response from the cortex easier to elicit" (Penfield & Perot, 1963, p. 683). Moreover, the AVHs reported in this study were "reproductions of past experience" (Penfield & Perot, 1963, p. 686) which is not true of all AVHs in schizophrenia. Consequently, their argument is not convincing.

6.1.2 Voice-hearing as faultily monitored imagined speech – Gregory's (2016) account

Gregory (2016) argues within a self-monitoring theoretical framework. Following Wu (2012; Cho & Wu, 2013), he argues that AVHs would be more appropriately conceptualised as instances of *imagined* speech that is faultily self-monitored than as instances of inner speech that is faultily self-monitored. In order to put his argument forward, he presents three arguments why inner speech should be considered a different phenomenon than imagined speech.

These arguments are based on the assumption that inner speech, like external speech, is a type of actual speech, or as he puts it "inner speech and external speech are similar in deep and important ways and should be considered different types of the same kind" (Gregory, 2016, p. 654). In his first argument he claims that inner speech and actual speech can be imagined. The same, however, he claims, is not true for imagining: one cannot imagine to imagine something and, at the same time, maintain the same point of view.

In his second argument, he gives the example of a politician that is preparing a speech. In this process, the politician imagines giving the speech, interrupting herself to make an observation about the speech using inner speech. He argues that inner speech in this case can

be considered a case of actual speech in analogy with the actual speech of an actor that is performing a play and interrupts himself in order to make a comment about his performance.

In his third argument, he provides various example phrases that follow the same pattern. These phrases all begin with "Imagining saying something" (Gregory, 2016, p. 666) and end for example with "to yourself" (Gregory, 2016, p. 666). He asks if any of these phrases would describe cases of inner speech. In line with his former arguments, he concludes that none of these examples would actually describe instances of inner speech. Having concluded that inner speech is not imagined speech, he now goes on to put forward that what is actually faultily monitored in AVHs is imagined speech. This view is based on the assumption that inner speech is produced in a person's own voice, whereas imagined speech may occur in other individuals' voices.

It is certainly debatable if the alternatives to standard self-monitoring accounts of AVHs proposed by Cho and Wu (2013) and Gregory (2016) constitute better alternatives. Nonetheless we have seen that philosophical reflection of existing models of AVHs can be valuable for initiating critical analyses of the soundness of such models.

We turn now to approaches to AVHs that use concepts rooted in continental philosophical tradition for the conceptualisation of such phenomena. They belong to the area of clinical philosophy or phenomenological psychopathology.

6.2 Clinical-philosophical approaches to voice-hearing

6.2.1 AVHs as "quasi-present" voices – a phenomenological-hermeneutic approach

Thomas, Bracken, and Leudar (2004), in general, regard AVHs as meaningful and understandable in terms of a voice-hearer's life history and belief system. According to the authors, a voice's meaning cannot be revealed by neurological or psychological approaches alone. The account they present in the reviewed study is based on Merleau-Ponty's philosophy of embodied and situated experience. By means of a case example, they propose, that in some cases voices may be conceptualised as the "quasi-presence" of a voice of a specific person that is actually not present. In this case example a woman reports hearing her dead husband. To put it in the authors' words, it is proposed that in this case "his presence has lived on for her in such a way and with such a power that he now comments critically on event that in his life he had no knowledge of" (Thomas et al., 2004, p. 21). In that sense, the

authors propose that we might conceptualise her husband's as "embodied, her past in her present" (p.21) and, thus, as "quasi-present"[21].

6.2.2 Voices as expressions of altered structures of experience

The accounts we will examine in the following, refer specifically to AVHs in the context of schizophrenia spectrum disorders. To put it in the words of the authors of one of the reviewed study, they assume that "schizophrenic hallucinations are their own specific kind of hallucination" (Wiggins & Schwartz, 2007, p. 126).

AVHs in these accounts are regarded as secondary phenomena in that they emerge from altered structures of experience *per se*[22]. These alterations are assumed to manifest themselves in an altered self- and world-experience and are considered to occur gradually. What these approaches have in common is that they consider AVHs as "embedded in a globally changed experiential framework" (Henriksen et al., 2015, p. 178). They assume that "hallucinations can only be understood as a function of the totality of the schizophrenic's personality" (Rojcewicz & Rojcewicz, 1997, p. 1) whereby "the patient, in order not to be misconceived, must be comprehended as inseparably related to his or her world" (Wiggins & Schwartz, 2007, p. 114).

Within continental philosophical approaches to voice-hearing in schizophrenia one can distinguish between approaches that focus on alterations on the level of pre-reflective experience and approaches that focus on alterations on a non-experiential level (Mishara, 2007). Put differently, we may say that the former asks "what kind of generally altered pre-reflective experience enables the occurrence of AVHs?", whereas the latter asks "what generally altered a priori constituents of experience enable the occurrence of AVHs?"

These approaches rely on different philosophical concepts, which shall be explained briefly where they become relevant. However, such accounts are neither mutually exclusive nor are they always clearly distinguishable as "a-priori" processes can be considered as closely intertwined with pre-reflective experience (Fuchs, 2005a).

[21] Quasi-presence can be understood in the sense that past experiences may have a role in structuring present experiences (Gutting, 2001).

[22] Note that schizophrenia has been subject of phenomenological philosophical investigations, since the emergence of the concept of schizophrenia (Škodlar et al., 2013).

6.2.3 Voice-hearing as symptom of a self-disorder

Based on recent phenomenological, development-psychologically and neuroscientific concepts, proponents of an "ipseity-disturbance" as the basis of AVHs distinguish between a basic and a personal self (Fuchs, 2012b). The *basic (or minimal) self* (ipseity) designates an implicit, pre-reflective sense of "mineness" that is thought to be intrinsic to all (normal conscious) experience, remaining intact even in cases of loss of autobiographic memory, whereas the *personal self* is thought to constitute itself in the relation to others from the second year of life (Fuchs, 2012b). (We will examine Fuchs' (2005, 2013b) account in more detail shortly.) This sense of self is called "pre-reflective" as it is assumed that it is not necessary to reflect upon your conscious experience being *your* experience, but that it is always already given as yours. In the reviewed studies, "basic sense of self", "basic self-awareness" or "ipseity" are interchangeable terms. Some of the authors propose that the basic self-awareness is dynamic and may be influenced by factors such as stress (Henriksen et al., 2015). Let us consider the proposed accounts more indepth.

6.2.3.1 Sass and Parnas' (2003) account of schizophrenia as a self-disorder

In a seminal paper, it was proposed that AVHs can be understood within the context of schizophrenic disorders as disorders of the basic self or "ipseity disturbance" (Sass & Parnas, 2003, p. 427). With ipseity, the authors denote the "the experiential sense of being a vital and self-coinciding subject of experience or first person perspective on the world" (Sass & Parnas, 2003, p. 428). Its disturbance, the authors argue, goes along with "complementary distortions of the act of awareness" (p.428), namely with what they call "hyper-reflexivity"[23] and diminished "self-affection". This "hyper-reflexivity" may manifest itself in becoming aware of aspects of one's actions that usually remain in the experiential background and is considered as a compensatory reaction to the postulated ipseity-disturbance.

In order to illustrate that, they cite a patient of McGhie and Chapman (1961): "[…] I take more time to do things because I am always conscious of what I am doing. If I could just stop noticing what I am doing, I would get things done a lot faster" (pp. 107-108, in Sass & Parnas, 2003, p.434).

With diminished self-affection, the authors mean "a weakened sense of existing as a vital and self-coinciding source of awareness and action" (Sass & Parnas, 2003, p. 427). Self-affection or some kind of self-awareness, for the authors, constitutes a condition for an

[23] Note, that one can distinguish operative hyper-reflexive processes that are assumed to be a rather automatic consequence of disturbed ipseity, and a reflective form of hyper-reflectivity. It is, however, unclear how they exactly be delineated.

experience to be conscious. “Hyper-reflexivity” and “diminished self-affection”, the authors propose, constitute complementary facets of the proposed fundamental alterations in ipseity in schizophrenia.

The authors propose that in the condition of schizophrenia one finds an “increasing gap between the sense of self and the flow of consciousness” (Sass & Parnas, 2003, p. 432). Inner speech and other mental processes are assumed to “no longer [be] permeated with the sense of selfhood” and instead to “become more like introspected objects, with increasingly reified, spatialised, and externalised qualities” (Sass & Parnas, 2003, p. 432). AVHs, thus, in the proposed account are conceptualised as based on “normal” cognitive phenomena that, due to a disturbed basic self-experience, are experienced in a transformed manner. The authors refer especially to commenting voices and conversing voices

This transformed experience has been described in terms of an *objectification* of inner dialogue.

6.2.3.2 AVHs as “objectified inner speech”: Stanghellini and Cutting’s (2003) account

Stanghellini and Cutting (2003) argue that the proposed “ipseity-disturbance” in schizophrenia ultimately may lead to an objectification of “inner dialogue”. They assume that inner dialogue which they define as “talking to oneself” (Stanghellini & Cutting, 2003, p. 126) is fundamental for self-conceptualisation and dominates one’s experience of oneself. At the same time, the authors assume that the process of inner dialogue normally remains subconscious. The authors maintain that a defining feature of inner dialogue is that “in it we experience at the same time a sense of unity and a sense of duality” (Stanghellini & Cutting, 2003, p. 123). This inner dialogue is assumed to become conscious in AVHs, thereby becoming like an object. To put it in the authors’ words, in the case of AVHs “awareness no more focuses on the outcome of inner dialogue (i.e., self- conceptualisation), but on its very process (i.e., two characters arguing with each other)” (Stanghellini & Cutting, 2003, p. 126). The morbid objectification of inner dialogue that, according to the authors, occurs in AVHs is not assumed to be an additional process of the postulated ipseity-disturbance and the compensatory hyper-reflexivity in schizophrenia. Rather, the authors consider it as an “extreme manifestation of these two basic phenomena” (Henriksen et al., 2015, p. 124). In the case of AVHs, the sense of unity usually inhabiting inner dialogue is assumed to be lost.

Summarising, Stanghellini and Cutting (2003) propose that a disturbance of ipseity goes along with a type of hyper-reflexivity that leads to a “detachment from ‘myness’ an

agency" (p.125) and finally to the proposed morbid objectification of inner dialogue and thus to the experience of AVHs.

6.2.3.3 AVHs as "objectified inner speech": Henriksen et al.'s (2015) account

Henriksen, Raballo, and Parnas (2015) introduce the notion of "primordial presence" to clarify the notion of "pre-reflective self-awareness". In the words of the authors, the notion of "primordial presence" means that a person's "pre-reflective immersion in the world" (p. 173) and her pre-reflective self-awareness are "in fact, inseparable" (p.173). What is new here is that the proposed "pre-reflective self-awareness" is coupled with a person's situatedness in the world.

The authors argue that the formerly proposed alterations of "pre-reflective self-awareness" (or using the new notion: "primordial presence") involve also changes in how space is experienced and an "objectification" of inner speech, which may ultimately lead to AVHs. More precisely, they assume that the disturbance of "primordial presence" allows that a "sort of persistent, inner space" (Henriksen et al., 2015, p. 174) is construed in which, for example, thoughts are experienced as having spatial qualities.

They then conceptualise AVHs as arising from "inner speech dialogues between thoughts that have acquired quasi-acoustic qualities" (Henriksen et al., 2015, p. 175). It remains open how thoughts can dialogue and why and how they acquire these "quasi-acoustic" properties. Inner speech, thereby, in accordance with Stanghellini and Cutting (2003) is defined as "implicit or silent medium for self-presentation" (Henriksen et al., 2015, p. 175).

Instead of taking AVH as abnormal perceptions, the authors regard them as cognitive phenomena, a proposal that is rooted in their observation that "hallucinatory voices seem to be given to patients in a sort of direct inner intuition […] rather than in a sensory perception (…)" (Henriksen et al., 2015, p. 167). They acknowledge that with the mechanism they propose they cannot account for AVHs that "occur quite suddenly or acutely" (p.176).

The authors describe the gradual self-alienation referring to three case vignettes from which they derive their account of AVH development. They hypothesise that increased thought pressure[24] combined with a reduced ability to distinguish auditory imagination from thoughts may lead to a state in which the patients do not know "if they, so to say, thought their thoughts or listened to them" (Henriksen et al., 2015, p. 171). In a second step, the authors report, their patients began to hear their pressing thoughts as spoken in their own voice. In

[24] Thought pressure can be defined as "rapidly racing meaningless, unconnected thoughts" (Cermolacce et al., 2007, p. 706).

terms of content those thoughts ranged from self-instructions and self-commands to self-conversations. Finally, "frank" AVH were characterised by "a loss of feeling that the heard thoughts belonged to the listening subject" (Henriksen et al., 2015, p. 171).

6.2.3.4 Voice-hearing in schizophrenia as disembodiment of the basic self – Fuchs' (2005a) account

Fuchs (2005a) has described the alterations of the basic self-experience in terms of disembodiment. This idea is based on the assumption of a strong interdependence between pre-reflective self-awareness and corporality (Leiblichkeit). The basic self, as the author understands it, is grounded on the body as "lived medium" through which we direct ourselves to the world (perceive/act)[25]. Similarly, Sass and Parnas (2003) assume that a tacit awareness of proprioceptive and kinaesthetic sensations serves as the medium of pre-reflective self-awareness[26]. The sense of agency is assumed to be based on such proprioceptive and kinaesthetic sensations as well as "the bodily sensation of being able to move (one's own body)" (Fuchs, 2005a, p.96)[27]. The basic self is further assumed to include a basal temporal self-continuity (Fuchs, 2012b), an idea to which we will come back shortly.

Fuchs (2012b) differentiates between three dimensions of a basic self: the primary bodily self, the ecological self, and the social self (see also Figure 13). This conception of the basic self indicates that already one's self-experience is not isolated but intertwined with one's ecological and social environment.

In schizophrenia, the author proposes, a gradual alteration of the *bodily* self-experience occurs. More specifically, the author assumes that the basic self is weakened and a disembodiment in the sense of a loss of the natural corporal embedding in the body and the world occurs (Fuchs, 2012b). To put it in the author's words, what characterises the condition of schizophrenia is a "divorce of the self from its body" (Fuchs, 2005a, p. 105). This disembodiment of the basic self, consequently, comes along with disturbances on all dimensions and levels of self-experience. Regarding the dimension of the ecological self, due to the postulated disembodiment the body, that in normal experience remains in the

[25] At this point it is worth noting that in phenomenology distinguishes between the lived body (Leib) or body-subject and the physical body (Körper) or body-object. "The first is the body experienced from within, my own direct experience of my body in the first-person perspective, myself as a spatiotemporal embodied agent in the world, the second is the body thematically investigated from without, as for example by natural sciences as anatomy and physiology, a third person perspective" (Northoff & Stanghellini, 2016, p. 8)

[26] This focus on the bodily (leiblichen) aspects of schizophrenia is what distinguishes Fuchs' account of schizophrenia from, for example, Sass and Parnas' account on which, amongst others, Fuchs builds.

[27] It has been proposed that an impairment of this sense of agency manifests itself in VH (Gallagher & Zahavi, 2008).

background or is transparent normal experience is assumed to be explicated (Fuchs, 2005a)[28]. This explication is further assumed to come along with an alienation of perception and action. Moreover, the ipseity-disturbance is assumed to affect the social dimension of the basic self (i.e., an impairment of the intersubjective constitution of the life-world) and ultimately also the level of the personal self, as it is based on the basic self (Fuchs, 2012b).

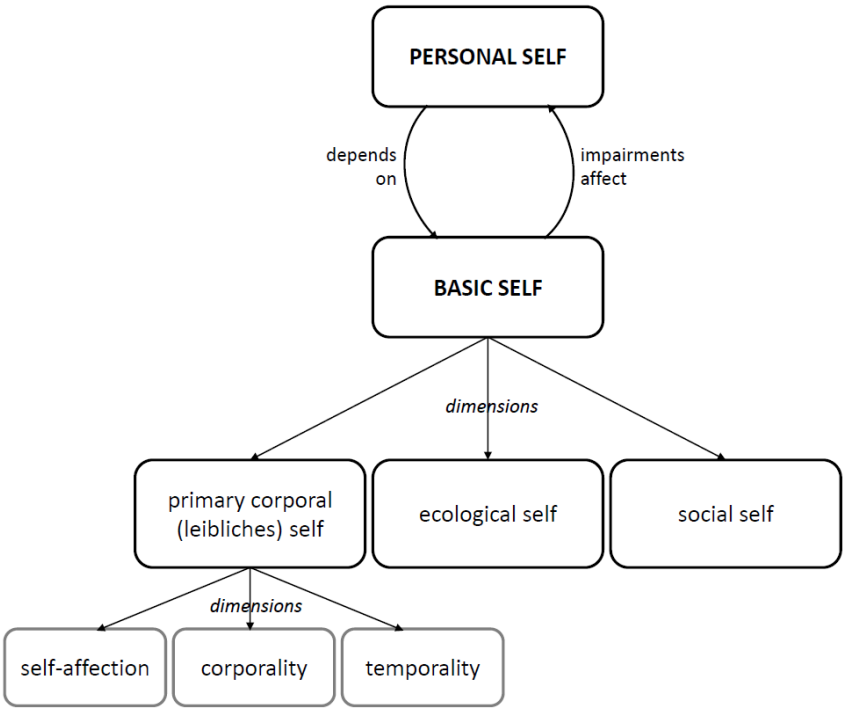

Figure 13 Schematic illustration of the postulated dimensions of the basic self, as well as its relation with the personal self (Fuchs, 2012b).

Within this theoretical framework, AVHs are considered to be due to the externalisation of self-generated activity that has become so alienated that is no longer experienced as such: the experience of inner speech is proposed to no longer pervaded by a sense of "mineness" and thus experienced as externalised.

6.2.4 Voice-hearing as expression of a disorder of "passive syntheses"

The concept of passive synthesis traces back to Husserl and has been used for the conceptualisation of AVHs and more generally schizophrenia (e.g., Wiggins & Schwartz, 2007). It is assumed that "normal" experience is ensured by automatic "multiple constantly occurring syntheses" (Wiggins & Schwartz, 2007, p. 117). These syntheses are assumed to

[28] Northoff and Stanghellini (2016) describe this process in terms of a "morbid objectivization, [in which] parts of one's body that are usually silently and implicitly present and at work become explicitly experienced" (p.10).

constitute "the basic ontological components of the world, space, time, causality, and the object-property relationship" (Wiggins & Schwartz, 2007, p. 117) or, put together, our "reality of the world" (Wiggins & Schwartz, 2007, p. 117). An example of such syntheses could be that features of objects are automatically synthesised so that we experience them as distinct objects.

6.2.4.1 Wiggins and Schwartz' (2007) account of voice-hearing as expression of impaired passive syntheses

Wiggins and Schwartz (2007) base their analysis of AVHs on concepts borrowed from both Husserlian and Heideggerian philosophy. In that sense, they maintain that mental disorders are manifestations of specific modes of human "being-in-the-world".

They assume that passive syntheses serve to reduce the world's complexity. However, in the case of schizophrenia, the authors propose, the ontological components of reality are de-structured because of impaired automatic syntheses. An assumed consequence of this de-structuring is that individuals with schizophrenia find themselves confronted with "an overabundance of stimuli" (Wiggins & Schwartz, 2007, p. 119). Then, the person, according to the authors, has to organise these stimuli *actively* and new kinds of syntheses will appear. Crucially, however, these "compensatory" syntheses will not have the same effects as the "normal" (impaired) syntheses would have. Rather, the reality of the person will be constituted in a new way. The authors think that it is "ultimately un-understandable" (p.121) why the world of a person is re-structured exactly the way it is restructured.

Where do the AVHs come in in this conceptualisation of schizophrenia? It is assumed that AVH serve for the person to reduce the complexity of the experience resulting from the assumed overabundance of stimuli. In the authors' view, they fulfil this function in "impart[ing] an organization to the patient's mental life that at least minimally stabilizes his or her world and self" (Wiggins & Schwartz, 2007, p. 121). This, however, has the price that the voice-hearer will be further distanced from the participation in social life.

Now, what is the role of passive syntheses for AVHs? Whereas normally hearing a voice is automatically synthesised with the person speaking, the authors assume that this is not the case in AVHs. To put it in the authors' words, they assume that in AVHs "the voice is intended without the synthetic co-intending of a person speaking; the voice alone is meant" (Wiggins & Schwartz, 2007, p. 123). This implies that the voices lack a precise spatial position. It is therefore assumed to be experienced as uncaused and unexpected, and thus, "given with a brute immediacy" (Wiggins & Schwartz, 2007, p. 122). The content of the

voice, thereby, is assumed to be personally relevant for the person. The authors, moreover, consider AVHs as quasi-acoustic and voice-like as they assume that the experience of a "voice" differs from the experience of hearing some other person speaking.

6.2.4.2 The role of inner time consciousness for voice-hearing (Fuchs, 2013b)

Within the context of AVHs as being due to a more basic "ipseity-disturbance", Fuchs (2013b) has later examined the role of temporality in such phenomena. The author considers this approach as complementing conceptions of schizophrenia as ipseity-disturbance.

He distinguishes between temporality as "pre-reflectively lived time" and explicit temporality. The former, which he considers relevant for the genesis of AVHs in schizophrenia, is outlined in terms of Husserl's analysis of the "transcendental synthesis of "inner time consciousness" (Fuchs, 2013b, p. 77). Basically, this serves to explain why we experience a "flow" of time and not infinitely many separate moments. The idea is that consciousness has a retentional-protentional structure, which forms the basis of an experience of temporal continuity. Put simple, this means that the experience of a specific moment implies a sense of what was just experienced (retention) as well as an anticipatory moment towards the succeeding experience (protention) (Gallagher, 2012). This synthesis of succeeding moments in terms of retention and protention is not carried out actively by a subject, but is automatic.

Fuchs (2013b) considers this synthesis as a prerequisite for the basic "self-awareness" and takes into consideration the hypothesis that it might even be synonymous with the coherence of a basic "self-awareness". In the condition of schizophrenia, the author proposes, the basic self-awareness is weakened and temporally fragmented. More specifically, he assumes that especially the protentional or anticipatory processes do not longer function properly. The postulated impairment in temporal synthesis, according to the author, will lead to "micro-gaps of conscious experience" (Fuchs, 2013b, p. 86). In the proposed theoretical framework, AVHs are conceptualised as manifestations of this disturbance of the synthesis of inner time-consciousness. In the case of AVHs, thoughts are assumed to be "no longer embedded in the continuity of basic self-experience" (Fuchs, 2013b, p. 87) and in extreme cases to be experienced as voices. The author hypothesises that the synthesis of inner time consciousness at a neurophysiological level may be associated with neural networks including the dorsolateral prefrontal cortex and the anterior cingulate cortex.

The role of the constitution of time for AVHs has also been proposed by others (Naudin & Azorin, 1997). They consider the hypothesis that "the other within the self of the

acoustico-verbal hallucination [is] linked to retentions which have become autonomous" (Naudin & Azorin, 1997, p. 187) as "the "voice" represents itself under the mode of the perfect tense, (always-already-there) […] ahead of the subjects' current experience" (Naudin & Azorin, 1997, p. 183).

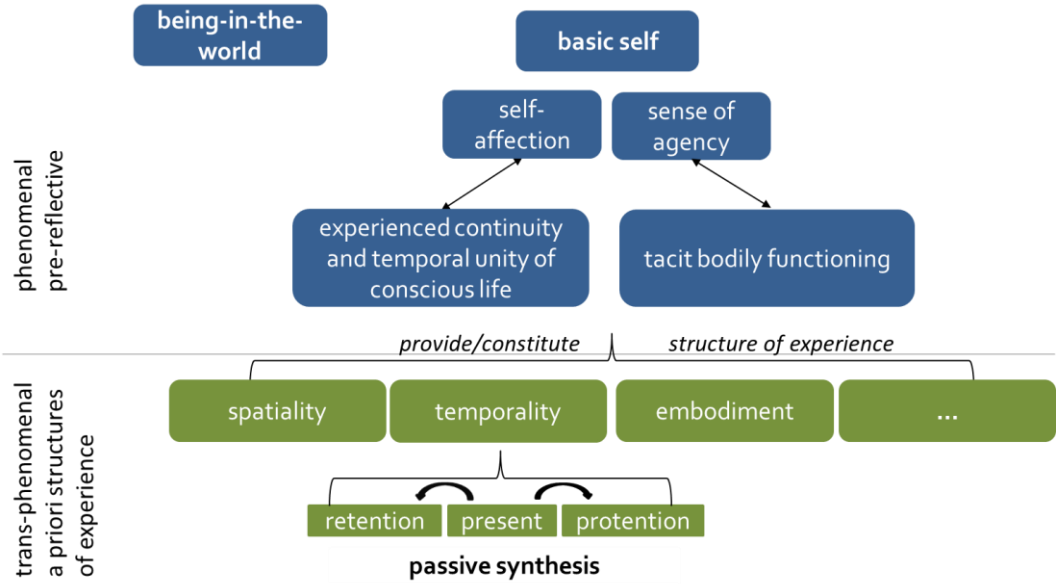

Figure 14 Schematic illustration of philosophical concepts used for conceptualisations of VH in conceptions of schizophrenia as a self-disorder and as disorder of passive syntheses. Note that all connections are to be viewed as hypothetical. Moreover, the schema is not thought to propose that conceptions of VH as manifestation of impaired passive syntheses implies their conception as manifestation of an ipseity-disturbance. That is not the case, as explained in the text. As it becomes clear there, conceptions of schizophrenia as self-disorder and as disorder of passive syntheses have often been developed independently. Nonetheless, there are authors that consider the role of passive syntheses within conceptions of schizophrenia as a self-disorder (e.g., Fuchs, 2013b).

6.2.5 Voice-hearing as compensatory for a disturbed relation between subject and world – Rojcewicz and Rojcewicz' (1997) account

Rojcewicz and Rojcewicz (1997) suggest that AVHs occur for "human reasons" (p.1), namely when the relation between subject and (interpersonal) world is disturbed. It is based on the assumption that humans' experience, characterised by directedness towards and situatedness in the inhabited world (Rojcewicz & Lutgens, 1996), is subtended by an "intentional arc". The world is assumed to provide solicitations that are assumed to be preconditions to establish an intentional arc and thus a relation with the world. In the case of schizophrenia, the authors assume, this world of solicitations is rejected, especially in the realm of interpersonal life and the intentional arc is slackened. However, it is assumed that every person has an inherent drive to establish an intentional arc with the (interpersonal) world. AVHs are then considered to be attempts to "re-establish a connection with the outside world" (Rojcewicz & Rojcewicz,

1997, p. 33) by providing new solicitations, a kind of interpersonal field in which the voice-hearer can engage.

Regarding the content of AVHs, the authors hypothesise that this content is interpersonal as they postulate that AVHs occur because of interpersonal reasons. That AVH-episodes tend to be brief, according to the authors, may be because "the slackening of the intentional arc does not allow prolonged dialogue" (Rojcewicz & Rojcewicz, 1997, p. 31). Moreover, they hypothesise that voices are often identified as stemming from a source different from the self, in analogy to the "original" (rejected) solicitations.

6.2.6 Voice-hearing as manifestation of the anticipation of an other – Naudin and Azorin's (1997) account

Naudin and Azorin (1997), as many authors of the reviewed studies, regard AVHs as modifications of the own inner voice of the hallucinating person. According to the authors, we might describe an AVH as the explication of the pre-reflective knowledge that another person might anticipate one's interiority. In that sense, the authors write of an "anticipation of others' intentional possibilities" (Naudin & Azorin, 1997, p. 190) that manifests itself in the form of a "voice". What is special in the case of AVHs is that the voice's "intentionality" and that of the voice-hearing person "constitute one and the same movement" (Naudin & Azorin, 1997, p. 183)". However, for some reason, in AVHs the person "grasps himself or herself as if he or she were an other"[29] (Naudin & Azorin, 1997, p. 183). Further, the authors put forward that the essence of an AVH is its non-perspectival quality. That means that it is impossible for someone else to share the same reality. Based on that, the authors further propose that AVHs might be understood as a "dialogical crisis" (Naudin & Azorin, 1997, p. 175), because AVHs, they think, lack an encounter's dialogical character. The relation between voice-hearer and voice is an "unfair" relationship as the voice-hearer is exposed to the voice. In that sense a voice-hearer 's body becomes "an object-body that is simply subjected to voices" (Naudin & Azorin, 1997, p. 183). As the hallucinatory voice is "disembodied", that is, comes without a physically present speaker, it is impossible for the voice-hearer to engage with it in the way he could engage with a physically present person talking to him/her.

Summarising, in the phenomenological philosophical approaches to AVHs that we reviewed, AVHs are conceptualised as arising as secondary phenomena due to a

[29] We might compare this approach with the Vygotskian approach to inner speech put forward by Jones and Fernyhough in a study reviewed above (Jones & Fernyhough, 2007a). There they assume that the development of inner speech in children includes the internalisation of the perspectives of others.

fundamentally altered structure of experiencing oneself, one's "mental life" and the world one lives in. In their approaches to AVHs, the authors of the reviewed studies employ concepts of different philosophers in order to analyse the altered way of experience of a person with schizophrenia, which they assume is at the basis of AVHs.

We have already seen that the argument Wu (2012) adduced in order to substantiate his account of AVHs is not really convincing. However, the other accounts we have reviewed also draw only incomplete pictures of AVHs. A range of complex concepts has been used for the conception of AVHs within schizophrenia. However, it remains unclear, *how exactly* the concept of ipseity is related with the concepts of self-affection and temporality or what exactly the relation between diminished ipseity, dis-embodiment and objectification of mental processes is. Nonetheless, these approaches go beyond the neuroscientific studies reviewed above in that they include and focus on first-person experience and its descriptions. In this the voice-hearer as a person and his/her experience are considered as indispensable for the understanding of voice-hearing.

6.2.7 Methodological discussion clinical-philosophical approaches to voice-hearing – how *pre*-reflective is pre-reflective experience?

Mishara (2010) has rather harshly criticised the concept of ipseity stating that "the concept of ipseity, and its […] appropriation as passive self-affection (or so-called pre-reflective self-awareness) is ultimately a matter of faith" (p.16). Consequently, he ascribes this concept "limited usefulness in the diagnosis, treatment and/or research of schizophrenia" (Mishara, 2010, p. 18) . In that sense, it has been doubted that one can reflectively acquire knowledge of one's pre-reflective experience (Schlimme, Bonnemann, & Mishara, 2010). For this reason, pre-reflective experience is considered as inaccessible to scientific experimentation (Mishara, 2010).

However, one does not have to be so pessimistic: it seems well possible to deduce what a pre-reflective experience is like usually, from when it is altered. Also, an instrument has been developed in order to investigate abnormal self-experience (Parnas, Møller, Kircher, & Al, 2005). This Examination of anomalous Self-experience (EASE) scale has been shown to discriminate between patients with schizophrenia-spectrum disorders and patients with other mental diseases (Parnas & Henriksen, 2014). It remains to be shown, if such a measure is, for example, systematically associated with AVHs, or different types of it.

7 General Discussion

In this chapter, after shortly summarising the reviewed results, they will be critically discussed regarding conceptual issues. Based on this critical examination, a tentative to describe obtained results in an alternative way is presented.

7.1 Summary

In a first step, we have seen that voice-experiences can be described regarding multiple dimensions and are experientially complex and heterogeneous phenomena.

Afterwards, literature regarding AVHs/VH from different fields of Cognitive Science was systematically reviewed with the aim of examining how AVHs are conceptualised in different Cognitive Science disciplines. We have seen that different Cognitive Science disciplines have focused on different aspects of AVHs. A great variety of concepts has been used in order to conceptualise AVHs in neuroscientific, psychological, and philosophical approaches towards such phenomena. These concepts range from supposed neuronal processes (e.g., corollary discharge) over psychological constructs (e.g., belief) to phenomenological concepts (e.g., ipseity), and hint at different metaphysical assumptions, epistemic objects and epistemic approaches of the contributing disciplines.

The diversity of possible conceptualisations may be partly due to the diversity of AVHs themselves. Given the phenomenal heterogeneity of voice-hearing, it seems unlikely that, for example, one cognitive mechanism may suffice for a sound conceptualisation of all AVHs. Certain concepts may be more appropriate to conceptualise certain types of AVHs and other concepts to conceptualise others.

In that vein, several different subtypes have been proposed, such as hypervigilance (Dodgson & Gordon, 2009), inner speech (McCarthy-Jones, Thomas, et al., 2014), autobiographical memory (McCarthy-Jones, Thomas, et al., 2014) hallucinations. Regarding neurocognitive models of voice-hearing, a recent review identified similar concepts (Upthegrove, Broome, et al., 2016).

Coming back to the experiential features of AVHs, studies from different disciplines have largely focused on different aspects of AVHs. The reviewed neuroscientific studies have largely compared voice-hearers with non-voice-hearers, not much further focusing on experiential details. One study took into account more “physical” properties, such as perceived location of the voice (Looijestijn et al., 2013). Neurocognitive models have focused

on the question why AVHs are experienced as stemming from non-self sources as well as on their audibility. The reviewed psychological accounts have rather focused on voice-hearers' relationship to their voices as well as their context in terms of stressful life-events. Phenomenological philosophical approaches focused on the description of altered structures of experience in schizophrenia per se, in which context AVHs are assumed to emerge.

In the studies reviewed in the present work, structural as well as functional brain alterations in voice-hearers with schizophrenia diagnosis in specific brain regions have been reported. Such alterations have been reported to occur both during voice-experiences themselves, as well as during resting state or the execution of tasks thought to be related with processes postulated to be altered in individuals with voice-hearing experiences.

In some of the reviewed neuroscientific studies, VH was explicitly conceptualised as resulting from a "brain disease" (Aguilar et al., 2008, p. 434). In that vein, it has been proposed that altered neuronal activation patterns in voice-hearers may trigger compensation mechanism on a neuronal level "trying" to compensate for these alterations and that such compensatory mechanisms may go along with the experience of hearing a voice (Sperling et al., 2009).

Other studies have focused on voice-hearing conceptualised as being due to auditory-processing deficits. In the reviewed studies it has been proposed that voice-hearers show altered functional coupling between brain regions associated with speech processing, as expressed in altered oscillatory synchrony between those regions (Mulert et al., 2011; Sritharan et al., 2005).

Emotional word paradigms, in which voice-hearers listen to emotional words resembling their "voices'" content, suggest that brain regions associated with emotion processing, speech processing and memory processing are activated to a greater extent in voice-hearers compared to healthy controls (Aguilar et al., 2008; Escartí et al., 2010; Horga, Fernández-Egea, et al., 2014). In that vein, it has been proposed to conceptualise AVHs within a framework of "normal" auditory processing (Badcock, 2010). In those approaches, it is assumed that voice-hearers "process" speech in an abnormal manner and that such alterations are related with the occurrence of voice-experiences. It remains, however, unclear how they are related exactly.

In the reviewed studies, AVHs have also been conceptualised as unintentionally activated auditory memories (Waters et al., 2006) or as being related to memory deficits (Brébion et al., 2013). However, the most popular ways of conceptualising AVHs in the

neuroscientific literature are conceptualising them as being due to altered "top-down" and "bottom-up" processing in the widest sense. Such models propose, for example, "bottom-up" factors consisting in auditory cortex hyperactivity or neurotransmitter dis-regulations and "top-down" factors such as cognitive biases, such as a hypervigilance bias.

Most results of the reviewed neuroscientific studies have been interpreted in terms of pointing at impaired (verbal) self-monitoring or predictive processing in voice-hearers, which may be due to the fact that many of them were designed on the basis of models that conceptualise AVHs as being due to or implying such impairments. This is a nice example that third-person observations in science are not made from an independent objective standpoint, but are theory-laden and possibly biased conclusions (Cytowic, 2003).

Verbal self-monitoring has been investigated in both behavioural and electrophysiological studies, with inconsistent results.

Whereas neuroscientific approaches to voice-hearing have focused on inner speech and verbal self-monitoring, in the realm of psychology research on AVHs has mainly been based on different concepts. These span relational aspects of voice-hearing, including social cognition, beliefs about voices and the context of the occurrence of AVHs.

In the present review, we found that neuroscientific, psychological, and clinical-philosophical approaches to AVHs largely rely on different conceptual spaces. As Aguilar et al. (2008) put it crudely "proponents of these different approaches (neuroimaging vs. psychosocial) are not listening to each other" (p.437). In the reviewed psychological research, we found a shift away from the focus on audibility towards voice-hearing's social aspects. It has, for example, been argued that AVHs are social phenomena in the sense that they include a dialogical moment (Bell, 2013). In the context of these studies voice-experiences are not simply conceptualised as auditory experiences without corresponding stimuli, but as "constructed as that of relating to an interpersonal other" (Hayward, 2003, p.369). Voice-experiences have been found to be shaped by social patterns occurring in a person's life. Moreover, voice-hearers seem to employ similar patterns of relating when they relate to their voices and significant others in their lives. These "interpersonal" properties of voice-experiences have widely been neglected in approaches towards VH focused around the concepts found to be relevant in neuroscientific research about VH, although it has been pointed at the importance of the consideration of these aspects in cognitive models of voice-hearing (Leudar et al., 1997).

Some philosophers refer directly to concepts used in neurocognitive approaches to AVHs. In those studies, the usefulness of self-monitoring accounts of AVHs as default model has been questioned (Cho & Wu, 2014; Wu, 2012). Gregory (2016) presented arguments for the assumption that it is rather imagined instead of inner speech that is faultily monitored in AVHs. In phenomenological philosophical approaches to VH still different concepts have been used for the description of AVHs. Whereas some of these approaches have focused on the conception of schizophrenia as a basic self-disorder, others focused on the conception of schizophrenia as a result of impaired passive syntheses. In those approaches AVHs are considered as secondary phenomena that are due to a more basic primary disturbance of a person's structure of experience.

Besides the many open questions left open by individual approaches that we have considered in the respective sections, there are some questions that several of them have not answered satisfactorily yet. We will consider them in the following sections.

7.1.1 Some questions left open by the reviewed studies

In many of the reviewed approaches to VH, it is assumed that these phenomena can be understood within some more basic deficit or alteration that enables the occurrence of AVHs. Due to altered predictive processing, self-monitoring, or structures of experience, it is often assumed that, for example, inner speech is experienced in the form of AVHs. We then have to wonder why voice-hearers do not experience voices constantly? And that is certainly not always the case: there is, for example, evidence for the assumption that inner speech of voice-hearers does not differ from inner speech of individuals without such experiences (Langdon, Jones, Connaughton, & Fernyhough, 2008). Put differently, these assumed alterations do not seem to be *sufficient* conditions for AVHs to appear. The reviewed conceptions of AVHs have, thus, to be considered as incomplete stories. None of them provides a satisfactory account of how exactly AVHs arise. This might also be due to a neglect of the communicational core of voice-hearing phenomena.

Also, in many of the reviewed studies, AVHs are conceptualised as involving some form of inner speech. However, the concept of inner speech is defined in differing ways in the reviewed studies, or not even defined at all. This raises the question: what is inner speech? May there be both inner speech (whatever that may be) and imagined speech AVHs?

Besides some exceptions (e.g., the proposal of a Vygotskian approach to inner speech by Jones and Fernyhough, 2007a) the term is used in an ambiguous or not satisfactorily defined way. However, if the concept of inner speech is so central to AVH-research in multiple disciplines, it is worth describing and examining in-depth what it is thought to be.

Another point is that the minority of the reviewed studies refers to the specific content of particular voices. However, the voice's content itself may provide valuable hints regarding its aetiology.

This illustrates that besides neuroscientific and clinical-philosophical approaches, psychological research is crucial for identifying the circumstances in which AVHs arise. The assumption of trait-alterations of self-monitoring processes or structures of experience is not dynamic enough for allowing to conceptualise intermittent AVHs.

7.1.2 Some notes on the prevalence of neuroscientific studies in the present review

In the present work, and in line with a recent review (Upthegrove, Broome, et al., 2016), the field of neuroscience has been identified as the dominant one in voice-hearing research, both in terms of empirical studies and proposed models. This is mirrored by the fact that a vast amount of research funds available for psychiatric research is allocated to projects that are based on the implicit or explicit assumption that psychiatric phenomena are symptoms of "brain diseases" (Zedlick & Thoma, 2017).

One may speculate that this is due to an implicit assumption that neuronal processes are somehow more "real" than the subjective experience. However, as noted before, third-person observations are also theory-laden (Cytowic, 2003) and empirical hypotheses are often prescribed by a researcher's natural experience (Naudin & Azorin, 1997). In the current chapter of brain research history, which has been proposed to be called "brainhood" (Vidal, 2009), we find neurosciences as a "universal frame of reference for addressing human nature" (Borck, 2012). Applied to voice-hearing, we could say, that in many of the reviewed studies, neuroscience seems to be assumed to be the ultimate frame of reference for addressing voice-hearing's nature.

Why could such a "neuro-dominated" perspective be critical? Although the majority of the reviewed studies belong to the realm of neuroscience (which is also true for the studies retrieved in the initial database search), it is this area that seems to have the least direct practical applicability for voice-hearers. Whereas psychological findings have been applied in psychotherapy (e.g., Hayward, Overton, Dorey, & Denney, 2009), it seems more difficult to

convert neuroscientific findings into pharmacological innovations as "no dramatically new discoveries in drugs have occurred since the 1950s" (Le Moal & Swendsen, 2015, p. 598). Moreover, one study found that voice-hearers that assumed that their experience is due to a neurochemical imbalance feel powerless regarding their voices (Jones, Guy, & Ormrod, 2003). Having in mind that feeling powerless regarding one's voice seems to be related with distress (Birchwood et al., 2004), one may thus hypothesise that it is not advisable for clinicians to transmit voice-hearers that their voices result from a "brain disease".

As indicated before, the present reviews results are largely in line with other recent reviews of neuroscientific and psychological studies about voice-hearing (Ćurčić-Blake et al., 2017; Upthegrove, Broome, et al., 2016). However, former reviews of the voice-hearing literature have not probed sufficiently basic assumptions that underlie, for example, interpretations of results from neuroscientific studies and discussed their impact on how AVHs are conceptualised. We will discuss such conceptual issues now. Of note, methodological shortcomings of the reviewed studies are often due to or intertwined with conceptual issues.

7.2 Conceptual issues

It has become clear until this point that the question of what AVHs or voice-hearing is an important one, as it has practical consequences[30]. This is so because the conceptualisation of such experiences guides the research approach towards them. Consequently, it is important to invest resources into research projects that are based on conceptualisations of AVHs that ultimately are relevant for voice-hearers suffering from such experiences. As indicated before, "evidence generated by clinical research will depend on who asks the questions, who defines the outcome measures, who interprets the findings, and who disseminates the outputs" (Greenhalgh, Snow, Ryan, Rees, & Salisbury, 2015, p.2).

7.2.1 Where and what is the hallucination in neuroscientific studies? – The standard conceptualisation of AVHs

With the exception of studies focusing on a relational nature of voice-hearing, almost all of the reviewed neuroscientific and cognitive psychological studies rely in a greater or lesser

[30] Note that it is also conceptual issues that are at the core of many methodological problems discussed above.

extent on the "standard" conceptualisation of AVHs as perceptual experiences without corresponding external stimuli or as false perceptions. This "standard definition" of AVHs as perceptions without object dates back to Esquirol in the 18th century (González, 2010). It has led researchers to search for abnormalities of perceptual processing in voice-hearers and to focus on audibility, which is critical as approximately only one half of voice-hearers with a schizophrenia diagnosis experience their voices as literally auditory (Jones & Luhrmann, 2016; Moritz & Larøi, 2008; Nayani & David, 1996; Woods et al., 2015) and only a subgroup of those, in turn, experience their voices as "speaking" as loud as other individuals (Moritz & Larøi, 2008). This leads us to the suggestion that the "conceptual core" (González, 2010, p. 195) of the prevailing conceptualisation in voice-hearing research may not coincide with the "experiential core" of AVHs. That a substantial part of voice-hearers does not experience their voices as literally auditory illustrates that audibility is unlikely to be at the core of (at least a substantial part of) voice-experiences. Alternatively, we must abandon the momentary use of the designation 'voice-hearing' or AVH for a large part of phenomena that up to now have been designated as such. A while ago, there was a proposal to introduce a new general term[31] for hallucinatory phenomena (Stevenson, 1983). That such a term has not been implemented raises doubts about the practicability of that second option, although it appears entirely reasonable. In fact, we can assume that "auditory verbal hallucination" is a misnomer for many experiences summarised under this notion.

The standard definition has recently been criticised in-depth regarding its conceptual shortcomings (González, 2010). Such a conceptualisation is, among other things, grounded on the mis-conceptualisation of (most) AVHs as being indistinguishable from perceptual experiences. Although that is the case for *some* voice-experiences, most voice-hearers have "insight" in the sense that they know when they are hallucinating and when they are not (Nayani & David, 1996). "Hallucinatory" perceptions, furthermore, are assumed to be "false" in the sense that they do not correspond to stimuli accessible in an intersubjective world. However, González (2010) rightly notes that the "experience itself cannot be mistaken and is neither true nor false" (p.196) and therefore it is misleading to speak of a false perception. Hence, it makes no sense to define AVHs as perceptions, as a real-time connection between perceiver and extracorporeal world is established through perceptual processes. In that sense, perceiving implies an intersubjective existence of the "something" that is perceived (González, 2010), which is not the case in voice-hearing, as voice-experiences are private. In

[31] He proposed the term "idiophany" as collective term for private (unshared) sensory experiences.

the same line, it does not make sense to speak of an AVH as being unreal, as the experience of a voice is real but private. Instead, we may say that a voice-hearing experience is not public, in the sense that other individuals cannot experience the voice from a first-person perspective.

We have seen that the standard conceptualisation of AVHs rests on questionable conceptual foundations. Moreover, we have seen that the use of the "standard" conceptualisation of AVHs in AVH-research has practical consequences. However, in the reviewed studies there is more to the conceptualisation of voice-hearing than its "standard" definition. We will consider such conceptual issues further now.

Let us now turn to the examination of (implicit) philosophical assumptions as exhibited in the language of the reviewed neuroscientific studies.

7.2.2 Some notes on mixing up epistemic levels in neurocognitive accounts of voice-hearing

One may get the impression that the proposed models as derived from reviews of the literature are often a mere juxtaposition of various individual theoretical components. These models often lack a conclusive connection between those components or an epistemological framework in order to integrate results from different epistemic levels[32]. Moreover, in many of the reviewed studies we find a conceptual mixing of different epistemic levels: it is often not clear which processes are assumed to be subpersonal and which are conscious, which processes are attributed to the voice-hearing person and which to his/her (erroneously personified) brain. This is reflected in the use of physical and intentional vocabulary likewise to describe brain functioning. In the reviewed studies, we find a transfer of "intentional"[33] vocabulary into the description of subpersonal, for example, neuronal, processes that are used to explain AVHs. AVHs, however, cannot be due to "intentional" subpersonal processes, as we will not find such processes on a subpersonal level, but only on the level of a person as a whole. Let us consider some examples.

The author of one of the reviewed studies states that it is a "fact that auditory hallucinations are excitatory phenomena that cause a phenomenological experience of a percept of something that does not correspond to a real event" (Hugdahl, 2009, p. 557). The cited sentence contains more than a conceptually dubious formulation: first, the author states

[32] On this, see also Kotchoubey et al. (2016) on neuroscience: "Any attempt to develop an integrative neuroscience has to deal with epistemic compatibility of the various methods. The usual solely additive combination of methods and levels may not be sufficient to construct a comprehensive picture of neuropsychological phenomena. Only theoretical efforts seem to promise integration by building conceptual bridges" (p.5).

[33] "intentional" is used here in the sense of "being directed towards something" or "being about something".

that AVHs are "excitatory phenomena". "Excitatory" is an adjective usually used to describe neural potentials. Thus, by using this word in this context, the author implicitly suggests that AVHs are reducible to neuronal processes, which is arguably not the case. Although voice-experiences may be *enabled* by neuronal activation, they are arguably not neuronal events, but experiences that are embedded in a person's lifeworld and have a subjective side. Second, these AVHs are assumed to cause the experience of a percept. However, we have already seen that the assumption that AVHs are perceptions rests on faulty conceptual grounds. Of course, a voice-hearing experience may nonetheless be a *perception-like* experience. Third, in that quote we find a reification of AVHs, as it is even better demonstrated by a similar but different quote of the same author in which he states that "auditory hallucinations generate activity in the speech regions in the left hemisphere much like real auditory input" (Hugdahl, 2009, p. 555). Auditory hallucinations, here, remain mysterious unidentified entities that have causal influence on brain activity. Where and what are they?

Waters et al. (2006) state that their "model's proposal of a failure in the control of intentional inhibition explains that patients would find it difficult to suppress irrelevant mental events, which would then be experienced as conscious events" (p.77). It is, however, not plausible that someone could intentionally inhibit unconscious events. For someone to be able to inhibit an event, it seems to be a necessary condition that he/she is conscious of this event. If the person was not, how would he/she know that there is something he/she could inhibit at all?

7.2.3 The brain – an independent entity producing voices?

Conceptual shortcomings in the reviewed studies can largely be framed in terms of "mereological fallacies". In general terms, one speaks of a mereological fallacy when psychological attributes applying to an animal as a whole are falsely ascribed to a part of the animal (Smit & Hacker, 2014). Ascribing properties to the brain, which in a meaningful way can only be ascribed to a person as a whole, represents a case of a mereological fallacy.
Nevertheless, many times in the reviewed studies we find a (at least at the linguistic level) "personification of the brain"[34]. However, it is questionable that the brain – as Fuchs (2011) puts it – is a "god-like creator of mental life" (p.197) and thus of AVHs. It is not less dubious

[34] We are aware, that it might be almost unthinkable to describe brain functioning without the use of metaphors, however, it should not be disregarded which practical consequences that has.

to ascribe activities to the brain that, meaningfully only can be ascribed to the person or voice-hearer as a whole.

In that vein, some of the authors of the reviewed studies write about an "auditory hallucinating brain" (Sritharan et al., 2005, p. 191), or "the hallucinating brain" (Allen, Larøi, & McGuire, 2008, p. 187). Others state that "normally, Wernicke can decide whether the perception is outer generated […] or inner generated […]" (van Der Gaag, 2006, p. 115).

In the context of predictive processing accounts of voice-hearing, it has been stated that "you (or, perhaps more accurately, your nervous system) roughly think […]" (Wilkinson, 2014, p. 152), a "brain has certain expectations" (Wilkinson, 2014, p. 146) or "can wrongly think" (Wilkinson, 2014, p. 147). Others write of cortical hierarchy levels that "remember[…] frequently observed temporal sequences of input patterns and assign[…] meaning […] to these sequences" (Krishnan, Fivaz, Kraus, & Keefe, 2011, p. 130) and "higher levels [that] predict future input […] and project[…] their future expectations to the lower levels" (Krishnan et al., 2011, p.130).

You might wonder: what is wrong with all these statements? The point is that a brain does not think, nor remember, nor expect anything, nor ascribe meaning, nor does it hallucinate. All those activities can only be ascribed in a meaningful way to a person as a whole. To ascribe them to the brain is to commit mereological fallacies. We will not find entities in our brains that compare or predict anything. There are "no homunculi" in our brains interpreting auditory signals and deciding if they are self-generated or not. A voice-hearer's brain does not decide about the source of an experience, neither does a neuron or a population of neurons as they do not decide anything at all (Fuchs, 2013a). In order to apply such vocabulary in a meaningful non-metaphorical way, we need to "mak[e] the organism (or person) the crucial reference point" (Frisch, 2014, p. 1). That a brain is embedded in such an organism's body does not mean that its single cells or cell groups can make decisions.

This type of metaphors (personification) has been identified as one of three major types of metaphors that dominate neuroscientific language (Goschler, 2007). The other two types identified in the respective analysis of neuroscientific literature are metaphors of spatialisation and technological metaphors. Let us turn to the latter category now.

7.2.4 Are AVHs due to faulty information processing in the brain?

Some of those notions, used in the reviewed studies to describe AVHs on a neuronal level, originate from vocabulary that is used to describe computational processing. In the history of

models explaining the functions of the brain, the functions of the brain have been described in analogy with the most recent technical innovations ever since (Borck, 2012). Hence, it is not surprising that brain functioning in current models of voice-hearing is largely described in terms of such a vocabulary. As the authors of one reviewed study note "until today, the psychological perspective on brain functioning is determined by the concept of information processing" (Strik & Dierks, 2008, p. 67). However, to speak of neuronal functioning as "information processing" implies misinterpretations that have an influence on how AVHs are conceptualised.

"To inform someone" means to "make someone known" (Merriam-Webster's online dictionary, 2017b). "To inform" is a transitive verb and, thus, it requires an accusative object, that is, a subject that is informed. Put differently, in order for something to be "information" it has to be information *for* someone who possibly understands that information. In that sense, Callaos and Callaos (2002) have distinguished between the terms "data" and "information", whereby data are "transformed into information by means of a subject's perception and interpretation" (Callaos & Callaos, 2002, p. 82). Thus, we may conclude that it is misleading to speak of "information processing" in the brain or "neuronal information" and alike, as there is no subject that could be informed by such neuronal processes. Neurons or neuron population are no subjects capable of understanding information and there is arguably no homunculus in our brain that could receive and understand information. For that reason, the most we can do is to metaphorically speak of information processing in the brain – on closer inspection we will be unable to find such. To receive information is something a human being is capable of. However, to speak of the brain or its parts, as receiving information constitutes a misguided use of the notion of information (Fuchs, 2011; Smit & Hacker, 2014) and a mereological fallacy.

There are numerous examples of such fallacies in the reviewed studies. Ćurčić-Blake et al. (2013), for example, discuss the role of the Broca's area as receiving information as if it was an entity capable of the interpretation of information. However, a lack of information of the Broca's area cannot be at the origin of AVHs as Broca's area does not receive 'information' at all.

Waters et al. (2012) state that AVHs "arise through an interaction between information arising from neural activations and top-down activity" (p.688). They state further that "phenomenology-based models are useful in pointing to the evolution and transformation of neural information into increasingly differentiated signals that are subject to modification by

factors such as emotions" (p.625). It remains unclear how information can arise from neural activations, and as we have seen there is no neuronal information as such that could be transformed. Where would it be and who would transform it? Moreover this statement rests on dualist grounds. To speak of neuronal processes as "bottom-up" and emotions as "top-down" makes only partially sense. By doing so, the authors implicitly suggest that neuronal processes and emotions, brain and mind, would be strictly separable. However, emotions are arguably always embodied in the sense that they go along with specific neuronal patterns, that enable them.

In the context of self-monitoring accounts of voice-hearing, Heinks-Maldonado et al. (2007) claim that "an efference copy contains not only information about the quality of the sounds being produced but also critical information about when the sound should be perceived" (Heinks-Maldonado et al., 2007, p. 295). In that vein, the authors of another reviewed study write of "efference copy information" (Jones & Fernyhough, 2007b, p. 393) that might not reach the comparator. Others write that "self-generated actions are perceived without the distinctive information informing the individual that they are self-generated" (Seal et al., 2004, p. 65). I don't know about you, but in my case nobody ever informed me that my actions are self-generated, even less neurons, as their activity is beyond my subjective experience. Even if I was informed, what would this information consist of? I am not *informed* that an action is generated by me or not, I *experience* it as self-generated or not.

In the context of predictive coding accounts of voice-hearing, the author of one of the reviewed studies writes "by using information from seeing the person's lips move, my brain has certain expectations […]" (Wilkinson, 2014, p. 146). Others write that the "thalamus […] could […] transmit information largely matching the expectation to auditory and prefrontal cortices" (Nazimek, Hunter, & Woodruff, 2012, p. 808). Again, however, nor does any person's brain see, nor expect, nor does the thalamus "transmit information", as there is no information as such for the brain nor its parts. We could make a similar point for the notion of "representation", however, for the sake of brevity we will refrain from that.

7.2.5 Cartesian Dualism in the reviewed neurocognitive models

Conceptualising voice-hearing as "brain disease" is an incomplete account and remains on the grounds of Cartesian mind-body dualism. Although some of the authors of the reviewed studies acknowledge that the "dichotomy mind–brain makes no more sense" (Strik & Dierks, 2004, p.369), in most of the reviewed studies it is assumed that neuronal processes can *cause*

conscious experiences. The authors of the reviewed studies mention "neural mechanisms that produce hallucinations" (Horga, Peterson, et al., 2014, p. 8072), frontal brain areas that "produce thoughts" (Nazimek et al., 2012, p. 803), "bottom-up" and "top-down" neuronal processes that "interact to produce these erroneous percepts" (Seal et al., 2004, p. 175). AVHs in such accounts remain products of the brain. Such interpretations, however, are based on dualist grounds.

Hardly anybody would deny that the brain is crucial for human conscious experience. Few would disagree that neuronal processes underlie conscious experiences, in the sense that they (amongst other factors) enable individuals to have them, however that they *cause* them is a far stronger and less uncontroversial assumption. Changes at a "mind level" do not *cause* changes at a "brain level", in the sense that they occur in the realm of two different "substances" influencing each other. We might rather say that they go along with them. If neuronal processes underlie conscious experience, then altered neuronal processes will enable different conscious experiences, but they do not *cause* them. As such, it is not surprising that we find neuronal changes going along with "mind changes" due to psychotherapy (Brody et al., 2001) – we may say they are "two sides of one medal". A strict conceptual distinction between "mind" and "brain" processes is misleading, as there arguably is no such thing as a "free-floating mind" influencing neuronal processes, nor the other way around. Rather, the mind is arguably always embodied (and thus "embrained"), that is, it is not independent from neuronal processes. To put it differently, a "state of mind" has always various sides: subjective first-person and neuronal processes, observable from a third-person perspective with the adequate technology. At the same time, AVHs are not reducible to neuronal processes, as we will not find subjectivity in neuronal processes. Moreover, neuronal activity can only be interpreted in a meaningful way taking into account that a brain is always embedded in a living body and its world (Frisch, 2014). This embeddedness must be taken into account for a meaningful interpretation of the brain's activity as a part of a dynamic system consisting of the brain as a part of a person embedded in his/her environment. There is no point in artificially separating it from its context, in considering it as an independent entity, and searching for AVHs in it. Such a search must be in vain.

7.2.6 Much ado about nothing? – About the use of metaphors in the conceptualisation of AVHs

Well, one might argue, the language used in neuroscientific and cognitive psychological studies is largely metaphorical and cannot be taken literally. The reader might wonder if it is worth considering such issues at all. One could argue that the use of metaphors in science is trivial or researchers are fully aware of those notions only acting as metaphors in order to describe neuronal functioning (Dennett, 2007). If so, the above presented critique, would, indeed only be "much ado about nothing". But is that the case?

It is dubious that neuroscientists have the same "philosophical awareness" about the terms they use as Dennett, a philosopher. We may wonder, why the authors do not identify metaphors as such, and express themselves as clearly as possible. Here, we might argue that the use of metaphors, indeed, may be of great usefulness for developing new models and theories of voice-hearing. That is true, and in fact, it has been argued that it is impossible to think without metaphors (Lakoff & Johnson, 1980). In a similar line, metaphors have been fittingly described as "important conceptual "tools" in the scientific tool-kit" (Reynolds, 2014, p. 182). The authors of one of the reviewed studies rightly note that "current psychiatric semiology contains implicit theoretical assumptions" (Strik & Dierks, 2008, 66) that have far-reaching "consequences for scientific reasoning and for empirical research" (Strik & Dierks, 2008, p.67). If we, now, suppose that metaphors may convey such implicit assumptions and that such metaphors "shape" our thinking, then it is not trivial for the investigation and understanding of voice-hearing which metaphors scientists choose for discussing voice-hearing. Consequently, the usefulness of certain metaphors for such purposes should be outlined: what benefits do we (and ultimately voice-hearers) have from conceptualising AVHs using specific metaphors? That is specifically important, as it has been shown that "metaphorical approaches have the potential to mislead and distort our understanding" (Reynolds, 2014, p. 176). Thus, the use of metaphors in the context of the conceptualisation of AVHs, is arguably often no "merely linguistic problem […] but deeply rooted in scientific arguments" (Goschler, 2007, p.7). Moreover, when using them we should not forget that metaphors are "only" metaphors, as useful as they may be. In this process, it is important to consider, for example, which idea of human beings or in our case more specifically which idea of voice-hearers, such metaphors convey. We have seen above that how AVHs are conceptualised has practical consequences, for example in terms of attribution of research resources and for voice-hearers regarding therapeutic strategies. The relevant question for us,

then, is if the metaphors used in the voice-hearing literature do have an impact on how they are conceptualised? Let us consider that a bit closer.

We may hypothesise that a decomposition of the "living whole" of the voice-hearer in its parts, that is in brain and "rest" has consequences. The (metaphorical) application of attributes to the brain that in a meaningful way can only be applied to the person (in our case voice-hearer as a whole living organism) might lead to the focus on the brain in voice-hearing research. The metaphors above discussed and that are present in conceptualisations of voice-hearing imply a focus on the brain (or a shift away from the focus on the voice-hearer as a whole) as we, suddenly, find intentionality "implanted" in the brain. To put it in an exaggerated way, if the brain is assumed to be able to both produce and experience voices, what do we need the voice-hearer as a person for? The use of such metaphors, thus, seems to "invite" for reductionist conceptualisations of voice-hearing.

What consequences may reductionist approaches have for a voice-hearer? Reductionist approaches to clinical phenomena may "undermine the patient's capacity for self-understanding, self-efficacy, and autonomy" (Fuchs, 2005b, p. 117).

Now, one may wonder, if the use of such metaphors is misleading, which ones can we use instead? What kind of metaphors allows us to "mak[e] the organism […] the crucial reference point" (Frisch, 2014, p.1) again? If we assume that voice-hearing research is ultimately to serve individuals that suffer from such phenomena, we may ask: which metaphors are especially helpful for voice-hearers? Which metaphors suggest mechanisms involved in voice-hearing that are useful for developing adequate ways of handling the "voices"? To put it in a voice-hearer's words: "Anything that allows us explain our voices is important. Similarly, any research that takes place should have a fundamental benefit for voice-hearers. The pursuit of academic knowledge for its own sake does us no favours" (Cockshutt, 2004, p. 11).

Shortly, an attempt is presented to interpret the reviewed results in light of a different metaphor, within a phenomenological-ecological framework, which might prevent such a "brainhood" and enable us to draw a more holistic conceptualisation of AVHs. Before, let us shortly consider some conceptual issues that are raised by reviewed phenomenological philosophical accounts of AVHs.

7.2.7 Same, but different? – On the fuzzy boundaries of phenomenological concepts

A range of different concepts has been used in order to describe basic alterations of experience as they are postulated to occur in schizophrenia. However, it remains often unclear in how far they are related exactly. For example, it remains unclear how exactly the proposed basic self-affection and basic self-awareness are related: is the former a condition of the latter or a dimension of it? Is the latter a manifestation of the former? Are they overlapping or even synonymous terms same thing in the end? We may pose similar questions for the relation between lived temporality and basic self-awareness.

Similarly, we may ask in how far primordial presence and basic self-awareness are inseparable according to Henriksen et al. (2015). Are they inseparable in conceptual terms in empirical terms? Are they the same things and if not how may we disentangle them? It also remains unclear how one can communicate with oneself unconsciously (as proposed by Stanghellini & Cutting, 2003). Moreover, it is unclear how thoughts can dialogue in the form of inner speech or how and why they acquire quasi-acoustical qualities (as proposed by Henriksen et al., 2015).

7.3 Towards an integration of neuroscientific, psychological and clinical-philosophical perspectives on voice-hearing

The concepts identified to be used in the different Cognitive Science disciplines in order to conceptualise AVHs do not seem to have much in common at the first sight. How AVHs are conceptualised, hence, is mostly discipline-specific with each discipline focusing on specific aspects of AVHs.

Nonetheless, some authors, from a phenomenological standpoint, criticise self-monitoring accounts for removing voice-experiences from their context (Thomas et al., 2004). Others state explicitly that self-monitoring accounts of AVHs is incompatible with their view (Stanghellini & Cutting, 2003). In contrast, Fuchs (2005a) proposes that a sense of agency on a neurophysiological level is associated with "mechanisms of forward modelling, efferent copy, and action monitoring" (p. 96) amongst others. He parallels his approach with recent neuropsychological findings in schizophrenia and more generally proposes that there is "increasing evidence for a structural homology between the phenomenology and cognitive neuroscience of schizophrenia in the emphasis on the temporal order of mental life" (Fuchs, 2013b, p. 88). We will take that as a starting point.

7.3.1 Examples of common themes in neurocognitive and clinical-philosophical approaches to voice-hearing

At closer inspection, we can identify common themes between different approaches to AVHs. Three examples are the themes of self, temporality, compensation and memory (Figure 15). The concepts of predictive coding and passive time synthesis can be seen, for example, as referring to the common theme of temporality. The concept of passive synthesis describes the connection of the "flow" of consciousness in terms of retention and protention. Similarly, predictive coding accounts of AVHs assume that a major accomplishment of the brain is to predict incoming stimuli in time. This assumption can be paralleled with the concept of protention that is assumed to be a "vaguely determined expectation or openness towards the future" (Fuchs, 2013b, p. 85). It should be noted right away that the authors of these different assumptions most likely rely on very different metaphysical assumptions. Therefore, it is not possible to simply equal, for example, the concepts of prediction and protention. However, both conceptions assume that the disruption some predictive processes in voice-hearers may be associated with experiences mental events as "voices".

The theme of memory has been considered in both neurocognitive and phenomenological philosophical approaches to AVHs. It has been proposed that AVHs may be constituted by intrusive memories (Waters et al., 2006). On the other hand, it has been proposed that AVHs can be described as "quasi-present" voices, that is, the experience of the voice of someone who is absent, but whose presence is incorporated so deeply in the structure of the experience of a voice-hearer, that he/she continues to "hear" that person even when he/she is not present. Whereas the former authors refer to individual cognitive impairments in voice-hearers, the authors of the latter stress the embodied and embedded nature of human experience.

Regarding compensation, it has been proposed that AVHs may be associated with compensatory mechanisms for altered brain function on a neuronal level (Sperling et al., 2009). Rojcewicz and Rojcewicz (1997) have proposed on a clinical-philosophical level that voices may be the manifestation of an attempt to re-establish relations with the social world that has been formerly rejected by the voice-hearer. Irrespective of the validity of these approaches per se, they do not seem in principle incompatible. However, it is also not clear at first sight how exactly they could be compatible. We notice, thus, that without taking into consideration a broader framework regarding, for example, neuronal processes and

experience, it seems an unrewarding endeavour to integrate perspectives from different epistemic levels.

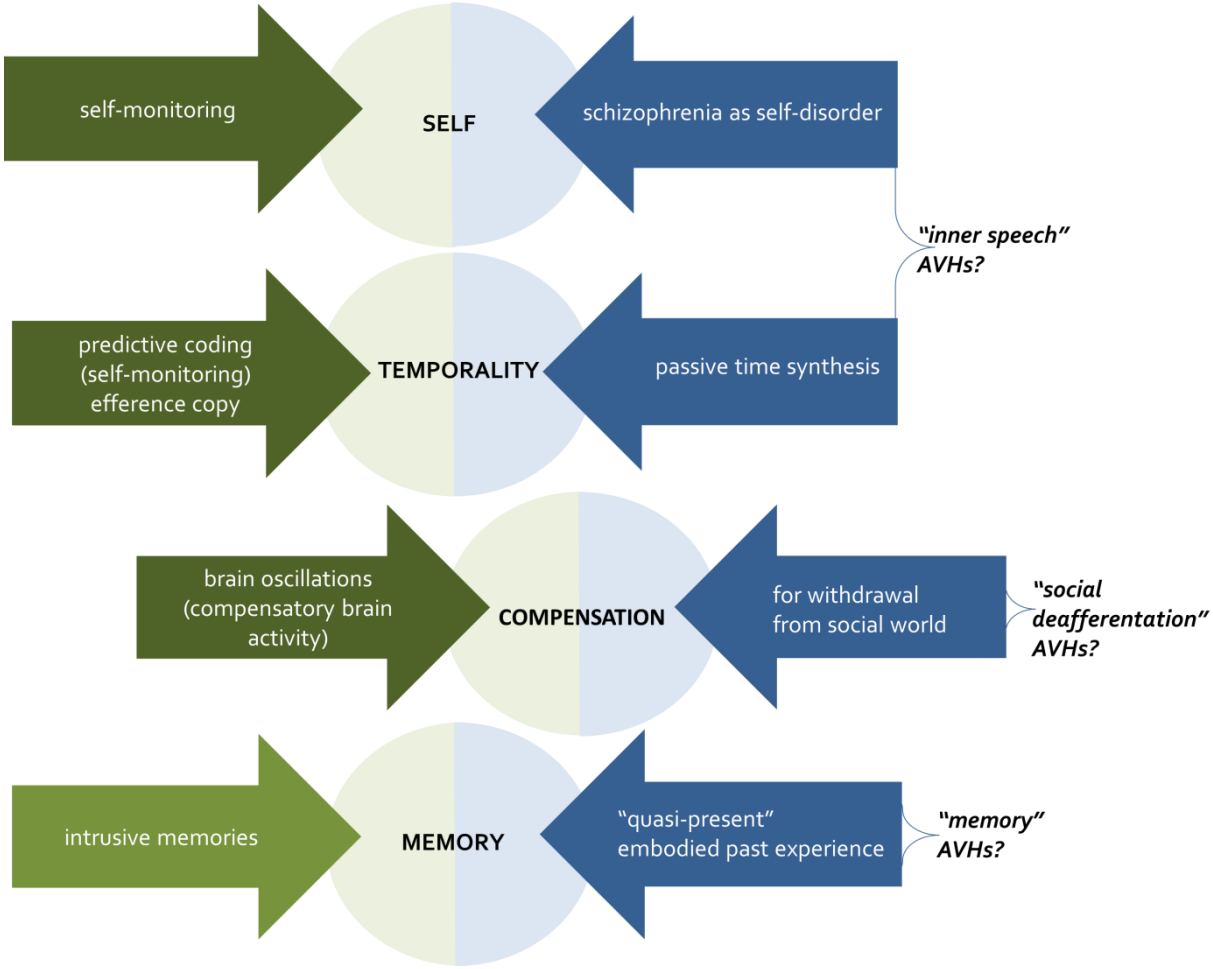

Figure 15 Common themes in reviewed studies from different Cognitive Science disciplines and their speculative relevance for proposed subtypes of AVHs. The themes of self, temporality, compensation and memory have been addressed by different disciplines included in the review. The green arrows refer to concepts proposed in neurocognitive approaches to voice-hearing, whereas the blue arrows refer to concepts proposed in clinical-philosophical approaches.

7.3.2 How to combine results from different levels of analysis?

Consequently, at the end of this work, we find ourselves in the situation of having to consider the relationship first, between "phenomenal" data and "physiological" data, and second, between different levels of, for example, brain activity (e.g., neurotransmitter level, brain oscillations). There have been several attempts to integrate results from various epistemic levels regarding AVHs, a part of those studies being subject of the present review. However, they are unsatisfactory regarding several points. They often remain on (more or less explicit) reductionist assumptions. Moreover, they often combine results from different levels of

analysis in a simplistic or unclear manner. In one of the reviewed studies, for example, it is proposed that "the concept of massive modularity very much approximates the idea of a possible translation between the psychological and neurobiological level of observation" (Strik & Dierks, 2008, p. 68). In this example, it remains unclear how the authors arrive at this conclusion. However, most of the reviewed studies do not take into account such considerations at all, although it has been proposed by researchers of voice-hearing that it may be fruitful to take into account general theories of consciousness when conceptualising such phenomena (McCarthy-Jones, Trauer, et al., 2014). If we want to connect neuroscientific, psychological and clinical-philosophical results we have to consider (at least) shortly the relation between data regarding neuronal processes and data obtained by means of first-person reports. That does not mean that we have to solve the so called "hard problem of consciousness" (Chalmers, 1995) (i.e., the problem of how it is possible that creatures consisting of flesh and blood can have subjective experiences). It should be noted beforehand that a simple addition of the reviewed approaches into one holistic approach is not possible.

This is, besides other reasons, also due to differing basic assumptions about human experience and mind-body relationship of different disciplines included in the review. In the following, however, we attempt to deduce some preliminary exemplary hypotheses about structural homologies between different standpoints assumed in the reviewed studies that may be further developed. For this purpose, it is proposed that for a conceptualisation of AVHs in a Cognitive Science context that aims to integrate results from different levels the concepts of aspect duality and circular causality (as proposed, e.g., by Fuchs, 2013a) might prove valuable.

7.3.3 First-person and third-person approaches as referring to different aspects of voice-hearing

Following these ideas, AVHs or voice-hearing are proposed to be conceptualised as "life processes" of which we can examine subjective aspects and, for example, neurophysiological aspects (Figure 16). Moreover, it is proposed that alterations of a voice-hearer's brain's structure and functions are shaped by his/her environment and are only understandable taking them into account.

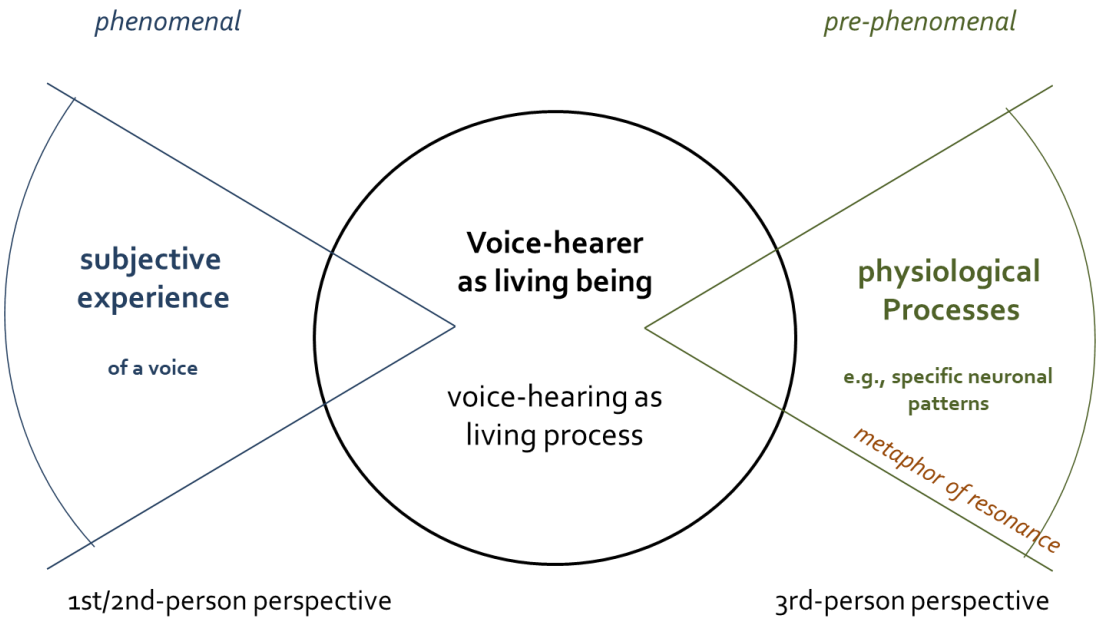

Figure 16 Voice-hearing from a dual aspect perspective. Following Fuchs (2011, 2013a), we can conceptualise VH/AVHs as living processes taking place in a specific voice-hearer. Towards that living process we may now adopt different perspectives: it is expressed both in a specific subjective experience as well as specific physiological processes, whereby both aspects are assumed to be two sides of the same process that are not transferable into one another and that do not exert efficient causality onto one another (figure adapted from Fuchs, 2011, p.200). For the description of neuronal processes associated with AVHs the metaphor of resonance might provide an alternative to the ones of information and representation.

What implications does such a conceptualisation have? First, it offers an alternative to the (implicit) interactionist assumptions pervading neuroscientific approaches to AVHs – that processes in one sphere, for example, neuronal processes, can *produce* subjective phenomena, for example, a voice-experience. Instead of focusing on a voice-hearer's brain, we then consider the voice-hearer as a living organism as primary entity in which we can observe both integral life processes (such as experiencing a voice), as well as physiological processes (such as neuronal processes related with voice-hearing) at different levels of detail[35]. Following Fuchs (2012a), we may thus describe AVHs "on the one hand as a complex concatenation of physiological mechanisms, on the other hand as a biographically understandable reaction […]" (p.216f.).

These two aspects of the living organism as ontological unity, according to Fuchs (2011, 2013a) are to be seen as two epistemologically complementary aspects that are not

[35] Similarly, Kotchoubey et al. (2016) propose for an integrative neuroscience that "a double perspective should be defended that goes beyond the opposition between a fundamental anti-naturalism, on the one hand, and a reductive naturalism, on the other hand" (p.13).

transferable into each other[36]. Importantly, and in contrast to the implicit assumptions of many reviewed neuroscientific studies, there are no *efficient* causal relationships assumed between biological and experiential aspects (Fuchs, 2012a), but rather "concordant changes within both aspects" (p.339)[37].

As alternative to the criticised prevailing metaphors of information and representation in neuroscientific conceptions of AVHs, it is proposed that the metaphor of resonance (e.g Fuchs, 2011, 2013a) might be a candidate for the description of neuronal processes associated with AVHs that comes without the problematic metaphysical assumptions of the former.

What does that concretely mean for the reviewed studies? Let us examine how these concepts (aspect duality, resonance) can be used for re-interpreting reviewed studies in order to reach an integrative conceptualisation of voice-hearing phenomena.

We can state, that there may well be certain neuronal excitation patterns and dispositions for neuronal excitations that, besides a voice-hearer's subjective experience are one aspect of an AVH. Regarding predictive coding accounts of AVHs, we may for example suppose that specific expectations (or the subjective state of being disposed to experience something as surprising or not) may go along with specific neuronal "excitation dispositions".

However, this is different from stating that these neuronal excitation patterns do *cause* those expectations. Rather they have to be considered the "other side of the medal" of a voice-hearer's state of expecting or not a specific voice. We, thus do not need to assume that a voice-hearer's brain predicts (or fails to predict), for example, a mental event.

Neuronal excitability changes might also be associated with self-monitoring. Take the reviewed neurophysiological evidence for impaired verbal self-monitoring in voice-hearers with schizophrenia diagnosis as an example. It has been proposed that the N1-component of the auditory ERP is dampened in response to self-produced speech as compared to speech of others in healthy individuals, but not in voice-hearers (Heinks-Maldonado et al., 2007).

Instead of interpreting such results in terms of a comparator mechanism, we might propose that healthy person differ in their resonance-disposition towards their own versus the speech of others. The observed N1-dampening may thus indicate a reduced resonance-disposition (or excitability) regarding self-produced stimuli (as expressed at a neuronal level).

[36] How *exactly* the physiological and mental processes are intertwined in the living organism remains an open question (Fuchs, 2011).

[37] "there is no causation involved between 'the mental' and 'the physical', as if they were separated entities; rather, the person as a living being embodies and encompasses both aspects" (Fuchs, 2011, p. 217).

In voice-hearers, we may then hypothesise, we find an (abnormally) increased resonance-disposition towards (some) self-produced stimuli as expressed through a lack of N1-dampening in association with self-produced speech. Further, this might be related with an increased resonance between speech production and speech perception brain regions, or put differently with an abnormally heightened self-resonance. This would be in line with Stanghellini and Cutting's (2003) proposal that in the case of AVHs aspects of the self that usually are integrated in one's experience become explicated and are experienced as "quasi-other". Put differently, we might describe voice-hearing-phenomena in terms of an intra-psychological resonance space, where voice-hearers enter in resonance with (alienated) parts of their selves as if they were another. In clinical-philosophical terms this may also tentatively be described in terms of a kind of hyper-reflexivity. Certainly, such a description may only be applicable to a subgroup of AVHs.

Note that a comparator in the sense of a specific brain region that compares predicted with incoming input (such as the cerebellum) does not need to be assumed in such a conception (Engel, Fries, & Singer, 2001). We might rather postulate that incoming stimuli that are expected "resonate" with specific available neuronal excitation patterns[38] and, thus, go along with different neuronal responses as if the stimuli would not have been expected. These different responses, in turn, might go along with different subjective experiences.

In a similar line, we may speculatively interpret the aberration in the observed aberration in the theta-band before AVH-onset (van Lutterveld et al., 2012) as corresponding to micro-gaps in time experience due to impaired passive time synthesis (Fuchs, 2013b).

The reduced gamma-band synchrony in response to auditory stimuli that has been reported for voice-hearers as compared to healthy controls (Mulert et al., 2011) is in line with the assumption of clinical-philosophical positions that the experience of schizophrenia patients is generally altered, in the sense of an altered self- and world experience. We might speculate that an altered resonance disposition with regard to the intersubjective world (as postulated by Rojcewicz & Rojcewicz, 1997) might correspond to an altered resonance disposition regarding external stimuli on a neuronal level in the form of a reduced gamma-band synchrony with environmental stimuli. Of course auditory stimuli in the form of "clicks" are not to be equated with the intersubjective world. In order to test this specific hypothesis, it would be more appropriate to conduct *social* neuroscientific EEG-studies with voice-hearers,

[38] Such available neuronal excitation patterns can be described in terms of attractors (Fuchs, 2011).

where, for example, is tested if one finds different neural oscillatory patterns in social situations in voice-hearers as compared to non-voice-hearers.

Besides the relation between data from first- and third-person levels, in the reviewed studies we are further confronted with different levels within, for example, third-person data (e.g. genetic, brain structure, brain functioning). Here, it might be useful to distinguish between horizontal and vertical relations. The notions of vertical and horizontal circular causality (as proposed e.g., by Fuchs, 2013a) might provide a framework for the integration of results from different levels of analysis. According to the author, the notion of vertical circular causality refers to the circular relation between the whole and the parts of a living organism. This includes downward and upward causal effects between different levels of hierarchy. Further, Fuchs (e.g., 2013a) proposes that in the sense of vertical circular causality, mental processes might exhibit a formative causal role on physiological processes.

In this sense, beliefs about voices or cognitive biases might act as top-down constraints onto possible experiences. Returning to the resonance-metaphor, in the case of hypervigilance hallucinations, a hypervigilance bias might be expressed by a heightened (neuronal) resonance-disposition towards specific stimuli. This is in line with the results of one reviewed study that found heightened perceptual sensitivity in schizophrenia patients with as compared to without AVHs (Vercammen et al., 2008). This influence, of course, is only possible, as they are embodied in the sense that they are enabled by neuronal processes (Fuchs, 2012a). Structural brain alterations reported for voice-hearers may also serve as an example of top-down formative vertical causality in constraining neuronal functioning.

As an example of bottom-up vertical circular causality, we might consider abnormally constrained neurotransmitter activity, as proposed to play a role in AVHs by Aguilar et al. (2008)[39]. Although these authors focus on other neurotransmitters, the neurotransmitter GABA (gamma-aminobutyric acid) might be relevant in the context of the reviewed neuroscientific studies. This neurotransmitter has been related with gamma-band oscillations, as well as theta-band oscillations (Wulff et al., 2009). Moreover, a recent study provided evidence for the role of GABA as biological aspect of the inhibition of intrusive thoughts (Schmitz, Correia, Ferreira, Prescot, & Anderson, 2017). Impairments in neuronal inhibition due to abnormal GABA functioning in schizophrenia may be associated with the reported

[39] Of course, the expression of genes is to be considered as constrained both in terms of vertical and in terms of horizontal circular causality.

decrease in theta-band power that was found in the right hippocampus during AVH-onset. Such mechanisms may be particularly appropriate for the further investigation of memory-AVHs.

Horizontal circular causality, in turn, is used in order to refer, first, to feedback cycles on the same hierarchical level within the organism and, second, to relationships between the living organism and his/her environment (Fuchs, 2013a).

We might consider a proposal of Birchwood et al. (2000) in the light of the concept of horizontal circular causality. The authors propose that a vulnerability for voice-hearing might also include certain social schemata acquired in former interpersonal relations (e.g., with critical caregivers). Thus, on a horizontal level, interpersonal relationships may influence, for example, the content of experienced voices. As an example, let us consider someone who was/is used to hearing a critical comment in specific situations. The experience of receiving critical comments in those situations may be so incisive that it may become a part of the structure of one's experience of such situations. This, in turn, may lead to a heightened disposition to experience critically commenting voices in such situations. We could describe "quasi-present" voices in the same sense. To use the resonance-metaphor, we might describe such voices in terms of "continued resonance".

Such a circular conception of causality provides us with an alternative of simple one-way causation[40] (e.g., brain – experience). Accordingly, we can view AVHs not as "brain diseases" but as circular events, which enables considering them in their context (Figure 17).

Summarising, Fuchs (2012a) proposes that mental illness can be regarded a "*complex interplay of circular processes* both at the vertical, organismic level and at the horizontal, interpersonal level" (p.338) where the brain acts as a mediating or transforming organ.

Importantly, this framework allows for the dynamic conceptualisation of voice-hearing: as different types of voice-hearing may be traced back to dis-functions at different sites of the cycle. That means that for example, the relevance of biological or psychosocial aspects for AVHs may depend both on individual cases and the temporal course of a specific case (Fuchs, 2012a). Before considering limitations and future directions we can derive from the present work, let us shortly consider some advantages of the proposed application of a phenomenological-ecological framework to voice-hearing.

[40] At this point, it is important to note that different types of causality can be differentiated. Causality may, for example, be efficient or formative. Whereas the former refers to classical physical causation (e.g., A causes B), the latter refers to causality in the sense of, for example, structurally limiting the possible efficient causalities in a system (Mühling, 2014).

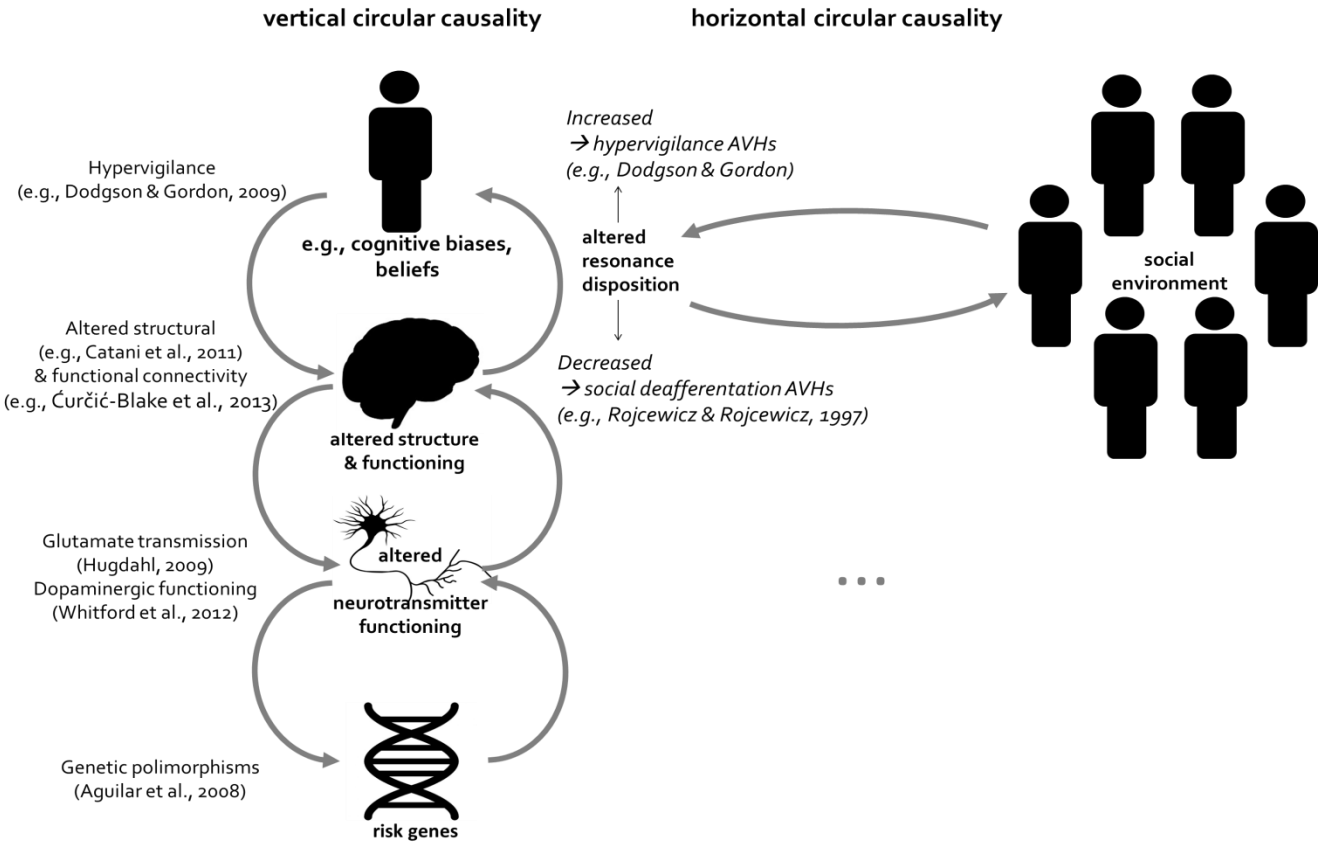

Figure 17 Different levels of analysis as framed within hypothetical relations of circular causality. Voice-hearers, Aguilar et al. (2008) propose, might be genetically disposed to AVHs. If a specific gene is expressed, however, as we see in the schema, might be ultimately influenced by a person's social environment. On the level of neurotransmitter functioning, it has been proposed that Glutamate (Hugdahl, 2009) and dopamine (Whitford et al., 2012) might play a role in voice-hearing. Altered neurotransmitter functioning might further influence functional and structural brain connectivity. On the other hand cognitive biases or beliefs about voices might be effective in terms of formal causality, that is, in influencing what kind of neuronal processes take place at all. We might describe different subtypes of AVHs on the horizontal level in terms of resonance. Hypervigilance AVHs, for example, might go along with an increased resonance disposition towards (specific) environmental stimuli. On the other hand social deafferentation AVHs (e.g., in situations of withdrawal from social life) might go along with a decreased resonance disposition regarding environmental stimuli, but an increased resonance disposition towards own activity.

7.3.4 Advantages of this conceptualisation

A clear advantage of a conceptualisation of AVHs in phenomenological-ecological terms is that such an approach does not reduce voice-hearers' experiences to "meaningless" symptoms, that result from an ill brain. It allows for regarding neuronal processes that are specific to voice-hearers within their wider ecological context and a re-focussing from the brain to voice-hearing as integral life-process. Including the voice-hearers environment in the conceptualisation of voice-hearing might, furthermore, prove helpful to examine why some voices are not constant: "neuronal dispositions" specific of certain situations might enable the experience of voices in some situations but not in others. The concept of circular causality also allows for a conception of AVHs as dynamic phenomena as continuous reciprocal influences are assumed in this conception. Moreover, this phenomenological-ecological approach is sufficiently broad for the integration of results from different epistemic levels. Although this statement may be exaggerated, it has been proposed that an advantage of an approach to AVHs that allows for the integration of results from different epistemic levels "fosters interdisciplinarity and collaboration across traditional borders, facilitating a real breakthrough in future research" (Hugdahl & Sommer, 2017, p. 1).

7.4 Limitations

One limitation of the present work is the restriction to works in the English language. It cannot be excluded that through the inclusion of other languages a different picture about the research landscape of AVHs would have emerged.

One could further object that certain perspectives towards AVHs, such as a psychological, are underrepresented in the present work. Similarly, it could be argued that the search of references of the included studies would have yielded further relevant results. Given the vast body of literature about AVHs, as well as the present work's space limits, it was certainly not possible to consider every possible perspective onto AVHs. However, the present work's aim was to consider perspectives towards AVHs in the actual debate about such phenomena with no claim to completeness. Unlike a meta-analysis the present work's aim was not to include all available data, but rather to provide a big picture of how the phenomena of AVHs are approached by different Cognitive Science disciplines. Given that a recent review provided similar results regarding the neuroscientific "landscape" of AVHs (Upthegrove, Broome, et al., 2016) it seems unlikely that the present work presents a distorted picture.

Regarding the uneven ratio of reviewed studies for each discipline, we might respond, for example, that due to the more holistic nature of clinical phenomenological approaches to AVHs in the context of schizophrenia as compared to the great diversity of neurocognitive approaches towards AVHs, less works are needed to be considered for providing an overview of such perspectives. Also, clinical-philosophical works are often more extensive.

One could also question the focus on a single "phenomenon" (AVHs) as artificial, as schizophrenia is associated with a range of other symptoms. However, AVHs are one of the defining symptoms of schizophrenia according to the prevailing diagnostic manuals. Moreover, in the reviewed studies, AVHs have been partly considered in their context of, for example, altered structures of experience (clinical-phenomenological approaches). That AVHs are trans-diagnostic phenomena (e.g., McCarthy-Jones & Longden, 2015) also justifies their consideration in apparent isolation. Lastly, a better understanding of AVHs also implies a better understanding of the human mind's complexity and possibilities (Hugdahl & Sommer, 2017).

One might further criticise the proposal of the utility of the resonance-metaphor for combining results regarding AVHs from different disciplines and associated levels of analysis as being vague. It is certainly true, that there is a long way to go until a sound theory of AVHs (and e.g., associated brain functioning) in terms of resonance. However, this metaphor seems to be a promising alternative to information- and representation metaphors, whose appropriateness has to be questioned and is certainly not less speculative. Moreover, relatively vague concepts, such as the one of "resonance" come with the advantage of possible circulation "between different domains of research" (Morange, 2010, p. 180) which may be useful in overcoming the limits of a single discipline or approach (Kotchoubey et al., 2016). If these metaphors are useful for the treatment of distressing voices, and thus, for voice-hearers remains open for empirical inquiry. Given that there is evidence that voice-hearers who assume that their experience is due to a neurochemical imbalance feel powerless regarding their voices (Jones, Guy, & Ormrod, 2003) an aspect-dualist view on AVHs, where the voice-hearer and not neuronal processes are put in the center, seems to be a promising alternative to reductionist approaches.

Given the initial research question (what are AVHs?) one might also wonder why no clear definition of such phenomena was provided. As a beginning, a shift away from audibility towards the communicational character of voice-experiences for a re-conceptualisation of AVHs was proposed. Also, as noted in the beginning the re-conceptualisation of AVHs has to be regarded a process, to which the present work hopefully

contributes. Moreover, given the vast diversity of voices, there might be several possible definitions for different types of voices. The present work in that sense is to be seen as a point of departure rather than of arrival.

7.5 Future directions

From the present work, various implications for future AVH-research can be drawn. Various recommendations result from the fact that AVHs are heterogeneous and individual experiences, even reported within a context of schizophrenia-spectrum diagnoses. In future studies, consideration of phenomenological features of voice-hearing is crucial, if one does not want to take the risk of developing models of voice-hearing and carrying out studies that are of little use for an understanding of AVHs that is relevant for voice-hearers. The consideration of voice-content is likely to be important in order to disentangle different AVH-subtypes and develop adequate treatment options.

In order to obtain more consistent empirical results, this heterogeneity has to be taken into account in future studies about AVHs. In order to capture this heterogeneity, the measures used in the reviewed studies are not sufficiently fine-grained. A first step into the direction of more fine-grained measures seems to conduct large-scale qualitative studies. It has been repeatedly reported that patients appreciated to talk in detail about their voice-experiences (e.g., Rosen et al., 2015; Stephane, Thuras, Nasrallah, & Georgopoulos, 2003). Therefore, a readiness to participate in such studies should be expected.

Neuroimaging studies, for example may be designed in order to investigate possible differences between biological aspects of AVHs that differ in phenomenology. It may, for example, be hypothesised that different neural substrates are engaged in second-person and third-person AVHs: second-person AVHs may be associated with a greater activation of brain regions involved in social cognition, whereas third-person AVHs might be associated to a greater extent with brain areas involved in rumination. As voice-experiences and a voice-hearer's relation to his/her voices may change over time, moreover, it should be recorded when AVHs were first experienced in order to make the inclusion of time as a co-variable possible.

The involvement of voice-hearers' perspectives may also be of value for the discussion of theoretical models of VH that aim at explaining their experiences. Concretely, it might be, for example, examined in qualitative studies in how far voice-hearers think that their experience of the power of a voice corresponds to a belief about that voice. Such

preliminary studies might prevent the investment of time and money into research projects that are possibly flawed from the beginning.

Together, neuroscientific, psychological and philosophical approaches to AVHs would benefit from increasing the "conceptual clearness" in their accounts. This would both render them more intelligible and make them more easily empirically accessible. It should, for example, be taken into account that certain concepts used in neuroscientific approaches to AVHs, only serve for metaphorical descriptions of brain functioning. Phenomenological philosophical theorists might investigate further how different proposed concepts relate to each other and can be delineated. Further, it could be considered in interdisciplinary discussions in how far homologies or overlapping between concepts proposed by different Cognitive Science disciplines can be established. Importantly, researchers from different disciplines are trained in different technical jargons and may understand specific technical terms differently, that is, in accordance with their discipline's jargon. In this context, it is relevant to take (differing) basic assumption of different disciplines into account. This would help to prevent the hampering of interdisciplinary teamwork regarding AVHs by implicit differing basic assumptions. Fruitful interdisciplinary work about AVHs would certainly be beneficial for voice-hearers, as it allows for drawing a more complete picture of AVHs.

According to recently proposed guidelines regarding the design of experiments (Garcia-Marques & Ferreira, 2011) it might make sense to try to develop experiments that are "only weakly theory dependent" (p.197) and test very specific hypotheses in order to provide results that are helpful in different competing conceptions of AVHs (on this point see also Cho & Wu, 2013; Ćurčić-Blake et al., 2017).

Lastly, if we are right that a considerable part of AVHs have an experiential core of being communicated to or about, taking into account pragmatic/linguist perspectives will prove valuable to complement neuroscientific, psychological and clinical-philosophical accounts of AVHs.

8 Conclusion

In the present work literature regarding AVHs from different fields of Cognitive Science (i.e., neuroscience, psychology, and philosophy) was systematically reviewed with the aim of identifying which concepts are used in different approaches to conceptualise such phenomena. In contrast to former literature reviews, such approaches were examined regarding implicit and explicit metaphysical assumptions in order to regard their standpoints in a wider Cognitive Science context.

Regarding the reviewed empirical results, the designs of the studies do not allow to draw final conclusions. Moreover, methodological diversity makes it hard to compare different studies directly, even when for example the same neuroimaging method was applied.

Existing neuroscientific conceptions of AVHs largely overlook core experiential features of VH as well as the great heterogeneity of such phenomena. Instead we find an emphasis on such features that seem to be relevant only for a subgroup of such phenomena, such as audibility. Voice-hearing is best conceived as a group of phenomena. It is unclear if there is one essential feature characteristic that applies to all phenomena that are designated as "auditory verbal hallucination" or "voice-hearing" in the clinical context. We have proposed that some experience of communication (e.g., being communicated to or about) may be a candidate for such a feature.

The reviewed psychological conceptions of AVHs focus on voice-hearers' relations to their voices as well as their role as reaction to stressful life-events. Clinical-philosophical conceptions, then again, propose that schizophrenia is manifested in an altered structure of experience, against which background AVHs arise.

In existing neuroscientific and cognitive psychological literature, AVHs are largely conceptualised (implicitly) following the philosophical position of "interactionist dualism". That is, neuronal processes are assumed to efficiently cause (immaterial) mental phenomena, such as thoughts and beliefs and the other way round. Clinical-phenomenological approaches to voice-hearing on the other hand rely partly on concepts that have been criticised to be vague (Mishara, 2010).

A range of different, largely non-overlapping, concepts has been used in order to conceptualise AVHs in the Cognitive Science disciplines considered in this work. These concepts range from supposed neuronal processes (e.g., corollary discharge) over psychological constructs (e.g., belief) to phenomenological concepts (e.g., ipseity). Although

some common themes of these approaches can be identified (self, temporality, compensation, memory), these themes themselves are approached rather differently by, for example, neuroscience and clinical philosophy. Therefore, no simple parallels can be drawn between these disciplines in terms of structural homology. Nonetheless, the concepts of aspect duality and circular causality (as, for example, proposed by Fuchs, e.g., 2013a) have been proposed as a first step towards an integration of results regarding AVHs from different epistemic levels. The consideration of such frameworks, we think, constitutes a necessary basis for fruitful interdisciplinary integration of AVH-research. Such considerations are valuable for reflecting one's disciplines implicit basic assumptions regarding human existence and experience that possibly prevent an adequate conceptualisation of AVHs. An adequate conceptualisation of AVHs, however, is indispensable both for research into such phenomena and will ultimately be to the benefit of those who suffer from such experiences. On the way to a clearer understanding of AVHs, it is crucial to hear what voice-hearers have to say about their experiences.

Hopefully, the present work will contribute to the interdisciplinary discussion of methodological and conceptual limits of existing approaches to AVHs and provide input regarding the integration of different perspectives that takes into account such limits. This step, we propose, is indispensable for an interdisciplinary (re-)conceptualisation of these intriguing phenomena.

Appendix

Complete list of the studies included in the systematic literature review.

1.Aguilar, E. J., Sanjuán, J., García-Martí, G., Lull, J. J., Robles, M., Jes, E., & Jos, J. (2008). MR and genetics in schizophrenia: Focus on auditory hallucinations. *European Journal of Radiology*, *67*(3), 434–439. https://doi.org/10.1016/j.ejrad.2008.02.046

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