



Hallucinations and Sensory Overrides*

T. M. Luhrmann

Department of Anthropology, Stanford University, Stanford, California 94305-2145;
email: luhrmann@stanford.edu

Annu. Rev. Anthropol. 2011. 40:71–85

The *Annual Review of Anthropology* is online at
anthro.annualreviews.org

This article's doi:
10.1146/annurev-anthro-081309-145819

Copyright © 2011 by Annual Reviews.
All rights reserved

0084-6570/11/1021-0071\$20.00

*This article is part of a special theme on
Anthropology of Mind. For a list of other articles
in this theme, see <http://www.annualreviews.org/doi/full/10.1146/annurev-an40#h1>.

Keywords

psychosis, spirituality, anthropological theory of mind, anthropology of mind

Abstract

Hallucinations are a vivid illustration of the way culture affects our most fundamental mental experience and the way that mind is shaped both by cultural invitation and by biological constraint. The anthropological evidence suggests that there are three patterns of hallucinations: experiences in which hallucinations are rare, brief, and not distressing; hallucinations that are frequent, extended, and distressing; and hallucinations that are frequent but not distressing. The ethnographic evidence also suggests that hallucinations are shaped by learning in at least two ways. People acquire specific representations about mind from their local social world, and people (particularly in spiritual pursuits) are encouraged to train their minds (or focus their attention) in specific ways. These two kinds of learning can affect even perception, this most basic domain of mental experience. This learning-centered approach may eventually have something to teach us about the pathways and trajectories of psychotic illness.

HALLUCINATIONS AND SENSORY OVERRIDES

Hallucinations, or sensory experiences without a material source, are a window into the mind like nothing else. They provide perhaps the sharpest example of the way culture affects our most fundamental mental experience and the way that mind is shaped both by cultural invitation and by biological constraint.

In this review, I argue that the ethnographic literature suggests that the local theory of mind—the features of perception, intention, and inference that the community treats as important—and local practices of mental cultivation will affect both the kinds of unusual sensory experiences that individuals report and the frequency of those experiences. Hallucinations feel unbidden. They are experienced as spontaneous and uncontrolled. But hallucinations are not the meaningless biological phenomena they are understood to be in much of the psychiatric literature. They are shaped by explicit and implicit learning around the ways that people pay attention with their senses. This is an important anthropological finding because it demonstrates that cultural ideas and practices can affect mental experience so deeply that they lead to the override of ordinary sense perception. That is a powerful impact.

WHAT IS A HALLUCINATION?

A hallucination is a perception, while in a conscious state, in the absence of an external material stimulus. It should have the quality of real perception: It should be vivid, substantial, and located in external objective space (Chiu 1989). Dreams are not hallucinations: They occur in a sleeping state. Illusions are not hallucinations (although practically speaking, it is hard to draw a sharp line here). In an illusion, there is an external stimulus (e.g., the open door), but one is mistaken about what it is (e.g., a monster). Someone who experiences a hallucination has a clear awareness that the source of the sensation was not in his or her mind. He/she sees the monster—and note that if divinity itself has

in fact spoken, the human experience of hearing the speech is technically a hallucination because divinity is immaterial. By nature, the divine is not a sensory stimulus.

In fact, hallucinations really involve two independent judgments: whether the source of the experience is external or internal to the mind, and whether the experience is of the self or not of the self. People have reported on voices they have not heard externally, but which they still experience as not their own. In the psychiatric context, these inner voice hallucinations are more likely to be associated with dissociative disorder than with psychotic disorder, but patients with schizophrenia sometimes report both inner and outer voices. However, the technical definition of hallucination demands that the perceived source of the experience is external and not internal to the mind, and this review focuses on that phenomenon.

WHY DO HALLUCINATIONS OCCUR?

The psychiatric and psychological literature has reached no settled consensus about why hallucinations occur and whether all perceptual “mistakes” arise from the same processes (for a general review, see Aleman & Laroi 2008). For example, many researchers have found that when people hear hallucinated voices, some of these people have actually been subvocalizing: They have been using muscles used in speech, but below the level of their awareness (Gould 1949, 1950). Other researchers have not found this inner speech effect; moreover, this hypothesis does not explain many of the odd features of the hallucinations associated with psychosis, such as hearing voices that speak in the second or third person (Hoffman 1986). But many scientists now seem to agree that hallucinations are the result of judgments associated with what psychologists call “reality monitoring” (Bentall 2003). This is not the process Freud described with the term reality testing, which for the most part he treated as a cognitive higher-level decision: the ability to distinguish between fantasy and the world as it is (e.g., he loves me versus

he's just not that into me). Reality monitoring refers to the much more basic decision about whether the source of an experience is internal to the mind or external in the world.

Originally, psychologists used the term to refer to judgments about memories: Did I really have that conversation with my boyfriend back in college, or did I just think I did? The work that gave the process its name asked what it was about memories that led someone to infer that these memories were records of something that had taken place in the world or in the mind (Johnson & Raye 1981). Johnson & Raye's elegant experiments suggested that these memories differ in predictable ways and that people use those differences to judge what has actually taken place. Memories of an external event typically have more sensory details and more details in general. By contrast, memories of thoughts are more likely to include the memory of cognitive effort, such as composing sentences in one's mind. Paul McCartney has said that he was confused about whether he had written *Yesterday* or heard it on the radio because he woke up one morning with the tune running effortlessly through his mind (Bentall 2003, p. 365).

The relevant point is that our capacity to distinguish between what we have seen or heard and what we have thought is learned, to some extent. It draws upon our previous experience. This observation gives us a striking picture of our minds: not passively responding to events as if minds were the clay upon which impressions were imprinted—the very word “impressions” arises from this old view of the mind as recorder—but a mind that acts, creates, organizes, and constructs.

From the reality monitoring perspective, hallucination-like experiences occur not because there is necessarily something wrong with one's mind, but because one interprets something imagined in the mind as being real in the world. The most plausible mechanism here is that we constantly experience perceptual “breaks,” which we repair below the level of our awareness, either by filling in a perceptual break from its surrounding perceptual field or by interpreting the break with prior knowledge

(e.g., the way being told that strange sounds are English can change the way one hears them). Hallucinations probably occur in the process of repair, and the cause is likely more often perceptual bias than perceptual deficit. Bentall suggests that the most common conditions that lead to hallucinations are an ambiguous stimulus, emotional arousal, and cognitive expectation. Someone who perceives an ambiguous noise is more likely to interpret it, someone who needs an answer is more likely to listen for one, and someone who believes that an answer can be heard is more likely to hear one. It also seems to be the case that feeling as if one lacks control makes one more likely to perceive illusory patterns (Whitson & Galinsky 2008, p. 115).

THREE PATTERNS

There is, however, more than perceptual bias at work. There are different patterns of hallucinations, and there seem to be bodily or temperamental differences among those who experience the different patterns and between people who report any hallucinations and those who do not. Just how different these differences are is controversial. People who want to destigmatize psychotic illness argue that all hallucinations are points on a single continuum (Johns & van Os 2001, Scott et al. 2005). The evidence suggests that the opposite is true: that there are fundamental differences between pathological hallucinations and nonpathological hallucinations (Luhrmann et al. 2010). However, the relationship between the two does appear to be complicated. In any event, it seems clear that there are, broadly speaking, three different patterns of hallucination experience that transcend culture: sensory overrides, psychosis, and the Joan of Arc pattern.

Sensory Overrides

I call the first subset the sensory override pattern to distinguish it from the pathology often invoked by the word “hallucination.” I use the term because people experience a sensation in the absence of a source to be sensed. Sensory

perception overrides the existing stimulus. In the sensory override pattern, these moments are rare. Those who report them usually report one such moment, maybe two, perhaps a few a year. They are brief. People hear a word, a phrase, even a sentence or two, but not a paragraph. They are also not distressing.

When I sat down with individuals from the charismatic Christian church in which I have done fieldwork (Luhrmann 2010, 2012) and asked whether they had ever heard God's voice outside their head, or heard any voice when they were alone, or any other unusual experience, they told me about one experience or maybe a handful. The moments did meet psychiatric criteria for hallucinations: People were clear that the voice had come from outside, that they had heard it with their ears, or that the touch or vision felt as if external. But they were not the caustic experiences one finds in individuals struggling with schizophrenia. In fact, they were rather prosaic. Here is a typical example:

I was walking up the lake and down the lake and I was like, should I go home now? And [God] was like, "sit and listen." [Did you hear that outside your head or inside your head?] That's hard to tell, but in this instance it really felt like it was outside. [How many times do you think you've heard his voice outside your head?] Two or three. (Luhrmann 2010, p. 71)

Other anthropologists working in charismatic churches have reported a similar pattern. The anthropologists Dein & Littlewood (2007) persuaded 40 members of a Pentecostal church in London to complete a questionnaire on spiritual experience. Then they interviewed the 25 out of the 40 who said that they had heard God speak audibly. In 15 of the 40 cases, the anthropologists were confident that the voice had been experienced as audible and as external. For most of those congregants, these experiences were rare. Often, they had happened only once. For example,

Only once ever, that was when I was at university and I was praying about an issue that

was quite personal to me. I heard a voice in the room outside of myself giving me an answer to the issue. I opened my eyes and looked around the room but there was no one there in the room or in the vicinity. I concluded that God was talking to me. (pp. 219–20)

Whether internal or external, the voices focused on immediate issues. They offered practical direction, not grand metaphysical theology. Many, though not all, people had the experiences during emotional turmoil.

This pattern appears to be quite common. Anywhere between 10% and 70% of the general population, at least in the United States and in the United Kingdom, is willing to say that they have heard a voice when alone, or seen something no one else present could have seen, depending on the way the question is posed (Sidgwick et al. 1894, West 1948, Posey & Losch 1983, Tien 1991). The most detailed of these studies is the 1894 Census of Hallucinations, which asked ~17,000 people in Britain and elsewhere a version of this question. Just as in the case of the charismatic Christian churches, the vast majority of those who said yes could remember only one such moment, and the moment was brief and startling, but not distressing. Among those who have been bereaved, in studies carried out in Europe and America, 70%–80% of the group reported seeing, hearing, or feeling the absent spouse (Grimby 1993), a phenomenon also found in other cultures (Desjarlais 2003, Catedra 1992).

In my own work, sensory overrides are associated with absorption. Absorption is the capacity to become focused on the mind's object—what humans imagine or see around them—and to allow that focus to increase while diminishing attention to the myriad of everyday distractions that accompany the management of normal life. It is the mental capacity common to trance, hypnosis, dissociation, and much other spiritual experience in which the individual becomes caught up in ideas or images or fascinations (Roche & McConkey 1990). In the research literature, it is measured by the Tellegen Absorption Scale (Tellegen & Atkinson

1974). In my research, those who report sensory overrides score significantly higher on the absorption scale (Luhrmann et al. 2010). Other researchers have also noticed a relationship between absorption and reported hallucination-like phenomena (Glicksohn & Barrett 2003). Anthropologists have long observed that some people are more likely than others to have unusual sensory experiences, such as visions (e.g., Lowie 1925). A temperamental proclivity for absorption may explain these differences.

Psychosis

The second pattern is associated with psychosis, the psychiatric condition in which someone has an impaired ability to distinguish between the real and the unreal. In this pattern, hallucinations are frequent. They can occur many, many times each day. They are extended. People do not just hear a single phrase, such as “I will always be with you,” although psychotic hallucinations can be short: “Don’t touch that.” People with psychosis hear phrases repeatedly; they can hear long conversations commenting on their behavior; they can hear back-and-forth conversations about them in the third person. These hallucinations are unpleasant, even horrific. In the condition we identify as schizophrenia, hallucinations are primarily auditory (in all cultures) and they are often accompanied by strange, fixed beliefs (delusions) not shared by other people (for example, that malevolent government agents are running an electrical experiment in one’s brain). This pattern of hearing distressing voices appears to be universal and recognized as illness everywhere. This observation was first made forcefully by Robert Edgerton (1966) and then by Jane Murphy (1976) in response to the romantic idea that people diagnosed with schizophrenia in the West would be identified as shamans, and not as being sick, in non-Western societies. Anthropological work has since born out this claim (Jenkins & Barrett 2004).

Yet it may also be true that in a deep sense, schizophrenia is a disease of modernity. The combination of distressing voices, delusions,

and cognitive dysfunction that we identify as schizophrenia may have emerged with industrialization (Gottesman 1991). This is a complicated claim to make because it involves arguing from absence. Neither Shakespeare nor Homer depicted a madman with the level of cognitive dysfunction we now associate with schizophrenia, nor has it been easy for historians to identify schizophrenia in the premodern era (Midelfort 2000). Depression, by contrast, can be readily identified in discussions by Aristotle and Galen (Radden 2000). At the heart of this issue, however, is the complexity of what constitutes the phenomenon that Bleuler first called schizophrenia. To this I return below.

Joan of Arc Pattern

There is a third, much less common, pattern. Some people have unusual sensory experiences as often as do people who can be diagnosed with schizophrenia, yet without the intense distress psychosis carries in its wake or without any of its other symptoms—delusions, cognitive difficulties, emotional flatness. The obvious historical example is Joan of Arc, who was 13 when she began to hear voices. She said at her trial that there were three voices—Saint Catherine, Saint Margaret, and the archangel Gabriel himself—and that she heard and sometimes saw them every day, sometimes several times. To be sure, other accounts of long and vivid hearings exist in our spiritual traditions: Moses, Mohammed. The historian Ann Taves (2009a) uses the experience of contemporary figures who hear long dictations to argue that the two men who received the Hebrew commandments and the Koran were probably in a trance-like state of intense absorption while receiving the material. Joan’s voices seem different from these accounts because there is no clear evidence that her voices visited her in special ways or at special times. But she does not seem to have had schizophrenia, even though she heard voices often throughout the day and even though her voices seemed to have extended conversations with her. For a diagnosis of schizophrenia, a

person must experience substantial functional and cognitive impairment.

The distinction is worth making because Joan was not unique in hearing voices often and without distress. There do appear to be people who hear audible voices frequently but do not have psychosis (Romme & Escher 1989, Claridge 1997). Joan was enacting an already-existing model of a female mystic (Barstow 1985), and other individuals—such as Socrates—have been reported to have heard voices frequently, although many centuries later it is difficult to know what they actually experienced (Leudar & Thomas 2000, D. Smith 2007). This pattern seems to be rare, however, and little is known about its epidemiology. I have, however, met one or two people with this ability myself in the course of my fieldwork.

CULTURAL INVITATION AND THE ROLE OF EXPECTATION

Within these bodily or temperamental constraints, what we can call the “cultural invitation” shapes a good deal about whether people experience hallucinations and the way they experience them. We have known for a long time that the conditions under which someone is expected to experience a vision are socially specific: fasting versus not fasting, prior to the hunt or after the hunt, and so forth. Among Plains Indians, the expected conditions varied from group to group (Benedict 1922).

More recent research suggests that expectation may actually generate the nonpathological unusual sensory phenomena I am calling sensory overrides. One of the most remarkable examples is reported by Bilu and his student Kravel-Tovi (Kravel-Tovi & Bilu 2008, Kravel-Tovi 2009). Rabbi Menachem Schneerson, rebbe of the Lubavitcher Hasid, deeply observant orthodox Jews, died in 1994 without leaving a successor. Many Hasids thought in Schneerson’s lifetime that he was the messiah, and the messianic fervor grew following his death. In many ways the rebbe’s followers now act as if he is still present. When the Sabbath begins in his house in Brooklyn, followers

crowd into the room, singing and laughing, waiting for the rebbe to arrive. At one point, the crowd parts to let him reach his seat. And now, some of them have begun to see him, just as the disciples saw Christ: briefly, infrequently, and in a way that enables someone to claim his living presence. The rebbe seems never to have been experienced this way during his human life.

Another example of the role of expectation in sensory overrides is found in the fine work of William Christian (e.g., 1981, 1996), who discovered the delight people took in visions in the rural Spanish village in which he did his ethnography and who has since done the most complete anthropological study we have to date on the nature and frequency (to the extent this can be judged by the historical record) of these unusual experiences. When Lourdes became an annual pilgrimage site for Spaniards at the beginning of the twentieth century, pilgrims began to see Christ moving, sweating, bleeding, even writhing in agony in the little towns along the route (Manzaneda, Arganda del Ra, Gandia, Piedrillera, Melilla). Christian (1998) demonstrated that in Limpias, in the 1920s, when war made the passage to Lourdes impossible, more than one quarter of a million people came to see the Christ of Limpias and that one in ten of them saw the image move. His work on Catholic Spain makes two compelling points: first, that visions and other sensory experiences are common and often a source of intense satisfaction, and second, that what we know about visions and their visionaries is strictly controlled by prevailing notions about who can be believed and what can be seen and heard according to the religious system and its authority, although a vision may also serve to mobilize people against authority (Christian 1998, p. 107; 1987; see also De La Cruz 2009, Shenoda 2010).

More generally, the religious system in which people are embedded will shape what is possible in their experience (see Morgan 2010). One of the bluntest examples of this phenomenon is that unusual sensory experience is more common in shamanism than in possession. Indeed, in some basic sense, unusual sensory experience is basic to shamanism: The

shaman leaves his or her body to experience other worlds, and the sensory experience of those other worlds proves the realness of those worlds every time he travels. By contrast, those who are possessed by spirits cede their bodies to other agents. They themselves do not so much experience as perform, and they generally do not see or hear the supernatural on a regular basis (Bourguignon 1970, p. 185).

THE CULTURAL THEORY OF MIND AFFECTS MENTAL EXPERIENCE

More recent research allows us to develop this general claim about cultural invitation into a specific theory: that the particular dimensions of the way mind is imagined in any society—what one might call that society’s “theory of mind”—will shape the incidence and modality of sensory overrides and psychotic hallucinations. Although the term theory of mind has a distinct disciplinary meaning within developmental psychology, I use it here to refer to the way in which perception, intention, and inference are culturally imagined. Ethnographic data suggest that at least three dimensions of the local theory of mind shape unusual sensory experience: sensorium, boundedness, and interiority.

Sensorium

Different cultures ascribe meaning to the senses in different ways (Serematakis 1994, Howes 2005, M. Smith 2007). Protestants emphasize hearing, Catholics seeing (e.g., Schmidt 2000, Dyrness 2004). Catholic churches are like a feast for the senses, vision above all. Protestants have sought to strip God bare of all the clutter and left the ear as the primary vehicle through which one can know God. Hinduism explicitly privileges vision in the emphasis on *darshan*: “to ‘see’ is a means . . . of participating in the essence or the nature of the person or object looked at” (Nabokov 2000, p. 26; Fuller 1992). Islam rejects the use of the image to represent God and insists on learning about God through hearing about God (Hirschkind 2006). West Africans

cultivate kinesthesia more deliberately than do Euro-Americans (Geurts 2002).

These cultural differences seem to be reflected in the sensory modes of hallucination experience that people report; although again the cultural invitation interacts with the biological constraint. In a study of more than 1000 patients with schizophrenia from Austria, Lithuania, Poland, Georgia, Ghana, Nigeria, and Pakistan, subjects in all countries reported experiencing auditory hallucinations more often than hallucinations in any other sensory modality. In all countries, visual hallucinations were the next most frequently experienced. Yet, the rates of these experiences differed substantially, and these differences appear to reflect culture and not biology. West African patients reported the highest one-year prevalence rate of auditory experiences (more than 90% of Ghanaians and 85% of the Nigerians); Austrians reported the lowest rate (67%). The highest rates of visual hallucinations were also found in West Africa (54% of the Ghanians and 51% of the Nigerians) and in Catholic Poland (45%); Islamic Pakistanis reported the lowest rate (4%) (Bauer et al. 2010). [However, a study based solely on the hospital records of white Britons, Pakistani Britons, and Pakistanis in Pakistan reported a higher rate of visual hallucinations and fewer auditory hallucinations in Pakistan (Suhail & Cochrane 2002).] In early work, Kiev (1964) captured culture’s impact on psychosis by describing hallucinations as “pathoplastic” (p. 17): Hallucinations were biological sequelae of psychotic illness, shaped by the cultural expectations of the mind.

It is more difficult to demonstrate definitively that cultural invitation shapes the sensory modality of sensory overrides because the anthropologists describing them do not have epidemiological evidence about their rates. However, the ethnographic and historical material do largely support the role of the cultural invitation. The unusual sensory experience reported among evangelicals is often auditory (Dein & Littlewood 2007, Luhrmann 2010); that reported among Catholics is often visual (e.g., Christian 1981). The unusual experience

among Hindus is often visual. In a lovely book about spirit possession in South India, Isabelle Nabakov (now Isabelle Clark Deces) (2000) explains that *camis* (exorcists/healers) learn about their skills through visions. Here is one *cami*'s story:

On that day I left home earlier than usual to sell milk because my wife and I had had a fight. These days we were often not on speaking terms. On my way to Ginge a beautiful lady appeared to me, asking me to follow her to a clump of thorn bushes. I did, but she disappeared. I heard a voice that said, "don't stay here" and I fell unconscious. When the villagers found me and woke me up I realized that I had been lying in these thorny bushes for three days (pp. 20–21).

Sometimes there is an auditory experience, and sometimes not, but always there appears to be an act of sight, evidence that the goddess was there.

Ghosts are sensed in different ways by different peoples. Ghost stories told by the Chinese in Taiwan describe visual evidence, whereas those told by the Chinese in San Francisco are more likely to offer auditory evidence (Eberhard 1971). In Vietnam, when ghosts offer you water to drink, you discover that it tastes of salt (Kwon 2008). Some of the more imaginative contemporary work in anthropology explores the consequence of trauma through tracking the ways that ghosts have changed (Mueggler 2001, Snodgrass 2002).

Boundedness

By "boundedness" I mean the degree to which presence external to the mind can be understood to participate within the mind. Taylor (2007) distinguished between "porous" and "buffered" selves. The Ghanaian Ewe described by Meyer, he thought, have porous selves. The supernatural can flit in and out of them and even take up residence within them, as the supernatural did in premodern Europe. This is the example he cited: Celestine "walked home from Aventile with her mother

accompanied by a stranger dressed in a white northern gown"—a man her mother could not see (Meyer 2007, p. 11; 1999, p. 181). Modern Westerners, by contrast, he described as having buffered selves. One might quarrel with some of his characterizations while nonetheless accepting that minds are understood to be open to the world in different ways.

Another way of describing this distinction might be the importance of self-control, or one's personal authority over one's psychic experience. A handful of studies suggest that psychotic auditory hallucinations among white Britons are more likely to be experienced as commanding and instructing than those among Arabs or West Africans. That is, the voice itself is experienced as an unpleasant ego-dystonic command in the Western setting (Scott 1967, Kent & Wahass 1996, Okulate & Jones 2003). Sadowsky (1999) reports that the opposite was true in the colonial context but then drily observes that the patients may have been reporting nonhallucinatory experiences. One sees in the small psychiatric literature on culture and hallucinations a persistent observation that Westerners are more likely to distrust unusual sensory experience and more likely to assume that it means that something is seriously wrong with their minds (e.g., Al Issa 1977, 1995). The theme also appears in the anthropological literature. An early article suggested that those who are psychotic in Japan, a society that values sensitive social interaction, are more likely to be identified by their aggression, whereas those in the West are more likely to be identified by their hallucinations [Schooler & Caudill (1964) and echoed by Edgerton (1966)].

Before 1965, ethnographers asserted with confidence that Westerners valued control over their minds and thus did not value or cultivate either trance-like experience or unusual sensory phenomena (e.g., Wallace 1959). With the explosion of charismatic Christianity (Robbins 2004) and the New Age (Brown 1999), that claim has become weaker, and yet there is still something to it. Trance experience in the West is often associated with illness, as in posttraumatic stress disorder or dissociative

identity disorder; hearing voices even infrequently is still popularly thought to be the sign of madness. And the dramatic unusual sensory perceptions associated with altered states are still not publically cultivated in the West as they are in shamanic societies, where the sensory override is central to the task.

Interiority

The most famous claim about interiority is that in the absence of a concept of inner thought, people may experience powerful thoughts as hallucinations—as if emanating from a source outside themselves. That was what Julian Jaynes (1976) argued about the Homeric world in a brilliant (but probably mistaken) book entitled *The Origins of Consciousness in the Breakdown of the Bicameral Mind*. The social world in which Achilles was imagined, he argued, had no words with which to describe inner thought. The heroes are then depicted as hearing gods in moments of great emotion because those who imagined the heroes actually experienced such moments as hallucinations.

In fact, the reality monitoring model should suggest that social worlds that encourage people to attend carefully to inner thought create the conditions under which people are more likely to experience sensory override because mental images and inner thought are given more significance and, thus, more likely to have the sensory weight to be misattributed. The intense attention given to hearing God speak in the mind, for example, may make it more likely that people hear God speak with their ears. This is the implication of a new study of the Egyptian imagination (Mittermaier 2010). In Islam, imagination is traditionally a prophetic mode of perception, inspired by the divine, and a means to make the story of the prophet real to the worshipper, and dreams are the vehicle of the imagination. Although many modern Careines no longer treat their dreams as prophetically meaningful, the debates about their interpretations still keep dreaming in the forefront of awareness; they also draw the dreamer's attention to the imagined in ways that make what is imagined more real.

Meanwhile, the absence of cultural categories to describe inner experience does limit the kinds of psychotic phenomena people experience. In the West, those who are psychotic sometimes experience symptoms that are technically called thought insertion and thought withdrawal, the sense that some external force has placed thoughts in one's mind or taken them out. Thought insertion and withdrawal are standard items in symptoms checklists. Yet when Barrett (2004) attempted to translate the item in Borneo, he could not. The Iban do not have an elaborated idea of the mind as a container, and so the idea that someone could experience external thoughts as placed within the mind or removed from it was simply not available to them.

Specific Biopsychological Phenomena

In addition to these dimensions of the cultural imagination of mind, some categories of hallucination-like phenomena seem biopsychologically specific but rise and fall in frequency, depending on whether they are culturally cultivated, for example, sleep paralysis (Ness 1978, Hufford 1982, Hinton et al. 2005).

SPIRITUAL TRAINING

It is also true that spiritual training may make sensory overrides more likely. Inner sense cultivation—and mental imagery cultivation, in particular—is at the heart of shamanism and is central to many spiritual traditions. Noll's (1985) terrific essay was among the first anthropological pieces to focus on mental imagery cultivation as training (but see also Winkelmann 1990, Luhrmann 1989). In fact, two dominant forms of mental techniques in effect train the human mind to experience the supernatural: techniques that focus attention on the inner senses and those that train attention away from thought and sensation. Examples of the former include shamanism, Tibetan vision meditation, and the Ignatian spiritual exercises; examples of the latter are Zen meditation and Centering Prayer. Both train the attention, and they probably train the capacity for absorption. Although

the psychological literature is largely silent about whether these training techniques generate sensory overrides, the ethnographic and historical literature strongly suggest that inner sense cultivation produces sensory experiences that are interpreted as signs of the supernatural.

The evidence of training and its consequence is most available in the literature on shamanism. After describing the apprenticeship of the new shaman of the bope among the Amazonian Bororo, Crocker (1985) remarks,

The phenomenological character of these experiences, and their personal significance for the apprentice shaman, are very ambiguous. Their details and sequence are standardized almost to the point of collective representations, known by most adult nonshamans. Yet the three shamans I knew best spoke of them with vivid sincerity, adding variations and personal reactions at once idiosyncratic and consistent with the general pattern. (p. 206)

Hallucinations seem to be associated with rhythmic drumming, as the shaman enters the unusual state in which she or he will see spirits and their world, as in this account of Arctic shamanism (Tien et al. 1994):

Powerful shamans hallucinated during ecstasy and during these hallucinations communicated their prophecies to the audience. Ecstasies developed after intense drum-beating and the substitution of ear-splitting shouts for songs. . . . In this ecstatic state, the shaman would begin to hallucinate, as though he could see the surrounding sea, capes, rocks (the natural surroundings) where his spirits were to be found. (p. 122)

Training is also more or less explicitly described in the development of the capacity for spirit possession, and here, too, the early stages of going in to trance may be associated with unusual sensory experience (e.g., Halliburton 2005). In discussing spirit mediums in the Niger (Masquelier 2002) says,

In most cases, initial suffering is gradually replaced by tolerance and benevolence as both the spirit and the host learn to accommodate each other. Initiation (gyara) into bori clearly opens up the channels of communication between the medium and the spirit, but paradoxically, much of the knowledge about herbs that healers learn from the mutanen daji (“people of the bush,” spirits) is often divulged during the early period of illness and torment when novice hosts occasionally wander aimlessly in the bush and suffer from hallucinations. (p. 63)

In Christian Europe, the historical periods in which laity and cleric alike practiced intense inner sense cultivation was also associated with what historians call a “visionary” culture (Carruthers 1998, Caciola 2003). It is not always clear whether these visions report actual sensory perceptions, but people clearly did value sensory overrides and treat them as meaningful (Newman 2005). Independent of whether hallucinogens are consumed, the practice of inner sense cultivation appears to be associated with an increase in sensory experiences of the supernatural.

Meanwhile, ethnographic work suggests that the use of hallucinogens is also often associated with training so that the person who ingests has a culturally appropriate experience (Harner 1972, Dobkin de Rios 1972, Wax & Wax 1978, Winkelman 1986). Here is Reichel-Dolmatoff’s (1975) classic account of the education of a Tukano shaman:

The drugged apprentice will mumble and groan in his trance. Close by, the paye is sitting. “What do you see? Tell me, what do you see?” he will ask insistently and the apprentice will then find the words to describe his visions. “There is the bend in the river . . . a black rock . . . I can hear the water rushing. . . .” “Go on, go on!” the paye will insist, his ear close to the other’s mouth. “There are birds, red birds, sitting on the lower branches of the tree. . . .” “Are they sitting on your left or on your right?” the paye will ask. And so they continue, haltingly at times in deep silence, until

the older man knows what kind of images and voices his pupil is perceiving and can now begin to interpret for him (p. 79).

Mushrooms (genus *Psiloche*), peyote (*Lophophora williamsii*) in North American cases, and ayahuasca (*Banisteriopsis*) in the South American Amazon are the most prominent examples of hallucinogens used as a tool to experience the supernatural.

The hallucinations given by hallucinogens are different in kind than sensory overrides or psychotic voices (Shanon 2002). One seems to enter a daydream in which sensations are not imagined but experienced, externally, as real. And as in the case of those who become shamans, the experiences both conform to cultural expectations and are utterly one's own. Among the most poetic anthropological evocations of this process are these reflections by Taussig (1987):

There is this paradox, that in trying to depict the general one has to seize upon the singular, because yagé brings out and indeed depends upon intense living at extremity and exploration of the inchoate. There is no "average" yagé experience; that's its whole point. Thoughts become feelings and feelings thoughts, not necessarily in the epiphanal instant conceived by the Romantic conception of the image or the symbol, but in a friction-filled rasping of planes of different types of experience grinding on a sort of no-person's-land where concept and feeling fight it out for priority, leaving a new space where the sensation lives in its glowing self. It is also the case that, associated with this, the world "outside" trembles into life in unison with the world "inside." (p. 406)

IS THE SHAMAN SCHIZOPHRENIC?

Recognizing the impact of training on sensory overrides should lead us to revisit one of the oldest questions in this research domain, which is the relationship between schizophrenia and

shamanism and other forms of spiritual expertise. The early stages of the debate suggested that someone who would be diagnosed with schizophrenia in the West could function effectively as a religious expert in a non-Western setting. Georges Devereux (2000[1956]) has been the most quotable protagonist: "Briefly stated, my position is that the shaman is mentally deranged" (p. 226). In the decades when psychoanalysis dominated American psychiatry, when schizophrenia was understood as a response to maternal rejection, many anthropologists (and observers) argued that the vulnerability that is experienced as schizophrenia in the West could be transformed in a non-Western setting by being used to a valued end. Now that psychiatry has entered the biomedical era and the category of schizophrenia has been narrowed into the most debilitating of all psychiatric illness, most would (and should) disagree with these early ideas. Anthropologists (e.g., Good 1997) have argued clearly and effectively that schizophrenia (or serious psychotic disorder) is identified as an illness in all societies. Moreover, they have pointed out that the experiences of shamans and those who meet criteria for schizophrenia differ in systematic ways. From a contemporary perspective, overwhelming and compelling evidence indicates that shamanism as a practice is distinctly different from schizophrenia. Shamans and other spiritual experts have experiences that are culturally prescribed, at times that are culturally appropriate, and they usually have had a choice about whether to embrace their roles. People with schizophrenia do not have this choice. Many of those who work in the area presume that shamans and other spiritual experts draw on a psychological capacity for dissociation and absorption, whereas schizophrenia is a psychotic process (Peters & Price-Williams 1980, Noll 1983, Stephens & Suryani 2000).

And yet ambiguities exist. When is a hallucination a symptom of psychotic illness? Anthropologists are clear that hallucinations are not always associated with illness, but these investigators give different accounts of when they are associated. One answer is that

hallucinations should be considered symptoms of illness when they are uncontrolled (Lemelson & Suryani 2006, Hwang 2007). Another answer is that hallucinations become symptoms when they are socially unintelligible (Hwang et al. 2007, Saavedra 2009).

Meanwhile, recent psychiatric research suggests that the relationship between dissociation and psychosis is newly uncertain. The main reason for this uncertainty is that there is an emerging discontent within psychiatric science about the boundedness of schizophrenia. Researchers now argue for a “psychotic continuum” in which psychotic-like experiences are found distributed throughout the general population (Johns & van Os 2001, Scott et al. 2005). They increasingly pinpoint trauma and abuse of generative psychosis as well as of dissociative disorder (Read et al. 2005). It is increasingly clear that—just as the psychoanalysts used to argue—environmental stressors play a role in whether someone develops schizophrenia. Along with the pushback against the simple biomedical model of schizophrenia, there has arisen a movement arguing that all hallucinatory experience is fundamentally dissociative and should be treated with psychosocial interventions (Romme & Escher 1993). More researchers insist that hallucinations are present in dissociative disorder as well (e.g., Dorahy et al. 2009). As a result of this more recent research, the previously clear distinction between

psychosis and dissociation now seems more ambiguous.

This ambiguity is important because the dissociative process is known to be amenable to intervention, to training (Taves 2009b, Halloy & Namasceau 2011) Anthropologists have much to contribute to this debate by addressing the way implicit training and cultural invitation shape the expression of serious psychotic disorder. If anthropologists can clearly identify patterns in the way psychotic disorder shifts over specific cultural boundaries—patterns that reflect the impact of learning—we may be able to play a constructive role in discussions about how to manage these devastating illnesses.

IN CONCLUSION

The anthropological evidence suggests that hallucinations are shaped by learning in at least two ways. People acquire specific representations about mind from their local social world, and people (particularly in spiritual pursuits) are encouraged to use their minds in specific ways. These two kinds of learning can affect even the most basic domains of mental experience. Ultimately, this learning-centered approach may have something to teach us about the pathways and trajectories of psychotic illness.

DISCLOSURE STATEMENT

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENTS

Grateful thanks go to Julia Cassaniti and Jocelyn Marrow for some deep digging in the anthropological literature, and to George Luhrmann, Richard Saller, and Ann Taves for helpful comments on the draft. The author is also grateful to the John Templeton Foundation, the National Science Foundation, and the National Institutes of Health for support of of research related to this topic.

LITERATURE CITED

- Aleman A, Laroi F. 2008. *Hallucinations*. Washington, DC: Am. Psychol. Assoc.
Al-Issa I. 1977. Social and cultural aspects of hallucinations. *Psychol. Bull.* 84:570–87

- Al-Issa I. 1995. The illusion of reality or the reality of illusion. *Br. J. Psychiatry* 166:368–73
- Barrett R. 2004. Kurt Schneider in Borneo: Do first rank symptoms apply to the Iban? See Jenkins & Barrett 2004, pp. 87–109
- Barstow AL. 1985. Joan of Arc and female mysticism. *J. Fem. Stud. Relig.* 1(2):29–42
- Bauer S, Schanda H, Karakula H, Olajosy-Hilkesberger L, Rudaleviciene P, et al. 2010. Culture and the prevalence of hallucinations in schizophrenia. *Compr. Psychiatry*. In press
- Benedict R. 1922. The vision in Plains culture. *Am. Anthropol.* 24(1):1–23
- Bentall R. 2003. *Madness Explained*. London: Penguin
- Bourguignon E. 1970. Hallucination and trance. In *On Origins and Mechanisms of Hallucinations*, ed. W Keup, pp. 183–90. New York: Plenum
- Brown M. 1999. *The Channeling Zone*. Cambridge, MA: Harvard Univ. Press
- Caciola N. 2003. *Discerning Spirits*. Ithaca, NY: Cornell Univ. Press
- Carruthers M. 1998. *The Craft of Thought*. Cambridge, UK: Univ. Cambridge Press
- Catedra M. 1992. *This World, Other Worlds*. Chicago: Univ. Chicago Press
- Chiu L. 1989. Differential diagnosis and management of hallucinations. *J. Hong Kong Med. Assoc.* 41(3):292–97
- Christian W. 1981. *Apparitions in Late Medieval and Renaissance Spain*. Princeton, NJ: Princeton Univ. Press
- Christian W. 1987. Tapping and defining new power: the first month of visions at Ezquloga, July 1931. *Am. Ethnol.* 14(1):140–66
- Christian W. 1996. *Visionaries*. Berkeley: Univ. Calif. Press
- Christian W. 1998. Six hundred years of visionaries in Spain: those believed and those ignored. In *Challenging Authority*, ed. M Hanagan, LP Moch, W Brake, pp. 107–19. Minneapolis: Univ. Minn. Press
- Claridge G, ed. 1997. *Schizotypy*. Oxford: Oxford Univ. Press
- Crocker C. 1985. *Vital Souls*. Tucson: Univ. Ariz. Press
- Dein S, Littlewood R. 2007. The voice of God. *Anthropol. Med.* 14(2):213–28
- De la Cruz D. 2009. Coincidence and consequence: Marianism and the mass media in the global Philippines. *Cult. Anthropol.* 24(2):455–88
- Desjarlais R. 2003. *Sensory Biographies*. Berkeley: Univ. Calif. Press
- Devereux G. 2000[1956]. Normal and abnormal. In *Cultural Psychiatry and Medical Anthropology*, ed. R Littlewood, S Dein, pp. 213–89. New Brunswick, NJ: Athlone
- Dobkin de Rios M. 1972. *Visionary Vine*. San Francisco: Chandler
- Dorahy M, Dorahy J, Seagar RN, Corr M, Stewart K, et al. 2009. Auditory hallucinations in dissociative identity disorder and schizophrenia with and without a childhood trauma history. *J. Nerv. Ment. Dis.* 197:892–98
- Dyrness W. 2004. *Reformed Theology and Visual Culture*. Cambridge, UK: Univ. Cambridge Press
- Eberhard W. 1971. A collection of ghost stories from Taiwan and San Francisco. *Asian. Folk. Stud.* 30(2):1–26
- Edgerton RB. 1966. Conceptions of psychosis in four East African societies. *Am. Anthropol.* 68:408–25
- Fuller C. 1992. *The Camphor Flame*. Princeton, NJ: Princeton Univ. Press
- Geurts K. 2002. *Culture and the Senses*. Berkeley: Univ. Calif. Press
- Glicksoh J, Barrett T. 2003. Absorption and hallucinatory experience. *Appl. Cogn. Psychol.* 7:833–49
- Good B. 1997. Studying mental illness in context: local, global or universal? *Ethos* 25(2):230–48
- Gottesman I. 1991. *Schizophrenia Genesis*. New York: Freeman
- Gould L. 1949. Auditory hallucinations and subvocal speech. *J. Nerv. Ment. Dis.* 109:418–27
- Gould L. 1950. Verbal hallucinations and automatic speech. *Am. J. Psychiatry* 107:1010–19
- Grimby A. 1993. Bereavement among elderly people: grief reactions, post-bereavement hallucinations and quality of life. *Acta Psychiat. Scand.* 87:72–80
- Halliburton M. 2005. ‘Just some spirit’: the erosion of spirit possession and the rise of ‘tension’ in South India. *Med. Anthropol.* 24(2):111–44
- Halloy A, Namasceau V. 2011. Learning possession. *Ethnos*. In press
- Harner M. 1972. *The Jivaro*. Garden City, NY: Doubleday/Nat. Hist.
- Hinton D, Pick V, Chhean D, Pollack MH. 2005. ‘The ghost pushes you down’: sleep paralysis-type panic attacks in a Khmer refugee population. *Transcult. Psychiatry* 42(1):46–77
- Hirschkind C. 2006. *The Ethical Soundscape*. New York: Columbia Univ. Press

- Hoffman R. 1986. Verbal hallucination and language production processes in schizophrenia. *Behav. Brain Sc.* 9:503–48
- Howes D, ed. 2005. *The Empire of the Senses*. Oxford: Berg
- Hufford D. 1982. *The Terror that Comes in the Night*. Philadelphia: Univ. Penn. Press
- Hwang W. 2007. Qi-Jong psychotic reaction in a Chinese American woman. *Cult. Med. Psychiatry* 31:547–60
- Hwang W, Miranda J, Chung C. 2007. Psychosis and shamanism in a Filipino-American immigrant. *Cult. Med. Psychiatry* 31:251–69
- Jaynes J. 1976. *The Origin of Consciousness in the Breakdown of the Bicameral Mind*. Boston: Houghton Mifflin
- Jenkins J, Barrett R, eds. 2004. *Schizophrenia, Culture and Subjectivity*. Cambridge, UK: Univ. Cambridge Press
- Johns L, van Os J. 2001. The continuity of psychotic experiences in the general population. *Clin. Psychol. Rev.* 21(8):1125–41
- Johnson M, Raye CL. 1981. Reality monitoring. *Psychol. Rev.* 88(1):67–85
- Kent G, Wahass S. 1996. The content and characteristics of auditory hallucinations in Saudi Arabia and the UK: a cross cultural comparison. *Acta Psychiat. Scand.* 94:433–37
- Kiev A. 1964, ed. *Magic, Faith and Healing*. New York: Free Press
- Kravel-Tovi M. 2009. To see the invisible messiah: messianic socialization in the way of a failed prophecy in Chabad. *Religion* 39:248–60
- Kravel-Tovi M, Bilu Y. 2008. The work of the present. *Am. Ethnol.* 35(1):64–80
- Kwon H. 2008. *Ghosts of War in Vietnam*. Cambridge, UK: Univ. Cambridge Press
- Lemelson R, Suryani LH. 2006. The spirits, ngeb, and the social suppression of memory: a complex clinical case from Bali. *Cult. Med. Psychiatry* 30:389–413
- Leudar T, Thomas P. 2000. *Voices of Reason, Voices of Insanity*. London: Routledge
- Lowie RH. 1925. *Primitive Religion*. London: Routledge
- Luhrmann TM. 1989. *Persuasions of the Witch's Craft*. Cambridge, MA: Harvard Univ. Press
- Luhrmann TM, Nusbaum H, Thisted R. 2010. The absorption hypothesis. *Am. Anthropol.* 112(1):66–78
- Luhrmann TM. 2012. *When God Talks Back*. New York: Knopf. In press
- Masquelier A. 2002. From hostage to host: confessions of a spirit medium in Niger. *Ethos* 30(1):49–76
- Meyer B. 1999. *Translating the Devil*. Trenton, NJ: Africa World
- Midelfort E. 2000. *A History of Madness in 16th Century Germany*. Stanford, CA: Stanford Univ. Press
- Mittermaier A. 2010. *Dreams that Matter*. Berkeley: Univ. Calif. Press
- Morgan D. 2010. Image, art and inspiration in modern apparitions. In *Looking Beyond*, ed. C Hourihane, pp. 265–82. University Park, PA: Penn. State Univ.
- Mueggler E. 2001. *The Age of Wild Ghosts*. Berkeley: Univ. Calif. Press
- Murphy J. 1976. Psychiatric labeling in cross-cultural perspective. *Science* 191:1019–28
- Nabokov I. 2000. *Religion Against the Self*. New York: Oxford
- Ness R. 1978. The old hag phenomenon as sleep paralysis. *Cult. Med. Psychiatry* 2:15–39
- Newman B. 2005. What did it mean to say “I saw”? *Speculum* 80(1):1–43
- Noll R. 1983. Shamanism and schizophrenia. *Am. Ethnol.* 26:443–59
- Noll R. 1985. Mental imagery cultivation as a cultural phenomenon, with commentary. *Curr. Anthropol.* 26(4):443–61
- Okulate GT, Jones OB. 2003. Auditory hallucinations in schizophrenic and affective disorder Nigerian patients: phenomenological comparison. *Transcult. Psychiatry* 40(4):531–41
- Peters LG, Price-Williams D. 1980. Towards an experiential analysis of shamanism. *Am. Ethnol.* 7:398–418
- Posey T, Losch M. 1983. Auditory hallucinations of hearing voices in 375 normal subjects. *Imagin. Cogn. Personal.* 3(2):99–13
- Radden J, ed. 2000. *The Nature of Melancholy from Aristotle to Kristeva*. Oxford: Oxford Univ. Press
- Read J, van Os J, Morrison AP, Ross CA. 2005. Childhood trauma, psychosis and schizophrenia. *Acta Psychiat. Scand.* 112:330–50
- Reichel-Dolmatoff G. 1975. *The Shaman and the Jaguar*. Philadelphia: Temple Univ. Press
- Robbins J. 2004. The globalization of Pentecostal and charismatic Christianity. *Annu. Rev. Anthropol.* 33:117–43
- Roche S, McConkey K. 1990. Absorption: nature, assessment, correlates. *J. Personal. Soc. Psychol.* 59:91–101

- Romme M, Escher S. 1989. Hearing voices. *Schizophren. Bull.* 15(2):209–16
- Romme M, Escher S. 1993. *Accepting Voices*. London: MIND
- Saavedra J. 2009. Schizophrenia, narrative and change: Andalusian care homes as novel socio-cultural context. *Cult. Med. Psychiatr.* 33:163–84
- Sadowsky J. 1999. *Imperial Bedlam*. Berkeley: Univ. Calif. Press
- Schmidt L. 2000. *Hearing Things*. Cambridge, MA: Harvard Univ. Press
- Schooler C, Caudill W. 1964. Symptomatology in Japanese and American schizophrenics. *Ethnology* 3(2):172–78
- Scott EHM. 1967. A study of the content of delusions and hallucinations in 100 African female psychotics. *S. Afr. Med. J.* 4:853–56
- Scott J, Chant D, Andrews G, McGrath J. 2005. Psychotic-like experience in the general community. *Psychol. Med.* 36:231–38
- Seremetakis N, ed. 1994. *The Senses Still*. Chicago: Univ. Chicago Press
- Shanon B. 2002. *The Antipodes of the Mind*. Oxford: Oxford Univ. Press
- Shenoda A. 2010. *Cultivating mystery: miracles and a Coptic moral imagination*. PhD thesis. Harvard Univ.
- Sidgwick H, Johnson A, Myers FWH, Podmore F, Sidgwick EM. 1894. Report on the census of hallucinations. *Proc. Soc. Psychical Res.* 34:25–394
- Smith D. 2007. *Muses, Madmen and Prophets*. New York: Penguin
- Smith M. 2007. *Sensing the Past*. Berkeley: Univ. Calif. Press
- Snodgrass J. 2002. Imitation is far more than the sincerest of flattery: the mimetic power of spirit possession in Rajasthan, India. *Cult. Anthropol.* 17(1):32–64
- Stephen M, Suryani LH. 2000. Shamanism, psychosis and autonomous imagination. *Cult. Med. Psychiatry* 24:5–40
- Suhail K, Cochrane R. 2002. Effect of culture and environment on the phenomenology of delusions and hallucinations. *Int. J. Soc. Psychiatry* 48(2):126–38
- Taussig M. 1987. *Shamanism, Colonialism and the Wild Man*. Chicago: Univ. Chicago Press
- Taves A. 2009a. Channeled apparitions: on visions that morph and categories that slip. *Vis. Resour.* 25(1–2):137–52
- Taves A. 2009b. *Religious Experience Reconsidered*. Princeton, NJ: Princeton Univ. Press
- Taylor C. 2007. *A Secular Age*. Cambridge, MA: Harvard Univ. Press
- Tellegen A, Atkinson G. 1974. Openness to absorption and self altering experiences (“absorption”), a trait related to hypnotic susceptibility. *J. Abnorm. Psychol.* 83:268–77
- Tien A. 1991. Distribution of hallucinations in the population. *J. Soc. Psychiatry Psychiatr. Epidemiol.* 26:287–92
- Tien T, Shimkin D, Kan S. 1994. Shamans of the Siberian Eskimos. *Arctic Anthropol.* 31(1):117–25
- Wallace AFC. 1959. Cultural determinants of response to hallucinatory experiences. *Arch. Gen. Psychiatry* 1:58–69
- Wax ML, Wax RH. 1978. Religion among American Indians. *Ann. Am. Acad. Pol. Soc. Sci.* 436:27–39
- West DJ. 1948. A mass observation questionnaire on hallucinations. *J. Soc. Psychical. Res.* March–April:187–95
- Whitson JA, Galinsky AD. 2008. Lacking control increases illusory pattern perception. *Science* 322:115–17
- Winkelman M. 1986. Trance states: a theoretical model and cross-cultural analysis. *Ethnos* 14(2):174–203
- Winkelman M. 1990. Shamans and other ‘magico-religious’ healers: a cross cultural study of their origins, nature and social transformations. *Ethos* 18(3):308–52