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Olfactory-Triggered Panic Attacks Among Khmer Refugees: A Contextual Approach

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Abstract

One hundred Khmer refugees attending a psychiatric clinic were surveyed to determine the prevalence of olfactory-triggered panic attacks as well as certain characteristics of the episodes, including trigger (i.e. type of odor), frequency, length, somatic symptoms, and the rate of associated flashbacks and catastrophic cognitions. Forty-five of the 100 patients had experienced an olfactory-triggered panic attack in the last month. Trauma associations and catastrophic cognitions (e.g. fears of a 'wind attack,' 'weakness,' and 'weak heart') were common during events of olfactory panic. Several case examples are presented. A multifactorial model of the generation of olfactory panic is adduced. The therapeutic implications of this model for the treatment of olfactory panic are discussed.

Keywords

Cambodians; olfactory; panic attacks; panic disorder; post-traumatic stress disorder

The human ritual of renewal meant relearning old habits from her 'former' or pre-Auschwitz life: how to use a toothbrush, toilet paper, handkerchief, knife, and fork; how to smile, first with the lips, then with the lips and eyes; how to recapture forgotten odors and tastes, like the smell of rain.

Implicit in the procedure of renewal, however, annealed to it with the epoxy of disruptive memory, is the 'counter-time' of Auschwitz, where the rain stank of diarrhea and beat down on the camp, the victims, 'the soot of the crematoriums and the odor of burning flesh.'

(Langer, 1991, p. 3)

In this quotation, Langer highlights the salience of olfaction in the Holocaust traumatic ontology and its centrality in attempted recovery. Traumatic events are encoded into memory by auditory, olfactory, and visual cues (e.g. Ledoux, 1996; van der Kolk, 1996). The sensory modality of olfaction – whose afferent tracts connect directly to the limbic system – seems to play a pre-eminent role in emotion and alerting to threat (Ledoux, 1996). Though sights and sounds are commonly assessed triggers of flashbacks (Kline & Rausch, 1985), odor cues in individuals diagnosed with post-traumatic stress disorder (PTSD) and panic disorder have been

minimally investigated by psychiatrists and psychologists.¹ Not even one survey of the rate of olfactory panic in a clinic population has been conducted.

Medical anthropologists attempt to advance an embodied view of human ontology and to demonstrate the profoundly encultured nature of the sensorium (e.g. Howes, 1991; Jackson, 1989; Stoller, 1989). Cultural historians (e.g. Corbin, 1986) and medical historians (Classen, 1993; Classen, Howes, & Synott, 1994) have likewise revealed the constructed nature of our experience of smell, for example, olfactory hypervigilance produced by cultural categories and fears (see too, Dulau & Pitte, 1997). One must distinguish an *anthropology of sensory modalities* (e.g. smell, taste, kinesthetic sense) from an *anthropology of sensations* (e.g. dizziness, heat in the body), examples of the latter being the work of Csordas (1994), Jenkins (1991), Kirmayer (1996), and Kleinman and Kleinman (1994). Though related tasks, both leading to a prioritizing of the body, the two approaches differ.

Our group has identified unique aspects of the Cambodian refugee's embodiment of trauma: multiple subtypes of panic attacks – e.g. olfactory, orthostatic (i.e. panic caused upon moving from a sitting or supine position to standing), and 'sore neck' (i.e. a fear of the neck vessels bursting from an acute upward rise of wind in the body) (see Hinton, Ba, Peou, Um, 2000; Hinton, Um, & Ba, 2001a, 2001b, 2001c; Hinton et al., 2004).² One study by our group, which demonstrated an elevated rate of panic disorder (60%), also found that 11% of the Khmer psychiatric outpatients had experienced in the previous 4 weeks a panic attack meeting panic disorder criteria that was triggered by an olfactory stimulus (Hinton et al., 2000). In that study, olfactory-triggered panic attacks associated with flashback were not counted; association with flashback would cause the panic attack to be classified as indicative of PTSD rather than panic disorder.

Why do Cambodians have such high rates of olfactory and other types of panic attacks? In the case of olfactory panic attacks, trauma associations to odors would seem to be one cause (see, e.g. Hinton et al., 2000, 2004; Hinton et al., 2001a, 2001b, 2001c; Hinton, Hinton, Pham, Chau, & Tran, 2003). Also, cultural syndromes and associated catastrophic cognitions would seem to play an important part (Hinton et al., 2000, 2003, 2004; Hinton et al., 2001a, 2001b, 2001c). The Cambodian pathophysiology of 'wind' (and related cultural syndromes) profoundly affects the experience of autonomic arousal. Khmer refer to a state of somewhat increased inner wind – a state roughly equivalent to anticipatory or general anxiety – with the phrase, 'on the verge of a wind attack' (*caŋ kaət k^hyal*).^{3,4} According to the Khmer conception, to have increased inner wind and disturbed wind flow (i.e. 'on the verge of a wind attack') causes (i) symptoms of psychological and somatic anxiety (e.g. mild dizziness, gastrointestinal upset, worry, or shakiness) by a pathophysiology of inner wind (e.g. dizziness being caused by a rise of wind into the head), (ii) heightened reactivity to all stimuli (e.g. to smells), and (iii) a predisposition to an acute rise in inner wind that is called a 'wind attack' (*kaət k^hyal*) – a 'wind attack' usually being diagnosable as a panic attack (see Figure 1).⁵ Cambodians also

¹However, an extensive literature has been developed on a functional somatic syndrome, mainly conducted by persons of other medical specialties, that addresses the issue of odor-triggered panic attacks: multiple chemical sensitivity (Binkley & Kutcher, 1997; Guglielmi, Cox, & Spiker, 1994; Hartman, 1998; Leznoff, 1997; Poonai et al., 2000; Staudenmayer, 1997; Stenn & Binkley, 1998).

²High rates of PTSD are found in the Khmer population: an 86% rate of PTSD in a community sample (Carlson & Rosser-Hoggan, 1994).

³Readers familiar with the Spanish medical literature will recognize the interesting analogy between these expressions and those in Spanish, especially related to *ataque de nervios*: *al borde de un ataque de nervios* ('on the verge of a nerve attack') and *un ataque de nervios* ('a nerve attack'). The Puerto Rican anxiety and panic idioms relate to an ethno-psychophysiology of 'nerves,' whereas the Cambodian idioms relate to an ethno-psychophysiology of 'wind.'

⁴We use the phonetic system of Headley et al. (1997); however, our system varies by emphasizing aspiration by using an upper-case 'h' and distinguishing short and long vowels by a doubling of the vowel.

⁵Hence, increasing anxiety is viewed as increasing 'inner wind'; but Cambodians consider a 'wind attack' to be distinctly different from the state of 'on the verge of a wind attack,' a 'wind attack' being a very acute state of limited duration. Khmer treat 'on the verge of a wind attack' and a 'wind attack' (*kaət k^hyal*) using various elaborate wind-removal methods.

consider anxiety symptoms (e.g. those of general anxiety disorder, panic disorder, and PTSD) to indicate a 'weak heart' (Hinton, Hinton, Um, Chea, & Sak, 2002).⁶ According to the Khmer conception, a 'weak heart' produces (see Figure 2, p. 175): (i) multiple symptoms, one of which is increased reactivity to all stimuli (e.g. to smells); (ii) a great danger of death from heart arrest during states of anxiety;⁷ (iii) a tendency to be in a state of somewhat increased inner wind (i.e. 'on the verge of a wind attack'); and (iv) a tendency to have 'wind attacks'.⁸

The present study aims to determine the prevalence of olfactory-triggered panic attacks in an outpatient sample and to delineate the phenomenology of olfactory panic attacks, in particular, associated catastrophic cognitions (e.g. fears of a 'wind attack,' 'weakness,' and 'weak heart') and trauma associations. We speculated that trauma associations (in particular, to events that occurred during the Pol Pot period) and catastrophic cognitions (generated by cultural syndromes) would be prominent during episodes of olfactory panic.

Methods

Participants

The interviews were conducted by the first author, assisted by bicultural staff, at a freestanding psychiatric clinic in Lowell, MA. Of the 100 patients, 80% were female, 20% male, and the mean age was 45.6 years (range 35–64). Most of the Cambodians surveyed were former farmers (90%) with minimal education, unable to speak English (95%), and illiterate in their own tongue (65%). The majority of the patients were receiving psychiatric disability benefits, spending much time caring for children and grandchildren, and performing domestic chores.

Procedure

Previous ethnography and detailed interviewing by the first author, who is fluent in Khmer, determined certain common triggers of olfactory panic in the Khmer population; this data was acquired through clinical immersion: treating Cambodian patients 35 hours a week, some in hour-long therapy sessions, over the course of several years. Consecutive patients were queried as to the presence of a strong reaction in the previous 4 weeks to any of the following odors: (i) car exhaust fumes,⁹ (ii) cigarette smoke, (iii) trash odors, (iv) cooking smells (i.e. gas-stove fumes or the odor of burning food), and (v) certain other scents (e.g. perfume, nail polish, fresh paint, bleach, or new clothes). If the patient affirmatively replied to any of these probes, then it was determined if the olfactory-triggered reactivity met DSM-IV panic attack criteria (American Psychiatric Association, 1994): the sudden onset (coming to a peak within 10 minutes) of 4 or more of 13 specified autonomic arousal symptoms (e.g. shortness of breath,

⁶Wind illness is considered in terms of (i) a disturbance of the normal downward flow of wind due to blockages (e.g. at the joints and stomach), (ii) a reversal of the normal downward movement of wind (i.e. down through the limbs and alimentary tract) so that the wind moves upward in the body (i.e. up the limbs and up the alimentary tract), (iii) a sudden upsurge of wind in the body since it cannot exit the body through the normal downward flow (i.e. through the extremities and alimentary canal); (iv) multiple symptoms caused by the upsurge of bodily wind (e.g. in the trunk, impaired breathing, abnormally functioning heart; in the neck, neck distention; in the head, dizziness, and tinnitus), (v) symptoms caused by the wind (and blood not flowing outward) along the limbs, most particularly cold and numb hands and feet; (vi) the intrinsically cold nature of wind leading to a sort of blockage by coagulation, and (vii) the heart having to fight against the peripheral blockages, leading to palpitations. The terms for wind illness ('on the verge of a wind attack,' 'wind attack,' and 'wind overload') refer to progressive intensifying of processes i–vii.

⁷Palpitations do not have to be present in the state of anxiety to create acute fear of heart arrest. For instance, cold extremities are thought to be produced by blockages in the vessels of the extremities, especially at the knee and elbow joints. This blockage may be due to wind, which itself causes a sort of coagulation or is a result of the heart not pumping blood adequately. Yet, once blockages are present in the limbs, the heart must work harder to overcome those blockages. Dizziness may be attributed to blood and wind surging to the head; the heart is assumed to be in a hyperactive and dysregulated state. Hence, even in the absence of palpitations, symptoms such as cold extremities and dizziness generate fears of a disordered heart.

⁸As one can see, 'weak heart' (and 'weakness') identifies a sustained state of predisposition to anxiety; it can indicate disorders such as general anxiety disorder, panic disorder, and PTSD.

⁹We asked about 'car-associated gasoline smells' (*saŋ laan*) and 'car smoke' (*p^hsaŋ laan*). These two phrases translate the idea of 'car exhaust.'

palpitations). For the olfactory panic attacks caused by a particular odor, all DSM-IV somatic panic attack symptoms were assessed; if more than one olfactory-triggered panic attack of that type was experienced, then the symptoms of the worst attack were counted. The number of panic attacks triggered by a particular olfactory stimulus in the last month and the typical length of those episodes was determined.

For each type of olfactory-triggered panic attack the patient suffered (e.g. due to car exhaust), the patient was asked whether in the last month any of the panic attacks triggered by that olfactory stimulus were associated with flashbacks, and if so, at what frequency, the response options being 'sometimes' or 'always.' The patient was then asked to describe the flashback. The Clinician Administered Posttraumatic Stress Scale (CAPS; Weathers, Keane, & Davidson, 2001) determines the intensity of flashbacks, rated on a 0–4 Likert-type scale. If a patient appeared to have a flashback, the intensity was determined by the CAPS scale (to be counted as a flashback, the score had to be at least a '1'), which rates the patient's response to the question: 'How much did it seem as if ... (the event) ... were happening again?' Intensity of the flashback is rated on a 0–4 Likert-type scale as follows: 0, *no reliving*; 1, *mild, somewhat more realistic than just thinking about the event*; 2, *moderate, definite but transient dissociative quality, still very aware of surroundings, daydreaming quality*; 3, *severe, strongly dissociative (reports images, sounds, or smells) but retained some awareness of surroundings*; and 4, *extreme, complete dissociation (flashback), no awareness of surroundings, may be unresponsive, possible amnesia for the episode (blackout)*.

For those patients who had suffered an olfactory panic attack in the last month, a questionnaire was utilized to query about the presence of syndrome-generated olfactory fears during the most recent olfactory panic attack. The patients were asked, 'When you had your most recent olfactory-triggered panic attacks, did any of the following worries go through your mind?' The patient was then queried about nine possible concerns as delineated in the Syndrome-Generated Olfactory Fear Questionnaire (see below). The questionnaire assesses olfactory fear related to being 'on verge of a wind attack' (*caŋ kaət kʰyal*), 'wind attacks' (*kaət kʰyal*), 'bodily weakness' (*kʰsaoy kamlaŋ*), and heart weakness' (*kʰsaoy ben dooŋ*). These might be called 'wind syndrome fears,' 'weakness syndrome fears,' and 'weak heart syndrome fears.'

Patients who did not suffer an olfactory-triggered panic attack in the previous month were asked the following: 'Did you suffer an olfactory-triggered panic attack in the previous 6 months?' If the patient answered affirmatively, the patient was asked: 'Why did you have olfactory panic at that time?' If the patient asserted negatively, the following was queried, 'Did you have an olfactory-triggered panic attack in the last 5 years?' Patients were then asked why olfactory-triggered panic had improved. Finally, all the patients who denied having an olfactory-triggered panic attack in the last month were asked whether certain odors (e.g. car exhaust or cigarette smoke) were avoided for fear of having a panic attack.

Results

Of a series of 100 patients, 45 (45%) described experiencing olfactory-triggered panic attacks in the last month. For an analysis of the frequency of panic attacks triggered by specific odors and the rate of associated flashback, see Table 1. Many patients had panic attacks triggered by multiple types of odors. When analyzed by triggers, the following mean panic attack frequencies were found: car exhaust fumes, 2.4 per month; cigarettes, 4 per month; cooking odors, 1.8 per month; trash odors, 2 per month; and other, 1.5 per month. The mean length of a panic attack was 18.3 minutes (range 1–90; *SD* = 6.4). Based on the total of 83 olfactory panic attack types that were endorsed, frequent DSM-IV panic attack somatic symptoms included nausea (86%), shortness of breath (83%), dizziness (70%) and palpitations (66%),

choking sensation (64%), chest tightness (64%), shaking (59%), sweating (58%), chills/hot flashes (46%), and numbness/tingling (43%).

Flashbacks were common (see Table 1), and the average CAPS intensity was 2.5 (range 1–4; $SD = 1.0$). In a given patient, one type of smell may trigger panic attacks associated with flashbacks, whereas another odor triggers panic attacks but no flashbacks. Twenty-six of the 45 patients with olfactory panic (58%) had experienced at least one flashback during an olfactory-triggered panic attack. We also did a content analysis of the flashbacks triggered by car exhaust and cigarette fumes. In the case of car exhaust-triggered flashbacks, of the 23 patients who had experienced a flashback, 20 (87%) had a flashback of a battle scene, most commonly the memory of being trapped between the Cambodian and Vietnamese troops; while for the eight patients with cigarette-odor triggered flash-backs, six (75%) reported that the flashbacks involved battle scenes.¹⁰

The results of the Syndrome-Generated Olfactory Fear Questionnaire are given in Table 2.

Several patients (10/55; 18%) who denied olfactory panic attacks in the previous 4 weeks had experienced such panic attacks in the last 6 months; and all of those patients stated that olfactory panic attacks returned either when feeling (i) ‘weak’ (e.g. due to decreased sleep) or (ii) anxious, for example when ‘thinking a lot’ (*k-ut caraən*). Of those patients who denied having an olfactory-triggered panic attack in the last 6 months, several (20/55; 36%) had suffered an olfactory-triggered panic attack in the last 5 years. Patients attributed their improved condition to therapy and medication that caused them to be stronger (e.g. able to eat and sleep) and not to ‘think a lot’ (*k-ut caraən*). Many patients (19/55; 35%) who had not experienced an olfactory panic attack caused by a specific odor in the last month still described avoiding these odors by, whenever possible, not walking along the street for fear of encountering exhaust fumes; avoiding visits to houses of friends who smoke; having others take out the trash; or having others light the stove in order to avoid the gas smell.

Cases

Ry—Three years prior to the present interview, at the age of 46, Ry began psychiatric treatment. She had panic attacks triggered by car exhaust, cigarette smoke, and trash odors. In the car exhaust-triggered panic attacks, the patient experienced flashbacks of an event that took place during the Vietnamese invasion of Cambodia: a mortar shell exploded next to her, killing several friends. Panic attacks triggered by cigarette smoke or trash odors were not accompanied by flashbacks. The patient was diagnosed with PTSD and panic disorder and treated with medication (clonazepam and sertraline) and therapy.

In the 4 weeks prior to the interview, she had experienced two panic attacks, both triggered by cigarette smoke. On the day of her most recent clinical visit, when Ry walked into the vestibule at the entrance to the clinic, she encountered someone smoking a cigarette. As she passed the smoker, Ry suddenly experienced a constellation of symptoms: strong nausea, dizziness (*lənji lənjaə*), shortness of breath, palpitations, diaphoresis, the urge to urinate and defecate, and the feeling of imminent syncope. The ‘wind attack’ caused her to fear dying of a heart attack, stroke, or some other medical event, and her reaction to the odor confirmed her self-diagnosis of ‘weakness’ and ‘weak heart.’ Even after Ry moved into a smoke-free area, her symptoms persisted for another 10 minutes. She denied having flashbacks during this cigarette-induced panic attack.

Ry related the story of her exposure to severe bombing. While Vietnamese were fighting the Khmer Rouge at a site next to her natal village, she and some fellow villagers sought refuge

¹⁰In some cases, an odor caused two or more flashbacks.

in a nearby banana-tree grove. A mortar shell exploded very close by and the acrid smell of sulfur infused her nostrils with a burning sensation. There was also the odor of burnt vegetation and flesh along with a strong scent of blood. As she looked around, Ry saw that one person had been severed at the trunk, another's legs had been torn from the body, and blood was splattered everywhere. A few days later, a mortar shell exploded even closer to Ry, resulting in shrapnel injury and loss of consciousness. She explained that the smell of car exhaust is identical to the sulfurous odor of fumes from an exploded bomb. Ry also described how, during the Pol Pot period, she often encountered foul-smelling decaying corpses.

Sokha—Forty-five-year-old Sokha was diagnosed with PTSD and panic disorder. Initially, his main complaint consisted of severe startle: loud noises would cause him to have palpitations for 30 minutes. Sokha worried that his startle sensitivity indicated a weakness of heart and that he could die during a tachycardic episode. After we explained that startle-induced palpitations were normal in such situations and verified (through consultation with his physician) the healthiness of his heart, Sokha's startle-induced palpitations decreased to just 1 minute in duration and caused him only minimal distress. During the olfactory survey, our team learned of another phenomenon of great concern to Sokha. Upon encountering the smell of fresh paint or new clothes, he had a panic attack (in his words, a 'wind attack') along with a Pol Pot flashback of decaying corpses. And if the car ahead of him on the road emitted much exhaust – particularly in the case of diesel trucks – he would develop dizziness, palpitations, shortness of breath, nausea, sweating, and fear but without flashbacks.

During the Pol Pot period, Sokha lived in an area of Cambodia where many people were killed. Every day, new people arrived for execution; the bodies were piled on wood, then torched. The scent of burning flesh was omnipresent and overwhelming, and Sokha wondered whether this would soon be his fate. During his escape journey to Thailand following the Vietnamese invasion of Cambodia, Sokha saw multiple bodies in a state of putrefaction along the roadside. The corpses emitted an overwhelming stench. Flies swarmed around – and alit upon – the corpses, creating a constant buzzing. Many of the bodies were swollen to twice the original size, the skin cracking, a fluid exuding from the fissures and, in certain sections, invaded by undulating masses of maggots. Even after passing well beyond the corpses, Sokha could smell the odor for days, as if the stench had stuck to his body. As he described the image, Sokha looked suddenly ill, saying that just recalling the image made him feel dizzy and nauseated and made his hands grow cold and his head ache. He extended his hands outward for the first author to verify. They were icy cold. Sokha also explained that he had been exposed to the sulfurous smoke of bombs and gunfire.

When Sokha learned that it was common among Khmer refugees to have a strong physiological response to traumatic event reminders such as smells, that this reactivity was an expected and benign aspect of trauma-related disorder, he no longer ascribed his odor-provoked symptoms to 'inner wind,' 'weakness,' or a 'weak heart.' As a further therapeutic intervention, we suggested that Sokha keep a VicksTM sniffer in his pocket, utilizing it upon exposure to objectionable odors.¹¹ While sniffing the VicksTM tube, Sokha conjured the image of a garden scene, imagining that he smelled the fragrance of sweet flowers. During the visualization, he practiced muscle relaxation, especially of the shoulders, along with a head rotation, imagining his neck and spine to be the stem of a lotus and his head to be like a bloom dancing playfully in the wind. Sokha was also taught that he could take a half-pill of a benzodiazapine should the sniffer fail to relieve his anxiety. After these interventions, Sokha no longer experienced

¹¹In Cambodia (and Thailand), sniffers were traditionally quite popular, and were considered to have medicinal qualities and the ability to strengthen the heart and ease breathing; even today they are commonly used upon encountering a foul odor. In the US, Khmer patients achieve the same effect through the use of 'wind oil,' a fragrant green oil that is sniffed and applied under the nose.

olfactory-triggered panic attacks and only occasionally felt a mild sense of distress upon encountering a formerly problematic odor.¹²

Chan—Three times a week during the month prior to the interview, 59-year-old Chan experienced severe episodes of dizziness upon standing. He would immediately sit down, fearing ‘wind overload.’¹³ A panic attack would ensue that lasted about an hour. During about a third of the orthostatically induced panic attacks, Chan had a flashback of either his brother’s execution or of stacks of body parts. Whenever Chan was exposed to cigarette smoke, he suffered a panic attack (cold extremities, dizziness, nausea, shortness of breath, and fear) lasting 30 minutes – which he described as a ‘wind attack’ – in conjunction with a flashback of his brother’s execution. Such a cigarette-triggered panic attack had occurred once in the 4 weeks prior to interview. To relieve the symptoms of the olfactory-triggered panic attack, Chan immediately began to ‘coin’¹⁴ himself in order to remove excessive inner wind; Chan considered cold extremities, dizziness, and other symptoms to result from the blockage of vessels in the limbs and an inner accumulation of wind.¹⁵

In the Khmer Rouge period, just before the Vietnamese invasion of his village, Chan and his two brothers were farming rice about an hour’s walk from the village. Suddenly, six Khmer Rouge showed up at the rice field and proceeded to arrest both Chan and his brothers. The soldiers had learned that Chan’s two brothers had served as soldiers prior to the Khmer Rouge invasion. (The Khmer Rouge routinely hunted down and executed all former soldiers.) While Chan had always only worked as a rice farmer, he nevertheless was arrested as well. He was charged with two crimes: being related to a soldier and not revealing his brothers’ identities to the authorities. Three Khmer Rouge soldiers escorted Chan’s brothers to a distance of about 50 yards while another three Khmer Rouge remained behind to guard Chan. One of the guards lit a cigarette and, while exhaling smoke directly into Chan’s face, told him that they intended to kill and eviscerate his two brothers and consume their livers.¹⁶ Chan’s heart pounded against his rib cage, his chest tightened, and his face flushed with blood, while his head was sent into a whirling spiral of fear and rage and cigarette fumes. He watched as his brothers’ hands were bound behind their backs and a Khmer Rouge fired a rifle into each brother’s chest in turn. One and then the other brother collapsed backwards, and the odor of sulfurous gunshot fumes filled the air. The soldiers then escorted Chan to his dead brothers and forced him to watch as they eviscerated the bodies with a long knife and placed the livers on a banana leaf. The stench of blood and sulfur was overpowering. Chan was overcome with panic, nausea, dizziness, and

¹²This same treatment approach has been very effective in treating olfactory-triggered panic attacks in the Khmer population, that is, exploring trauma associations to the odors, education about PTSD (for example, learning how certain stimuli activate fear networks and result in extreme arousal, sometimes even in the absence of awareness of the link between that stimulus and previous trauma), ascertaining the patient’s catastrophic cognitions about arousal, and the prescription of a sniffer (and, when needed, a small dosage of benzodiazapine). See later for a fuller discussion.

¹³On the Khmer syndrome of ‘wind overload’ and orthostatic panic, see Hinton et al. (2001b, 2001c). Cambodians commonly talk of three stages of increasing severity of inner wind. During the first stage, called ‘on the verge of a wind attack’ (*caŋ kaət k^hyal*), some mild psychological and somatic anxiety commence, for example, a sense of fatigue, anxiety, slight trembling, and minor joint and muscle soreness. During the second stage, called a ‘wind attack,’ there is much more prominent psychological and somatic anxiety. During the third stage, called ‘wind overload’ (*k^hyal kəə*), the symptoms are even more severe; syncope is seemingly imminent – or even occurs. Wind overload usually only occurs upon standing. In a very rough sort of way, one could compare ‘on the verge of a wind attack’ with a state of general anxiety disorder and ‘a wind attack’ with panic attack. ‘Wind overload’ is ordinarily orthostatically triggered panic. To be ‘on the verge of a wind attack’ (*caŋ kaət k^hyal*) is to be in a state of somewhat increased inner wind.

¹⁴For a description of coining, see Hinton et al. (2001b, 2001c). Coining is a method thought to remove ‘wind’ from the body and to restore proper blood and wind flow in the vessels. One takes a coin and dips the edge in ‘wind oil’; the edge is then dragged in a proximal to distal direction either along the ribs or the front or the back of the body and/or along the limbs. Streaks result. The color of the streaks reveals how much wind has accumulated in the body.

¹⁵On the Khmer ethnophysiology of wind, see Hinton et al. (2001b, 2001c).

¹⁶In the Cambodian language, the expression ‘big liver’ means insolent. To eat someone’s liver is to appropriate that individual’s life force; evisceration with a knife (and liver eating) was a common method of killing utilized by the Khmer Rouge. See the article by Alexander Hinton (1998) for a detailed analysis.

leg weakness and feared he would collapse. The soldiers then let him go, saying that this would be his fate if he committed any errors.

Upon arriving back at his village, Chan found the Khmer Rouge commanding the villagers to assemble before the leader's house in order to view the butchered corpses of 12 people who had tried to escape the village. There was one pile of limbs, severed at the knee and elbow; in an adjacent mound were the heads; and beside that lay the eviscerated trunks, the abdomens splayed open with flaps of skin draping down, the livers having been extricated for consumption by the Khmer Rouge. Weak-kneed, dizzy, and nauseated, Chan stared at the horrifying image of his own likely fate. When the Vietnamese invaded his village a few hours later, he seized the moment to escape, and managed to reach the Thai border.

Sai—The smell of roasting or burning meat or lighted charcoal made 54-year-old Sai feel ill, with palpitations, anxiety, cold extremities, diaphoresis, a sore neck, and headache. She considered the symptoms to be caused by a wind attack triggered by the odor, and she proceeded to 'coin' herself. She was also unable to tolerate cigarette smoke, though unfortunately, her husband was an avid smoker. In addition, about once a week, upon smelling car exhaust, Sai experienced palpitations for an hour and had flashbacks. During olfactory-triggered panic attacks, neck tension was so intense that Sai worried about the rupture of her neck vessels,¹⁷ and cold extremities made her fear 'death of the limbs.'¹⁸ Sai quickly 'coined' herself in an attempt to remove wind from the body and to restore proper blood and wind flow.

When asked about exposure to these smells in the past, Sai recounted fleeing with her cousin during the Vietnamese invasion of Cambodia while mortar shells exploded not far from her. Exhausted and starving, Sai eventually collapsed to the ground to rest. Meanwhile, her cousin went on ahead to survey for a safe route and to search for food. Not long thereafter, a friend passed by and informed Sai that her cousin had been killed. Sai immediately ran in the indicated direction and found her cousin's decapitated body blown up into a tree and the severed head lying on the ground. The smell of burning flesh and sulfur was overpowering, the bomb having just exploded. Sai said the odor of car exhaust (but not cigarettes) brought back the memory of her cousin's death as well as memories of the numerous other corpses she had encountered during the Pol Pot period.

Leilee—Two smells bothered Leilee: perfume and the aroma of meat fried in oil. On three occasions in the month prior to interview, her daughter's perfume made Leilee nauseated, dizzy, ill, and so short of breath and tight in the chest that she feared she would die from asphyxia. She attributed all the symptoms to the pathophysiology of a 'wind attack.' Perfume fragrance triggered flashbacks of corpses she had once seen in an open burial pit following the takeover by the Khmer Rouge as well as the numerous corpses she later saw on the escape route to Thailand. In night- and daytime flashbacks that were not triggered by olfaction, she repeatedly saw a Pol Pot scene of two men being killed.

Leilee also nearly drowned at the age of eight, an event she relived in nightmares for many years.¹⁹ At 16 years of age, before the Khmer Rouge overtook the entire country, Leilee was living in a village that was often bombed by Americans. The bombs thunderously fell and created house-sized craters. The detonations destroyed trees and houses, shaking everything in the vicinity and saturating the air with a strong odor of sulfur.

¹⁷Neck vessel rupture is a common concern among Cambodians (see Hinton et al., 2001a).

¹⁸Khmer believe that limb paralysis (e.g. stroke) results from peripheral vessel blockage (see Hinton et al., 2001b, 2001c).

¹⁹As described elsewhere, a history of near drowning is common among female Khmer refugees (Hinton et al., 2000).

After the Khmer Rouge invaded Cambodia in 1975, Leilee's father, like most soldiers, was executed by the Khmer Rouge along with the majority of Leilee's family. (Often the family members of former military officers were killed by the Khmer Rouge.) Just after the Khmer Rouge takeover of the country in 1975, Leilee recalls walking along a field in the countryside, she had a 1-month-old child at that time and thus felt quite vulnerable. (In the post-partum state, emotional or physical stresses should be avoided lest permanent bodily disorder result; see Hinton et al., 2001b, 2001c.) She squatted down to rest, then noticed the mounds of freshly dug graves all around her. Frightened, she pressed on. Soon Leilee came to a ditch about 10 feet wide and 3 feet deep, filled with bloated bodies and swarming flies. The eyes and jaws of the dead protruded in a ghastly manner. The stench was overwhelming and for days the smell seemed to remain with her. Whenever she closed her eyes, Leilee saw these corpses again with vivid clarity.

About 6 months later, Leilee was walking along a road on her way to work in a rice field. Through banana, coconut, and papaya trees, she spotted two men on their knees, arms bound behind their backs. She crouched down to avoid detection. From her hiding spot, Leilee watched as the men were clubbed in the back of the head. They then tumbled into the freshly dug square ditch. In the shallow grave, both men started to have a tonic-clonic seizure; still convulsing, the men were covered with a foot of dirt.

Three months later, the Khmer Rouge discovered that Leilee's friend and co-worker in the rice fields was a former school teacher; one day, without warning, several Khmer Rouge entered the rice field where the two friends were working. They thrust a clear bag over the friend's head, shouting insults while suffocating her to death.²⁰ During the Vietnamese invasion in 1979, Leilee made her escape to Thailand. Along the way, she saw people left by the roadside. Some were moaning in pain, due to hunger or injury; others were begging for food. Many had already died, their corpses in various stages of decay and bloating. The almost palpable stench of the corpses seemed to cling to her body and every time she closed her eyes, Leilee saw the faces of the dead.

Leng—Once a week, the 65-year-old Leng had panic attacks triggered by car exhaust during which she recalled two cousins being shot during the Khmer Rouge period. In the throes of the flashback, she experienced about 5 minutes of dizziness, nausea, and palpitations. Like most other Khmer patients, when Leng felt ill or tired she was much more sensitive to odors.

Leng related that when the Khmer Rouge invaded her village, projectiles (mortar shells and grenades) exploded around her and bullets whistled by. Many houses, including her own, were consumed by raging fires. Several smells were present: the smoke of burning bamboo, the sulfur of bombs and bullets, and the odor of burning flesh. As Leng and her three cousins fled from the family home, they dodged between houses. One cousin was shot in the shoulder in the attempted escape; as he fell down, blood streamed forth from the wound. He was never seen again. Another cousin was hit in the thigh; he yelled out in pain, grasping his leg while blood gushed over his hand. Like the first cousin, he, too, was never seen again.

Meng—Upon arrival in the United States, Meng noticed that exposure to car fumes often triggered dizziness, palpitations, and other symptoms ('a wind attack' *caŋ kaət k^hyal*). These panic attacks lasted about 10 minutes. Initially, Meng did not understand the reason for the reactivity. Through clinical interviews we learned that after the Vietnamese invasion of Cambodia, Meng had tried to escape to Thailand but had been caught by the incoming Vietnamese soldiers. The soldiers forced her to squat down with her head positioned just below

²⁰This was a common manner of execution in the Khmer Rouge period. Of note, observing or enduring suffocation predisposes one to 'shortness of breath' focused panic (Hinton et al., 2000).

the foot-wide barrel of a mortar-shooting cannon. Then they fired the gun, which blasted sulfurous fumes and caused a severe ringing in Meng's ears. She fainted.

Five years after Meng and her husband arrived in the United States, Meng's husband started having an affair. A few months later the husband secretly confiscated all Meng's jewelry and gave it to his paramour. The night following this theft, Meng happened to run into her husband as he was exiting the Khmer community's Buddhist temple. It was dark outside, so the husband was holding a long-handled flashlight and, as usual, he was smoking a cigarette. Meng demanded the return of her jewels. He got very angry and swung the flashlight at her face. The metal end struck her jaw, spinning her in a clockwise direction. She fell to the ground and started to bleed, then quickly lost consciousness. Meng's friend later told her that blood 'flowed down the sidewalk for a block.' Following the assault, every day upon standing, Meng experienced palpitations and severe vertigo and the room seemed to spin in a counter-clockwise direction. (The first author has noted that Cambodians with a history of spousal abuse often experience counter-clockwise vertigo; we hypothesize this relates to the Cambodian marriage ceremony in which clockwise motions are highly emphasized, a tying-in of blessings. A counter-clockwise vertigo seemingly represents the unraveling of the marriage union.) The panic episodes lasted about half an hour. After being hit by her husband the smell of cigarettes caused Meng to have 10 minutes of palpitations, nausea, and dizziness.

In treatment we discussed the trauma associations and catastrophic cognitions related to odor. Meng also started to carry a sniffer and we created a visualization, one component of which was this perfumed fragrance. Upon encountering an offending odor, she utilized the sniffer and the visualization. Subsequently, car fumes no longer resulted in panic, and though the smell of cigarettes continued to cause a limited-symptom panic attack, the reaction was much milder. And she had no more episodes of orthostatically induced panic. In addition, whereas previously Meng took three medications (a selective serotonin reuptake blocker for anxiety and depression, benzodiazapine for anxiety, and gabapentin for sleep), she was able to discontinue using them all.

Discussion

Mechanisms Generating Olfactory Panic Among Khmer Refugees

Olfactory panic involves the complex interaction of various factors (see Table 3). We will discuss nine of the processes that seemingly generate a high rate of olfactory reactivity among Khmer refugees: (1) the direct physiological linking of odor to dizziness and nausea; (2) an Asian predisposition to conditioning to dizziness, nausea, and odors; (3) a trauma-mediated hyper-reactivity to odors; (4) trauma associations to odors; (5) catastrophic conditions regarding odors and odor reactivity; (6) metaphoric resonances to odors; (7) odor-related reduplicative-mediated symptom induction; (8) dysphoric associations to odor-induced sensations; and (9) an escalating interacting spiral of the processes indicated in 4–8 (in abbreviation, a TCMRDE panic attack, that is, a panic attack characterized by trauma associations, catastrophic cognitions, metaphoric resonances, reduplicative-mediated symptom induction, dysphoric associations to odor-induced sensations, and escalating arousal).

The Direct Physiological Linking of Odor to Nausea and Dizziness—A disliked odor tends to induce dizziness and nausea (and the associated emotion of disgust). This response is part of our basic biology (Rozin, Haidt, & McCauley, 2000). Likewise, dizziness will tend to induce nausea; these are physiologically paired sensations. Such paired responses have been attributed to a hard-wired poison rejection system (Rozin et al., 2000).

An Asian Predisposition to Conditioning to Dizziness, Nausea, and Odors—

Several studies demonstrate that Asian groups have a much greater propensity to motion sickness (two to three times greater on most measures) with far more nausea, gastric activity (by EGG), and dizziness in response to being surrounded by a spinning drum (Stern et al., 1996). Stern writes: ‘In our lab, 50% of healthy European- and African-American subjects and 80–90% of Asian and Asian-American subjects developed tachygastria and motion sickness while sitting inside a rotating optokinetic drum’ (Stern, Koch, & Muth, 2000, p. 304). (Of course, one cannot determine whether the so-called Asian predisposition to motion sickness has a genetic basis or results from cultural construction of the meaning of spinning, dizziness, and nausea.) In addition, studies of anticipatory nausea in patients receiving chemotherapy (e.g. in response to hospital smells) suggest that increased motion sickness represents not only an increased tendency to dizziness and nausea, but also, as a robust separate process, an actual heightened preparedness for conditioning to smell, dizziness, and nausea (Leventhal, Easterling, Nerenz, & Love, 1988; Morrow, 1991; Yardley, 1994). These findings would presumably have important implications in respect to the Asian experiencing of trauma, as in the following: (i) nausea and dizziness will tend to be experienced during the traumatic event, (ii) the event will most likely be strongly encoded in memory, and (iii) the memory will be readily recalled upon exposure to odor and/or dizziness and/or nausea.

Trauma-Caused Hyper-reactivity to Odors—Trauma may create (i) a predisposition to panic attacks and (ii) an easily triggered startle to sights, sounds, and smells (Bouton, Mineka, & Barlow, 2001). Some call this ‘amygdalar hypersensitivity,’ an easily triggered ‘alarm system.’ In regard to ‘odor startle,’ several authors conjecture that trauma engenders a propensity for odor sensitivities (Friedman, 1994), viz., a sort of hyper-reactivity to odor. Given the horrendous trauma suffered by Cambodians, such amygdalar hypersensitivity and a predisposition to ‘odor startle’ would be expected. One Khmer patient described her hypersensitivity toward loud noises and smells, both of which triggered palpitations, with the following Khmer idiom: ‘My heart is like a drop of water on a lotus leaf so that any little thing causes my heart to shake’ (*beh douy kñom douc t~~ak~~ ləə slək c^huuk r~~ay~~ away pah ñou haəy*).²¹

Trauma Associations to Specific Odors—A patient may react to certain cues linked to past traumas without actually having ideational recall of the traumatic events (Clark, 1999). In other words, a patient may have experienced a trauma (e.g. exposure to bombing), which in turn leads to a certain cue triggering a panic attack (e.g. the sulfur of car exhaust), yet the patient does not recall the event itself during exposure to the cue and the ensuing attack.²² For Khmer refugees, conditioning plays an extremely important role in the generation of olfactory panic

²¹In the Khmer language, palpitations are described as ‘heart shaking’ (*ñou beh douy*).

²²Why do certain patients have no flashbacks during odor-triggered panic attacks? This may result from a dissociation (either complete amnesia of the traumatic event or simply a lack of recollection) or from sensitization (that is, no trauma occurred to account for the particular smell sensitivity). In regard to sensitization, as discussed earlier, it may be that hyper-reactivity to certain smells may develop even in the absence of significant associated trauma (Friedman, 1994) due to the effects of adverse events previously endured.

Why does a particular Khmer patient have multiple olfactory triggers for panic attacks (e.g. car exhaust, cigarette smoke, and trash odors), but some scents trigger flashbacks whereas others do not? Such a differential response might result from several different causes: memory dissociation; stimulus generalization (for instance, perhaps the odor that served as the original conditioned stimulus elicits a flashback whereas other odors – sensitivity to which was acquired by stimulus generalization, Guglielmi et al., 1994 – do not evoke a flashback); or, too, a general sensitization to odor may occur as a result of earlier traumas, and hence, there are no traumas associated with certain smells to which the individual demonstrates sensitivity.

How does one classify those patients who have olfactory-triggered panic attacks in the absence of flashback? Should such cases be considered indicative of panic disorder or PTSD? In many cases, even when the individual does not have a flashback of a particular event during the panic attacks, traumatic events would seem clearly to have resulted in the person’s olfactory panic attacks. Still, some patients who initially seem to have had minimal exposure to traumas marked by odors later recover memories of this kind; for example, a sudden recollection of the overwhelming stench of a maggot-infested corpse, or the distinctive odor of fresh blood from decapitations and severed limbs caused by a bombing. Others have recently discussed the diagnostic dilemmas inherent in differentiating PTSD and panic disorder due to the issue of lost memory (Clark, 1999; Kellner & Yehuda, 1999).

attacks. For example, earlier, we demonstrated that car exhaust fumes and cigarette odors trigger flashbacks of battle scenes (see Results). Let us now examine six kinds of traumas strongly encoded by an odor.

Sulfurous Smoke of Bombs and Bullets—To patients, car exhaust smells just like the sulfur (*rumseew*) of exploding bombs and fired guns. Nearly every Cambodian refugee was exposed to bombing – often multiple times; many barely escaped alive. Gun battles and execution by shooting were also common. Before the Khmer Rouge period Americans dropped large bombs in parts of the country that were controlled by the Khmer Rouge (see the case of Leilee). As the Khmer Rouge took over the country in 1975, fierce gun battles ensued (see the case of Leng); and during the Pol Pot regime, execution by gunshot frequently occurred (see the case of Chan). At the time of the Vietnamese invasion, in 1979, the vast majority of Cambodians were forcibly moved to new areas by retreating Khmer Rouge. Many attempted to escape by crossing over to the Vietnamese-controlled areas or by traversing the Thai border. Cambodians had existed at near-starvation levels since the time of the Khmer Rouge takeover, and as vast numbers of people were forced to re-locate, food became even scarcer. Most fleeing Cambodians were caught, often more than once, in the crossfire between the Khmer Rouge and Vietnamese forces (see the cases of Ry and Sai). As patients who had been soldiers before the Khmer Rouge period explicated, being situated between fighting troops is much more traumatic than fighting on one or the other side: it is noisier, the smell of sulfur and smoke is much stronger, and there is a sense of passive helplessness. Often the person would be trapped in the zone between fighting troops for a day or more; if there were no place to take cover, one would have to run through the cross-fire to reach a safe zone. During the battle, all the senses were assaulted: one smelled the sulfurous smoke of exploding projectiles and the fumes of burning houses, vegetation, and animal and human flesh; one saw shrapnel wounds, the severing of limbs, evisceration, and spilled blood; and one heard the deafening clamor of mortal shells, grenades, machine guns, and rifles. The original exposure to bombing prompted a pairing of multiple odors (fresh blood, singed hair, burned flesh, burning vegetation, and the sulfur of bombs) with (i) a certain situation (the sight of decapitated bodies, intestines protruding from shrapnel-injured abdomens, and skulls with brain spilling out), (ii) specific somatic states (e.g. hunger, palpitations), and (iii) fears (being killed by bombs and shooting).

Cigarette Smoke—During the Khmer Rouge period, cigarette smoking was an extremely common habit. For one, it helped to keep away insects such as mosquitoes. The Khmer Rouge constantly smoked, having greater access to tobacco, especially pungent high-quality varieties. Hence, tobacco smoke – and the image of the cigarette itself – became a marker of starvation and trauma (Foa & Kozak, 1998). Furthermore, if a perpetrator smoked, then the victim often developed an aversion to cigarette smoke (see the case of Chan). Such linkages continue to occur; the first author has had several female patients who developed reactivity to cigarette smoke in the US after spousal abuse by husbands who smoked (see the case of Meng).

Burning Flesh—In Cambodia, the dead are cremated; the body is placed on wood and then ignited. Patients reveal that cremation produces a very strong odor of burning flesh and hair. Sometimes it is described as sulfurous, at other times it is compared to the odor of perfume or burning food. (Just before cremation, large amounts of perfume are applied to the deceased's body by the surviving relatives, causing some patients to associate perfume with cremation and the death.) The odor of burning flesh was encountered during bombings (see the case of Sai), and burning was also sometimes used as a means of execution and torture. More rarely, large numbers of those who had been executed were burned (see the case of Sokha), though usually the bodies were left to slowly putrefy.

Decaying Corpses—It is estimated that one and a half million Cambodians out of a population of eight million died during the 4-year Pol Pot period due to starvation, overwork, illness, malnutrition, or execution (Kiernan, 1996). Often these bodies were purposefully left unburied in shallow holes, a warning to those that might transgress the laws of the regime. Khmer Rouge frequently dumped the bodies of their victims into the water-filled rice fields to serve as ‘fertilizer,’ and many patients encountered such decomposing corpses while tilling the paddy. During the Pol Pot period, almost every Khmer came across dead bodies – usually on multiple occasions – often bloated and maggot-infested and exuding an overpowering stench. The antithesis to the adjustment to death that burial rites allow for the living (Hertz, 1907; Uwanyiligira, 1997): such was the effect of viewing the omnipresent corpses that slowly decomposed in a sickening and macabre image of progressive decay – and viewing the corpses conjured memories of relatives who had been killed and left to the same fate, not receiving proper burial. The corpses also embodied the probable soon-to-be state of the living.²³ Due to forced observation, Khmer became expert in describing the several stages of corpse decay.

Many corpses were encountered at the time of the Vietnamese invasion. Just before the invasion, growing paranoia among the Khmer Rouge led to widespread killing of persons thought to pose even a slight threat (Kiernan, 1996): someone remotely suspected of being a teacher, a former official or soldier, or anyone of Vietnamese ancestry – and in many areas, even young men, lest they later seek revenge against the Khmer Rouge. As the Khmer Rouge tried to ‘herd’ the populace, people were killed when attempting to escape to the Vietnamese-controlled areas (or to Thailand), and, at that time, many people died of starvation or as a result of being shot or bombed while caught in crossfire.²⁴

Torture-Associated Smells—Torture often involved exposure to strong odors. In many cases, patients who were being tortured were confined to small cells, and, like those held there before them, were forced to defecate and urinate within the confines of the prison cell.

House Burning—In Cambodia, many patients experienced deliberate or inadvertent burning of their homes or those of their neighbors. Even in America, because patients tend to live in poorer housing districts, it is not uncommon for them to have either experienced or observed residential fires.

Catastrophic Cognitions Regarding Odors and Odor Reactivity

Odors as Head Turners and Dizziness Inducers—When in a state of weakness, Cambodians consider the stimuli-scape to be dizziness inducing. Khmer react to smells as would an American to a sudden sound: they demonstrate ‘smell startle’ – and there is an orienting response, a turning of the head to find the source of an odor. But it is the forced turning of the head that is most disliked; it causes dizziness. If there are several bad odors, then multiple orienting responses – multiple rotations of the head – occur, and dizziness results. The disturbing effects of a bad odor are compounded by a continual ‘smell startle,’ that is, a forced turning of the head in search of the odor’s source.

²³Cambodians believe that if a person does not receive proper burial, that individual will return as a ghost to haunt the living. So, for instance, if you were to witness someone being killed, the spirit of the deceased might seek to harm you. Often sleep paralysis, literally, ‘the ghost pushes you down’ (*khmaoch saykat*), is interpreted as a ghost seeking to kill you. Hence, odor relates to survival guilt, the reminder of relatives (and friends and strangers) who failed to receive the rites of cremation and therefore wander in a ghost-like state of purgatory. The Khmer Rouge had the power to transform the living into tortured ghosts who seek to torture and kill the living. The Khmer Rouge practice of leaving bodies to decay in shallow holes had this effect.

²⁴For the Khmer refugee currently residing in the US, odors may recall, either consciously or unconsciously, these corpse experiences. So when, for instance, a Khmer refugee detects trash odors – and this is particularly true if the garbage is fly-infested – memories of corpses often are evoked; other odors such as perfume and fresh paint will have a similar effect (see the cases of Leilee and Sokha).

Idioms Configuring Odors as Poisonous—Khmer idioms configure odors as dangerous substances that provoke a physical reaction.²⁵ Various idioms enshrine the idea of a bad odor having the power to invade and poison the body, to provoke ‘inner wind’ (i.e. panic attacks), and to send the brain to spinning.²⁶ *C^huual* ‘penetrating odor’ means that the vapor enters the nasal cavities and invades the body and may well cause choking and other bodily symptoms (*Edition de l’Institut Bouddhique*, 1967). *C^hgiām c^huual* (*c^hgiām* ‘burning smell,’²⁷ *C^huual* ‘penetrating odor’) describes the pungent and disturbing smell of a burning body (e.g. the sulfurous-like smell of ignited hair). Upon exposure to some unpleasant smell, e.g. car exhaust, patients frequently speak of ‘odor poisoning’ (*thwā aoy pul*).²⁸ *Lap* means ‘to turn or spin, to be overwhelmed and anxious, or to be crazy’ (*Edition de l’Institut Bouddhique*, 1967); when a Cambodian claims to be anxious to the point of being *lap*, the meaning is frequently not only metaphorical: *lap* denotes the actual spinning of brain matter in the cranium. Cambodians often speak of a strongly pungent smell as causing them to be *lap*; the patient will aver that the odor was *c^hgiām lap* (*c^hgiām* ‘burning smell,’²⁹ *lap* ‘making-my-brain-spin’; this might be best translated as ‘making-my-brain-spin burning smell’).

‘Inner Wind’: Smell Sensitivity and ‘Wind Attacks’—Having somewhat increased inner wind (literally, ‘to be on the verge of a wind attack’ *caṅ kaat k^hyal*) predisposes one to reacting to an odor, and encountering an odor is thought to provoke a ‘wind attack’ (*kaat k^hyal*); that is, the panic symptoms triggered by the odor are interpreted as being produced by ‘inner wind’ (*k^hyal*). Cambodians explain most somatic anxiety symptoms by a pathomechanics of wind (see Hinton et al., 2001b, 2001c): dizziness indicates excessive wind in the head; sore joints, that wind does not travel normally in the limbs and may cause stroke; and nausea, that wind is hitting upward in the body and may ascend to cause dangerous havoc in the body. Any time that bodily symptoms are noticed upon encountering an odor, the symptoms will be considered evidence of an incipient ‘wind attack’ (*kaat k^hyal*) (see the cases of Chan and Sai), thereby giving rise to concerns about possible dire events resulting from a pathophysiology of inner wind.

Weak, Weak Heart, and Smell Sensitivity—Khmers believe that ‘bodily weakness’ (*k^hsaoy kamlay*), especially ‘heart weakness’ (*k^hsaoy ben dooy*), creates smell sensitivity (see Figure 2). Being ‘weak’ or having ‘heart weakness’ predisposes one to reacting to odors and, in turn, reacting to an odor ‘weakens’ the body.³⁰ The body is considered to have

²⁵In English, smell terms suggest less a physical reaction or a malevolent influence. In time, it is conceivable that the concept of *multiple chemical sensitivity* may slowly change the semantic field of certain words, particularly ‘mold’ and ‘chemical odor,’ so that it also includes the idea of a panicked bodily reaction.

²⁶The odors associated with bombing during the Vietnamese invasion, especially burning hair and flesh and clouds of smoke and sulfur, directly caused choking, shortness of breath, nausea, and dizziness. The burning odors, especially sulfur and burning hair, would be classified as any of three different smells: (i) ‘burning smell’ ‘spinning brain’ (*c^hgiām lap*) (or what might be translated as ‘making-my-brain-spin burning smell’); (ii) ‘poisoning’ (*thwā aoy pul*); and (iii) ‘penetrating odor’ (*c^huual*). Patients state that, upon burning, hair emits a horrible odor; this is called ‘burning smell’ (*c^hgiām*) ‘spinning brain’ (*lap*), meaning that the smell is so strong that it caused dizziness (*lajii laṅṅ*), nausea, headache, and other physical reactions. One may also say, the ‘burning smell’ ‘poisoned me’ (*pul*), to describe a similar state. Patients state that during exposure to fighting between the Khmer Rouge and Vietnamese, the smell of sulfur, burning hair, ignited houses and the like, was ‘burning smell’ ‘spinning brain.’ The stench was much stronger than just smelling a burning dog; one’s nose might start running, and he or she might be unable to breathe. Here in the US, upon exposure to car exhaust fumes that trigger a strong bodily reaction such as dizziness, headache, nausea, or shortness of breath, the patient will refer to this with idioms such as *c^hgiām lap* (‘making-my-brain-spin burning smell’).

²⁷In English, to describe a burning smell, one must use the word ‘smell’ preceded by a descriptor of the entity’s state, thereby suggesting the smell (e.g. ‘a burning smell’); in Khmer, there is a word that means ‘to smell burnt’ (*c^hgiām*), while a separate vocable means ‘burnt’ (*k^hiaoch*).

²⁸Cambodians commonly consider stimuli to have the power to poison the person, be this an olfactory stimulus or as a stimulus such as shaking or spinning in any modality (e.g. a shaking car or the sight of many persons milling about). Car sickness is described in the idiom of poisoning; a patient will say that a person’s bad driving, as in frequent sudden stops or driving excessively fast, ‘poisoned him’ (*pul*). Alternatively, the patient may state that the driving caused him to have a ‘wind attack.’

²⁹The horrible odor of the burning corpse or carcass is thought to provoke bodily disturbance; patients consider the odor to be an invasive influence, a sort of bad wind – it causes a ‘wind attack’ (*kaat k^hyal*) (i.e. multiple somatic symptoms, such as nausea, dizziness, tinnitus, and shortness of breath).

a certain reservoir of energy that once exhausted leads to death; a person having a 'weak heart' is thought to be at significant risk of dying as a result of heart failure during periods of palpitations. 'Heart weakness' is a key aspect of the Khmer traumatic ontology (Hinton et al., 2002); a sufferer of 'weak heart' displays cardiac over-reactivity in response to any stimulus, for example, to a loud noise or an odor (see the case of Sokha). When psychologically distressed, a Khmer may well make the self-diagnosis of 'weak heart' and consequently worriedly assesses sensitivity to smells. Smell sensitivity in turn confirms the self-diagnosis of 'weak heart' and generates fear of death due to heart arrest during odor exposure.

Syndrome-Generated Olfactory Fear—As delineated by the Syndrome-Generated Olfactory Fear Questionnaire, Cambodian illness syndromes – e.g. ideas about 'on the verge of a wind attack,' 'wind attacks,' 'weakness,' and 'weak heart' (i.e. the 'wind syndrome,' 'weakness syndrome,' and 'weak heart syndrome') – result in hypervigilance to olfactory stimuli for those who consider themselves to be suffering from those conditions. In American populations, such syndromes as the 'chronic fatigue syndrome,' 'multiple chemical sensitivity,' or the 'Gulf War syndrome,' likewise lead to olfactory hypervigilance. In the same way, one can speak of 'syndrome-generated orthostasis fears' (i.e. fears of dizziness upon standing) in the American syndrome of 'chronic fatigue' (Schondorf & Freeman, 1999), the Japanese syndrome of 'orthostatic dysregulation' (Nozawa, Imamura, Hisamatsu, & Murakami, 1996), and the Khmer syndrome of 'weak heart.' Illness syndromes produce anticipatory anxiety about reacting in a particular way to specific situations; bring about significant self-focused attention (in search of the predicted bodily symptoms) as well as anxiety upon being in the feared situation (e.g. encountering the odor or standing); and lead to catastrophic cognitions upon recognizing any bodily symptom indicative of the feared syndrome when in the feared situation.

Ethnophysiology-Mediated Anticipatory Anxiety—Fears of odor poisoning, inner wind, and weak heart generate *ethnophysiology-mediated anticipatory anxiety* (what could also be called *syndrome-mediated anticipatory anxiety*). Ethnophysiology-mediated anticipatory anxiety occurs in the following fashion. In a self-diagnosed state of vulnerability (e.g. 'weakness'), the patient will apprehensively survey for the presence of odors, worrying that an episode of odor reactivity may result in death from a 'wind attack' or 'cardiac arrest.' A state of anxious hyper-vigilance toward odors results.

Ethnophysiology-Mediated Symptom Amplification—This occurs when one encounters a stimulus (i.e. a sound, smell, a certain color of light, and so on) and expects that the stimulus will cause a particular bodily reaction (this might also be called *syndrome-generated symptom amplification*; in most cases to be discussed later, the word 'ethnophysiology' could be substituted for 'syndrome'). Consequently, upon encountering the stimulus, the following processes ensue: (i) an attentional focusing – a bodily seeking – for the presence of the ethnophysiologyally expected symptoms, so that even minor sensations will be noticed; and (ii) increased anxiety, which may be sufficient to generate the symptom (e.g. increased sympathetic outflow in the autonomic nervous system may produce cold hands, palpitations, and dizziness). For instance, the Khmer ethnophysiology indicates that encountering a noxious smell stimulus (especially when in a weakened state) may result in heart arrest and a 'wind attack'; upon encountering an odor, therefore the person will anxiously scan the body for evidence of palpitations and wind symptoms (e.g. dizziness), and anxiety

³⁰In English, we tend to use odor words to negatively evaluate performance in an activity requiring skill ('my tennis stinks') or to give a general assessment of things ('my life stinks') and sometimes a person's words and actions are referred to as a stinking thing ('That's bullshit'). Or one may say that a politician is rotten, or that one is in a rotten mood, though in this case an image is suggested that only implies a poor smell. When an image is invoked that necessarily suggests an odor, one may call this a 'visual smell evoker,' as in saying someone had a 'rosy performance.'

itself will tend to produce the symptoms. If any symptom is detected, anxiety and self-scanning increases even more. Panic may soon result.

Ethnophysiology-Mediated Symptom Induction versus Ethnophysiology-Mediated Symptom Amplification—One could also differentiate *ethnophysiology-mediated symptom induction* (i.e. no symptom was previously present but then the symptom is *induced* into being by processes unleashed by ethnophysiology-guided expectancy) and *ethnophysiology-mediated symptom amplification* (i.e. a symptom was already present but then the symptom becomes *amplified* by processes unleashed by ethnophysiology-guided expectancy) (see Figure 3). Ethnophysiology-mediated symptom induction results when a symptom was not detected previously, but then it is produced by: (i) ‘ethnophysiology-mediated attentional induction’ of the symptom,’ i.e. scrutinizing the body in search of the symptom results in the discovery of the symptom - some amorphous sensation, when focused upon in a mental frame of expectancy, becomes the sought-after symptom, the very fact of focusing upon it, seemingly augmenting it, like a camera focusing down upon one object; and (ii) ‘ethnophysiology-mediated arousal induction’ of the symptom,’ i.e. worried concern producing increased arousal that consequently generates the somatic-anxiety symptom. One may also refer to these processes as ‘attentional symptom induction’ (or more simply, ‘attentional induction’) and ‘arousal symptom induction’ (or more simply, ‘arousal induction’). Ethnophysiology-mediated symptom amplification results when the symptom is already present, but then it is worsened due to ‘ethnophysiology-mediated attentional amplification’ and/or ‘ethnophysiology-mediated arousal amplification.’ Or one may also refer to these processes as ‘attentional symptom amplification’ (or more simply, ‘attentional amplification’) and ‘arousal symptom amplification’ (or more simply, ‘arousal amplification’). Or to use more general terms that would apply to both the processes of induction and amplification, one might also use the terms ‘ethnophysiology-mediated attentional focusing’ and ‘ethnophysiology-mediated arousal augmentation.’ (The terms introduced in this section aim to specify the processes involved in what Hacking, 1999, refers to as ‘biolooping’ – the influence of an individual’s interpretation of bodily experience on the very state of the body.)

Metaphoric Resonances to Odors—In a given language, olfactory terms used to label unpleasant smells may serve simply as a classification of unpleasant smells. Or, in other cases, the olfactory terms may be used metaphorically to describe emotional state and person or situation evaluation.³¹ For Khmer speakers, bad odors metaphorically elicit ideas of rude speech, poor reputation, evil action, worthlessness, and a state of exasperation.

In Khmer, if a woman has not married by 40 years of age, she is said to be *pəuom* ‘spoiled, like old rice that gives forth a sour smell.’ To describe oneself as *krapul muk*, literally, ‘the face enveloped by a poisonous smell,’ indicates a state in which one is irritated by many problems, overworked, and exasperated: ‘if too many people talk to me, then it makes “my face to be enveloped by a poisonous smell” (*krapul muk*),’ or, ‘I have so many problems³² that I feel “my face to be enveloped by a poisonous smell” (*krapul muk*).’ To speak *k^hmah k^hmuə*’ (*nīyāy k^hmah k^hmuə*), literally, ‘to speak with a strongly stinking and musty smell,’ is ‘to speak rudely.’ To express strong dislike, one may say that the individual smells *k^hol*, meaning, smells like ‘fermented fish sauce that has gone bad and has rising bubbles’; this insult does not describe an actual scent but is a metaphor used to express how one feels about the person. Or, likewise, you may assert that the individual smells *k^haa* (‘like spoiled fermented fish or worm-infested dried or smoked fish’), again, not indicating an actual smell, but rather

³¹Speakers of English minimally employ olfactory words to convey negative appraisal. In English, many terms of approbation involve speaking of nausea, there often being implied a sense of smell (‘you make me puke’; ‘you disgust me’; ‘I am fed up’).

³²Often a reduplicative is used to describe ‘too many problems’ (*smok smaən*), thereby further creating a sense of dizziness. (See, the section, Reduplicative-Mediated Somatization)

serving as an idiom that articulates dislike. *To have a stinking name* (*səɔy c^hmuəh*) means ‘to have a bad reputation’; or one may say that *the lineage stinks* (*səɔy kee c^hmuəh*) to convey the same approbation. Several idioms employ the term *lap* (‘making my brain spin’), as in the following: ‘His reputation stinks to the point of “making my brain spin” (*lap*); even if you took perfume and sprayed it, his reputation still would not become fragrant’ (*kee c^hmuəh səɔy lap tuəh bəy youk tək ap bañ m um krəɔop dae*). If someone in the family commits a bad action, that person ‘makes the family’s reputation stink’ (*t^hwə ə aoy səɔy c^hmuəh*). *To make stink* (*samoy*) means ‘to insult someone’; *Don’t make me stink* (*kom samoy khñom*) would be translated as ‘Don’t insult me.’ If someone is going about spreading false rumors damaging the reputation of the family, ‘he walks about making my lineage stink’ (*kee daə samoy c^hmuəh kruəsaa khñom*). ‘To make *cəh cəap*’ (*t^hwə ə cəh cəap*; ‘to make smell like a urine [and blood] and fish’) is ‘to ruin someone’s reputation.’ If a daughter in the family becomes pregnant but has no husband, the family “‘stinks like urine [and blood] and fish’” (*cəh cəap*) all over the neighborhood,’ or, ‘the lineage stinks like a *croəm* “the reeking puddle area under the traditional house”’ (*səɔy niəm trəkoul* like a *croəm*). One may call a person a *kumruəy* (‘a corpse/carcass that stinks to the point of making one almost vomit’), meaning ‘an extremely evil person,’ as in someone who acts counter to the good of the country or laws, a traitor to the country.³³ If a parent is extremely angry because he feels the actions of one of his children has dishonored the lineage, the parent may complain, ‘my son stinks so badly that there is no comparison, stinks even more than a “a corpse/carcass that stinks to the point of making one almost vomit” (*kumruəy*)’). An ‘*asaoch* reputation’ (*asaoch kei c^hmuəh*) is ‘a reputation that stinks like a carcass/corpse that spreads a stench in all directions’; or one may insult someone as being evil by calling them *asaoch*. If a child acts out, gets expelled from school, or is imprisoned, the family is said to be *asaoch*, that is, ‘stinks like the strong and spreading odor of a corpse’ (*t^hwə ə aoy asaoch kei*). Someone who is *samoy kəkruk* (‘stinking thing,’ ‘horrible stench of a corpse with roiling maggots’) ‘has no honor and a ruined reputation like a stinking thing that has maggots roiling in it’ (*Edition de l’Institut Bouddhique*, 1967). Or if adolescent children run away from home, the family ‘stinks *kəkruk* (‘stinks the stench of a corpse that has roiling maggots’; *c^hmuəh kruəsaa miən səɔy kəkruk*). If a patient perceives her family to be in a state of poverty and dishonor, she may describe herself as ‘stinking like a corpse with maggots roiling in it’ (*səɔy kəkruk*).

As can be seen, for a Khmer, a bad odor may activate multiple metaphoric resonances; a foul odor conjures self-worth, financial, existential, and interpersonal issues. Upon being exposed to a disagreeable odor, the related metaphoric meaning networks are activated, bringing to mind present life circumstances that have been encoded in memory – cognized – as being a kind of stench. In addition, as soon as the odor activates a sensation (e.g. nausea, shortness of breath, or dizziness), each of these sensations may activate metaphoric resonances.³⁴ The metaphoric resonances to those sensations (and trauma associations and catastrophic

³³Of note, the Khmer Rouge would kill the person who was rhetorically and metaphorically referred to as a *kumruəy*, that is, a traitor to the country, thereby converting the individual into an actual *kamruəy*, seemingly delivering an appropriate punishment. In Khmer, ‘a worthless thing’ is a ‘stinking thing,’ and during the Khmer Rouge time, suspected traitors were made to stink by various means, such as making them clean latrines and use the contents for fertilizer.

³⁴That is, bad odors are particularly likely to evoke certain symptoms such as dizziness and nausea due to direct biological linking (i.e. the natural tendency of a bad odor to induce nausea and dizziness). In every cultural group, and for every individual, nausea and dizziness will be linked to certain metaphoric expressions. Interpersonal distress may tend to be somatized as dizziness and/or nausea (Kirmayer, 1984). As an example, the Cambodian language has a very rich vocabulary expressing dysphoria as dizziness and/or nausea (Hinton & Hinton, 2002). To express being disgusted with some situation, the person may say, ‘my heart is full’ (*cəet cət*); the word for extreme hate also means to feel nauseated (*k^hpəəm*). Anxiety itself is configured in an idiom of dizziness. Worry is described as ‘thinking here, thinking there’ (*kət nih kət nuh*), a kind of spinning of mind. If the individual is experiencing extensive interpersonal and personal distress, then by a process of metaphor-guided somatization, this will lead to a feeling of nausea and dizziness, increasing the likelihood of an odor reaction. And the odor, inducing a state of nausea and dizziness, will tend to evoke all the present life circumstances and conflicts that are bodily encoded by just such somatic states.

cognitions connected to the odor and those sensations), may contribute to the production of panic.

Reduplicative-Mediated Symptom Induction—When a smell stimulus is encountered (e.g. trash smells, car exhaust fumes), it is labeled and thereby encoded into language. The scent becomes a linguistic entity that occupies a certain position in phonetic and semantic space; it acquires a specific ‘cultural representation’ (Howes, 1986). In Khmer, certain idioms used to describe smells tend to induce sensations, particularly dizziness (and nausea). Many of the Cambodian idioms for describing smells are reduplicatives – a word of repeating subunits that display consonance, as in the English forms, ‘ding dong,’ ‘tick tock,’ and ‘splish splash’ – that involve extensive iconicity. We refer to this form of extero-stimuli–somatic linking – which is distinct from metaphor-mediated somatization³⁵ – as reduplicative-mediated somatization (or reduplicative-mediated extero-stimuli–somatic linking). Reduplicative-mediated somatization (along with metaphor-mediated somatization) is a form of idiom-mediated somatization.

One type of iconicity consists of sound similarity. This is best referred to as *aural iconicity*; aural icons generate ‘sound symbolism.’ A common example is onomatopoeia in which a name aurally resembles what it refers to (e.g. a bird’s name resembling its call); or the iconicity may be more abstract: the repetition of sound representing an iterated action, as in the reduplicatives, ‘tick tock’ or ‘ping pong’ (see Hinton, Nichols, & Ohala, 1994; Nuckolls, 1999). Iconicity may also exist in terms of the tongue (and jaw) kinesthetics performed during the articulation of the word (Diffloth, 1994; Sapir, 1949). This might be called *articulatory iconicity*; articulatory icons create ‘articulatory symbolism.’ One should distinguish the extero-stimuli–somatic linking that is only encoded in an abstract semantic sense (i.e. due to the referential meaning of the terms; Sapir, 1949) from that generated by articulatory and aural symbolism (Sapir, 1949). A word in which the semantic meaning is mirrored in articulatory and aural symbolism is felt to be especially affectively vivid (Sapir, 1949; Whorf, 1956); for the word causes the person to embody – and thereby induces – the indicated state: the movements of the tongue, lips, and jaw that occur upon saying the morpheme are iconic to the implied meaning. Following Landsberg (1981), we will use the term *iconeme* to indicate a word that displays either articulatory or aural iconicity.

In many Southeast Asian languages (e.g. Mon-Khmer languages), articulatory and sound symbolism are highly elaborated (Jacob, 1993); such is the case with the Cambodian language, particularly for reduplicatives (Gorgoniev, 1976; Jacob, 1993; Vuori, 2000). Through articulatory and sound iconicity, reduplicatives configure – and embody – stimuli as ‘dizzying.’³⁶ Khmer reduplicatives connote a dysphoric mood and/or negative state of the world (Ourn & Haiman, 2000); they suggest chaos, a confusing multitudinous simultaneity, and dizziness (see Diffloth, 1979, 2001). Reduplicates shape how the sensory-scape is experienced (Whorf, 1956), and affect profoundly the way of ‘attending to the world.’ Cambodian reduplicatives that describe exterior stimuli act as a transducer that converts exterior stimuli into bodily distress; they cause the experience of complex sensory-scapes – especially when the individual is in a self-perceived state of weakness and sensitivity – to induce, by articulatory and sound iconicity, a sense of chaos, rotation, and incipient dizziness.

Many Khmer olfactory reduplicatives that describe odors end in an aspirated vowel. Olfactory reduplicatives with word-final vowel aspiration lie on a spectrum of increasing severity: *m^hih*

³⁵As we will see later, if these word forms are metaphorical, they are so only in the most abstract sense. The underlying conceptual metaphor may be ‘repetitive stimuli are spin inducers.’

³⁶Reduplicatives are extremely common. For instance, a Cambodian social worker told a patient: ‘if you do not take your psychiatric medication, when there occurs “a problem that makes you spin” (here, a partial reduplicative is used: *wii wuat*), then I am afraid you will be “spinning and mixed up” (here, a reduplicative is used: *crəbook crəbal*).’

m^hih; *k^hmih k^hmih*; *k^hmah k^hmah*; and *k^hm^hh k^hm^hh*. The reduplicative *m^hih m^hih* indicates a slightly bad odor; *km^hih km^hih*, a sour,³⁷ more unpleasant odor, as in rice that is starting to go bad; *k^hmah k^hmah*, a stinkier odor, such as food that has gone completely bad and cannot be eaten, or the stench of fermented fish sauce that has not been properly prepared (e.g. due to adding insufficient salt); and *k^hm^hh k^hm^hh*, an odor a little worse than *k^hmah k^hmah*. Two other reduplicatives, *p^hoh p^hoh* and *p^hdoh p^hdoh*, specifically apply to a moldy odor, old rice being the most common example. To describe an offensive smell emitted by an individual, Cambodians often utilize one of the olfactory reduplicatives mentioned above. All of the olfactory reduplicatives mentioned can only be used after the word ‘stinks’ or ‘smells.’ In articulating the Khmer reduplicative words that describe bad odors (e.g. *km^hih km^hih*), the jaw makes a repeated back-and-forth movement, a swinging motion that is an embodied vertigo; and the prominent terminal aspirations in these olfactory reduplicatives create a sense of an active force,³⁸ a winded entity, the ejection of scent; through repetition and vigorous terminal aspiration (recall that Khmer have an ethnophysiology of wind, wind being the key pathological substance, that generates dizziness), these olfactory reduplicatives create a sense of dizziness.

Khmer have many reduplicatives to describe the turning from one direction to another, the orienting response to one and then another smell. The presence of more than one odor is considered particularly disturbing; it requires an orienting to one then another scent that then brings about dizziness. Let us examine the narrative of a woman who had olfactory panic attacks to see how she uses reduplicatives to describe her dysphoric olfactory experiences. As will be seen, these olfactory descriptors help to induce, by articulatory iconicity, a state of vertigo (and nausea) that leads to panic; that is, the idioms contribute to olfactory experience inducing vertigo.

The woman described an episode of olfactory-triggered ‘agoraphobia’ in the following fashion. Upon entering a mall she encountered many smells that ‘*crabook crabal* together’; she detected several irritating odors mingled together – people, shoes, and new clothes. Through aural and lingual kinesthetic means, *crabook crabal*, a reduplicative, indicates chaotic mixing, a feeling of repetition but also shift. The first syllable (*cra*) is completely repeated, while, the second syllable (*book*) is partly so: an iteration of the ‘b’ as well as the consonant-vowel-consonant structure (*book* to *bal*). Upon repetition of the second syllable, there is a vowel shift – *oo* to *a* (i.e. *book* to *bal*), with *oo* being lower and longer than *a* – and there is a terminal consonant shift – *k* to *l* (i.e. *book* to *bal*), with the *k* being a back consonant (i.e. velar) and *l*, a front consonant (i.e. alveolar). Next, she noticed an odor that was *m^hih m^hih*, another that was *k^hm^hh k^hm^hh*, and yet another *p^hoh p^hoh*. In an attempt to find the source of the odors, she turned the head ‘this way and that’ (*ae lwc ae kaet*), or literally, rotated her head ‘to the west and then to the east.’ In this reduplicative, indicating a 180-degree swivel of the head, only the first word (*ae*) is repeated. The patient smelled *pralook pralak* ‘a mixture’; the reduplicative *pralook pralak* creates a sense of incipient vertigo: the first syllable is entirely repeated while the iterated form of the second syllable varies but by vowel length and quality (*oo* to *a*; i.e. *pralook* to *pralak*). And she ‘smelled a “thing here, a thing there”’ (*an nih an nuh*). This reduplicative (*an nih an nuh*) is very commonly used; it is formed from the words for ‘thing’ (*an*), ‘here’ (*nih*), and ‘there’ (*nuh*). The words *nih* and *nuh* differ only in the vowel – one a high front vowel (*i*) and the other a high back vowel (*u*) – so that in saying one and then the other word, there is an alternation of a front and back vowel; consequently, a dramatic swinging back and forth of the tongue and jaw occurs upon saying *nih* and then *nuh*. The patient further asserted that she smelled clothes, shoes, and sweat, and to describe the sense of these three odors being in different locations, she used the idiom, ‘to detect a smell “up here and

³⁷It suggests a certain sourness due to the phonetic similarity to the word *k^hmeh*, meaning ‘vinegar.’

³⁸In the Khmer language, a word-final aspirated vowel has a general meaning – forceful outward directed action or an entity capable of that kind of action.

down there” (*an ceh an coh*). The reduplicative (*an ceh an coh*) indicates a sort of inclined turning of the head, from high left to low right or high right to low left, for the word *coh* means ‘to go down’; *e* is a mid-high high front vowel while *o* is a middle back vowel, so that the jaw actually moves down and back at a slant in saying one and then the other vowel (Headley, Chim, & Soeum, 1997). The patient stated that soon she felt dizzy (*nüt nää*); *nüt nää* is a reduplicative, with a shift from a front vowel to a mid vowel. The distress increased until the patient suffered a ‘wind attack’ (*kaət kʰyal*). She immediately sat down, feeling anxious and dizzy, her heart pounding, all the while fearing syncope and death. To treat her symptoms, she took a klonopin pill and applied fragrant wind oil to her limbs and just under the nose (on wind oil, see below).

In sum, certain Khmer idioms used to describe unpleasant odors – e.g. *mʰih mʰih*; *kʰmih kʰmih*; *kʰmah kʰmah*, *kʰm-ɛh kʰm-ɛh*, *crabook crabal*, *pralook pralak*, and *an ceh an coh* – may have the effect of inducing bodily symptoms (particularly, dizziness). These Khmer olfactory terms employ extensive articulatory iconicity; that is, they act as articulatory iconemes, thereby directly causing a sense of vertigo through the very act of articulation. Linguistic labeling of the smell stimulus activates *reduplicative-mediated symptom induction* (what might also be called *iconeme-mediated somatization*, one of the mechanisms of *idiom-mediated somatization*). One might say that there occurs linguistic-labeling symptom induction or linguistic-labeling symptom amplification (or, alternatively, reduplicative symptom induction or amplification).

Dysphoric Associations to Odor-Induced Sensations

As suggested above, in addition to trauma associations, catastrophic cognitions, and metaphoric resonances to a disliked odor, the sensations provoked by the odor (e.g. dizziness and nausea) – both directly and by triggering fear networks (e.g. trauma associations and catastrophic cognitions) – may trigger dysphoric associations (e.g. trauma associations, catastrophic cognitions, and metaphoric resonances). So, for instance, dizziness directly provoked by an odor may generate fears of excessive inner wind, an imminent ‘wind attack.’ Or some patients react to odors not because of a trauma association to the odor but rather due to trauma association to the sensations (e.g. nausea) provoked by the smell. Let us review a case example. After eating a certain poisonous insect, a Khmer patient vomited almost to the point of death; sadly, two of her children actually died from the poisoning. Here in the US, odors that brought about nausea, such as a gas smell, provoked vivid flashbacks of the event. She denied that the flashback or the original event was strongly marked by odors (though one cannot rule this out). So in this case, associations evoked by the odor-induced sensation (nausea) – rather than by the odor itself – resulted in the panic.

According to Clark’s classic model of how a panic episode occurs (Clark, 1986), the individual first notices a bodily change (e.g. palpitations). Subsequently, the individual worries that this bodily change indicates a dire event (e.g. a heart attack). Next, heightened anxiety leads to an increase of the somatic symptoms of autonomic arousal (e.g. palpitations). Then the worsening of certain somatic symptoms of anxiety (e.g. palpitations) makes the person even more worried about the possibility of acute demise (e.g. a heart attack). The rising anxiety further augments the somatic symptoms of autonomic arousal (e.g. palpitations). And so the cycle continues, in many cases leading to a panic attack. Our group has argued that among Khmer and Vietnamese refugees, a more complex model is needed. For one, trauma associations occur simultaneously with catastrophic cognitions (Hinton et al., 2001); in the case of Khmer, trauma associations and catastrophic cognitions interact to rapidly escalate arousal and panic, causing what might be called a ‘trauma-associations/catastrophic cognitions/escalating-arousal’ panic attack, or, using an abbreviation, a ‘TCE’ panic attack. Furthermore, metaphoric resonances to the odor evoke present financial and social circumstances, also contributing to the spiral of panic; and

reduplicative-mediated symptom induction will result in further symptoms, especially dizziness and nausea. Moreover, once autonomic arousal symptoms are induced (e.g. dizziness and palpitations), those symptoms activate trauma associations, catastrophic cognitions, and metaphoric associations. Hence, there may occur an escalating interacting spiral of trauma associations, catastrophic cognitions, metaphoric resonances, reduplicative-mediated symptom induction, and dysphoric associations to odor-induced sensations, or, to use an abbreviation, a ‘TCMRDE’ panic attack (see Figure 4).

Let us now apply the ‘TCMRDE’ model of panic generation to explore how olfactory-triggered panic may be generated. Among Khmer, an odor may activate a fear network relating to trauma memories (though the actual memory may not reach conscious awareness) while the very fact of olfactory sensitivity may evoke fear of having a ‘weak heart’ and excessive inner wind. Next, activation of trauma networks and catastrophic cognitions increases arousal. The sensation of a bad odor enveloping the face may invoke the feeling of being overwhelmed by life circumstances, as in the expression, ‘the face enveloped by a poisonous smell’ (*krapul muk*); or the odor may bring to mind the truant child who causes dishonor to the family, that is, who causes the family to have ‘a stinking name’ (*səoy c^hmuəh*). The patient may refer to the odor with reduplicatives – e.g. *k^hməh k^hməh* and *crəbook crəbal* – worsening the state of dizziness. And the odor itself may directly cause dizziness and nausea. As arousal increases, trauma networks, catastrophic cognitions, and metaphor associations to the sensations provoked by the odor are activated. For example, in addition to concerns about ‘weak heart’ and odor-related traumas, Leilee worried during olfactory-triggered panic attacks that shortness of breath would cause asphyxiation; and shortness of breath also evoked trauma memories: her near drowning, the witnessed killing by burial, and her friend’s death by asphyxiation with a plastic bag. Further, in Cambodian, idioms for shortness of breath express a sense of frustration (e.g. ‘short of breath in the heart’; *t^hap cət*); and Leilee had many child-related problems. Or, in Sai’s case, she experienced neck tension and worried about neck vessel rupture while at the same time neck tension activated a trauma memory: her cousin’s head severed at the neck. In the Cambodian context, there are multiple catastrophic cognitions, trauma associations, and metaphoric resonances to a sore neck (see Hinton et al., 2001a). Or if the odor causes a patient to experience dizziness, and if the patient has an ‘acting out’ son who ‘shakes’ (*krəlok*) the mind to ‘spinning’ (*lap*), somatic dizziness will recall the son’s acting out behaviors (i.e. the problems with the son are encoded as a sort of dizziness), increasing a sense of dysphoria and angst. As these examples demonstrate, the generation of a panic attack is a complex event; the TCMRDE model of panic attack generation attempts to reveal the symbolic, social, and psychological nexus that is such an event.

Therapeutic Approaches

The therapeutic approach to the patient with olfactory-triggered panic attack follows from the processes outlined in the TCMRDE model of panic attack generation (see Figure 4) and the multifactorial origins of smell reactivity predisposition (Table 3).

Trauma Associations—Exploring trauma associations to odors acts as a form of exposure that promotes successful emotional processing and modification of trauma networks (Foa & Kozak, 1986; Pennebaker, 1993; van der Kolk & van der Hart, 1991). The patient begins to transform the visual, auditory, kinesthetic, and affective aspects of the trauma-event schemas, previously experienced in a fragmentary manner, into linguistic structures that form part of a coherent narrative (Brewin, 2001). The act of verbalization changes the nature of representation, that is, transforms a ‘reliving experience’ into a verbal narrative, thereby decreasing the flashback intensity.³⁹

To help the patient successfully cope with the constant undesired recall of traumatic events triggered by olfaction, the patient may be taught to use mindfulness, that is, a multi-sensorial awareness of being-in-the-present-moment, as in attending to the particular color of the sky; the specific shape of a cloud in the sky; the speed by which a cloud drifts along; how the wind causes a leaf to dance in a certain manner; the feeling of wind on the skin; the proprioceptive sense of a particular bodily posture and movement; the inhalation and exhalation of breath in and out of the body at the mouth and nose, accompanied by a rise and fall of the chest; and ambient sounds. Mindfulness may be framed as a form of merit-making for the deceased. The person is reminded of the culturally sanctioned duty to make merit for the deceased; survival guilt and a sense of life purpose is thereby promoted.

The patient might be instructed in the utility of carrying a sniffer or 'wind oil' upon encountering an odor that triggers trauma memories. The visualization of a soothing scene and muscle relaxation are paired with the aromatic scent of the sniffer. Muscle relaxation and visualization promote recovery in trauma victims (Foa & Rothbaum, 1998).

As suggested above, patients may be afraid that flashbacks and reactivity to trauma reminders indicate incipient insanity or bodily demise (Falsetti & Resnick, 1997). These fears must be addressed (e.g. Barlow & Craske, 1994). The patient is taught that panic attack symptoms, as in dizziness and palpitations, may be elicited by reminders of past trauma; they do not indicate 'a weak heart' or other physical disorder. The patient should be queried about catastrophic cognitions regarding smell sensitivity (see earlier; e.g. weak heart or 'wind fears'). An alternative model of symptom production is offered: the western scientific model of the symptoms as being generated by the physiology of the autonomic nervous system (e.g. cold hands as due to non-dangerous vasoconstriction) should be explained.

Metaphoric resonances of the sensations induced by the odor should be discussed. For example, an odor may resonate with feelings of being in a state of 'the face being enveloped by a poisonous smell' (*krapul muk*) due to problems such as an acting-out child.

In the narrative of the patient, one should pay close attention to the reduplicatives used to describe the olfactory encounter. One can discuss with the patient how these reduplicative expressions cause the experiencing of complex sensorial landscapes to be dizziness inducing. The patient becomes aware of how idiomatic expressions shape the manner of being-in-the-world.

As discussed earlier, patients often have dysphoric associations to the symptoms induced by the odor (e.g. to dizziness or nausea or shortness of breath). These dysphoric associations (e.g. trauma associations, catastrophic cognitions, and metaphoric associations) need to be delineated.

In treating olfactory panic, the sufferer should be taught an active – rather than a passive – stance to the olfactory-scape. One chooses, to a significant extent, the odors one encounters and odor associations. The patient should be encouraged to create positive associations to the problematic odor. For example, the smell of gasoline could be used to conjure the pleasure of travel, past joyful car ventures, or visiting a particular loved landscape (Classen et al., 1994). In addition, the patient should try to surround herself or himself with pleasurable scents by placing flowers in the home or using perfumes; in this way, olfactory sensations become a

³⁹Patients often have a limited memory of the aspects of the trauma to which they have been conditioned (Brewin, 1989; Brewin, Dalgleish, & Joseph, 1996; Clark, 1999; Ledoux, 1996) and ask themselves, 'Why do certain odors cause a feeling of deep fear and agitation.' Even if a patient realizes the connection of the odor to a trauma experience, s/he wonders, 'Why does reactivity still continue? Why does the memory elicit such strong bodily reactions?' If a patient learns that the affective and physiological reactions to an odor result from trauma associations, alleviation usually results.

gateway to joy and positive memory rather than pain. The patient is encouraged to carry a sniffer and to associate this odor with relaxation and empowering imagery. The slow sipping of a fragrant jasmine tea can become a daily meditation. One guides the patient in creating a pleasurable olfactory cosmology, in remaking cosmology. A cosmology at the level of a society is simply a field of potential ways of being. Each person dwells in her or his own cosmology, an enacted and lived-in field of being. One moves through – and dwells in – certain sensoriscapes; smells of the sensoriscape acquire specific ‘dynamic interpretants’ (in the sense of Charles Peirce; see Hinton & Hinton, 2002). The sensoriscape forms an idio-cosmology, an idio-sensori-cosmology; the odors, acted upon by poesis (Kirmayer, 2002, in press), give rise to an idio-odor-cosmology. A ritual that involves odor only succeeds to the extent that the daily encountered odors now take on new dynamic interpretants that inspire and invigorate.

In summary, the following core techniques, based on the TCMRDE model of panic attack generation, can be applied in treating olfactory panic:

- identifying the trauma associations to the odor;
- teaching a protocol to be utilized at times of flashback (e.g. an attitude of mindfulness and loving kindness);
- addressing the catastrophic cognitions concerning odor reactivity;
- exploring the metaphoric associations to odor reactivity;
- attempting to create a positive re-association (i.e. new positive dynamic interpretants) to the offensive odor (e.g. to make the odor of gas evoke the memory of pleasant drives, Classen et al., 1994, or trash smells to evoke thoughts of a rich organic compost that may later give rise to fertile crops, Classen et al., 1994);
- teaching relaxation;
- suggesting the use of a sniffer and other essences to gain control of olfactory experience;
- maximizing the positive associations of the olfactory substance carried by the person – be this a sniffer or other fragrant substance – thereby creating positive associations and visualizations to accompanying the olfaction of the substance;
- promoting, more generally, positive olfactory experiences (e.g. the mindful drinking of fragrant jasmine tea); and,
- providing the patient with a medication to utilize at times of olfactory panic, as in a benzodiazapine or meclizine.

Conclusion

Olfactory-triggered panic attacks represent an important aspect of trauma-caused disorder in the Khmer refugee population. Future studies should investigate this phenomenon in other groups. Olfactory-triggered panic attacks need to be investigated in a systematic manner in trauma victims and those persons suffering PTSD and panic disorder. Surveys and ethnographic studies of smell sensitivity in trauma victims – and syndromes marked by olfactory sensitivity such as ‘chemical sensitivity’ – represent an important area of future research and clinical intervention.⁴⁰ By considering both multifactorial origins of initial odor

⁴⁰In addition, investigators of the functional somatic syndrome (Barsky & Borus, 1999) known as ‘multiple chemical sensitivity’ should assess whether patients’ reaction upon exposure to certain substances, odors in particular, meets DSM-IV criteria for a full or partial panic attack. They should also assess for the occurrence of flashbacks. Note that catastrophic cognitions play an important role in the generation of olfactory-panic attacks among sufferers of the ‘cultural syndrome’ of multiple chemical sensitivity.

reactivity and the escalating spiral of panic, a more adequate model of olfactory panic generation emerges. The present article suggests certain categories and processes for clinical and ethnographic use to develop a phenomenology of olfactory panic.

Biographies

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Figure 1.
The spectrum of wind severity.

Figure 2.
Weak heart and stimulus sensitivity: A vicious cycle of escalating concern.

Figure 3.
Subtypes of ethnophysiology-mediated somatization.

Figure 4.
The escalating spiral of panic in response to an odor; A TCMRDE panic attack.

TABLE 1

Frequency of olfactory panic subtypes in the previous month and rates of associated flashbacks

Type of odor	Patients with panic attacks triggered by this odor (N = 100)	Flashback frequency during panic attacks triggered by particular odors	
		Always	SometimesNever
Car exhaust	30	60% (18/30)	17% (5/30)23% (7/30)
Cigarette smoke	20	35% (7/20)	5% (1/20)60% (12/20)
Cooking odors	11	27% (3/11)	9% (1/11)64% (7/11)
Trash smells	10	30% (3/10)	10% (1/10)60% (6/10)
Other odors	11	18% (2/11)	9% (1/11)72% (8/11)

TABLE 2

Syndrome-generated olfactory fear questionnaire

	Percent reporting symptoms (N = 45)
'on the verge of a wind attack'	
Did you worry that you were 'on the verge of a wind attack,' predisposing you to reacting to an unpleasant odor?	80
Did you worry that you were 'on the verge of a wind attack,' predisposing you to having a 'wind attack' upon encountering an unpleasant odor?	73
Did you worry that you were 'on the verge of a wind attack,' predisposing you to being very ill or even dying if you encountered an unpleasant odor?	71
'wind attack'	
Did you worry that the symptoms you had upon encountering the odor, as in dizziness or shortness of breath, meant that you had a 'wind attack'?	91
Did you worry that the symptoms you had upon encountering the odor, as in dizziness or shortness of breath, meant that you had a 'wind attack' that must be treated by 'coining' or 'wind oil'?	87
Did you worry that the symptoms you had upon encountering the odor, as in dizziness or shortness of breath, meant that you might be having a fatal 'wind attack'?	87
'weak'	
Did you worry that you were 'weak,' predisposing you to reacting to an unpleasant odor?	91
Did you worry that you were 'weak,' predisposing you to having a 'wind attack' upon encountering an unpleasant odor?	87
Did you worry that you were 'weak,' predisposing you to being very ill or even dying if you encountered an unpleasant odor?	82
'weak heart'	
Did you worry that you had a 'weak heart,' predisposing you to reacting to an unpleasant odor?	87
Did you worry that you had a 'weak heart,' predisposing you to having a 'wind attack' upon encountering an unpleasant odor?	82
Did you worry that you had a 'weak heart,' predisposing you to being very ill or even having heart arrest upon encountering an unpleasant odor?	84

TABLE 3**The multifactorial predisposition to odor reactivity**

1	Psychological State
	<ul style="list-style-type: none"> a. Anticipatory Anxiety Cognitions <ul style="list-style-type: none"> i. <i>Weakness fears.</i> I feel tired. I didn't sleep well last night. I feel weak in the arms. When I heard an ambulance earlier today, my heart beat fast, so I bet I have a 'weak heart.' I am weak so I will react to odors. ii. <i>Internal wind fears.</i> I have sore arms. I feel a little dizzy (dizziness is a pathognomic sign of excessive inner wind). I have some excessive inner wind, and I will react to odors. iii. <i>Fears of the recurrence of panic attacks.</i> I had a bad panic attack last week. I am afraid that I will have another one. I am afraid that I will react to an odor, and that I will have to endure another panic attack. b. General Psychic Anxiety <ul style="list-style-type: none"> i. <i>Acute.</i> I don't have money to pay the rent tomorrow. ii. <i>Chronic.</i> I am worried about my relatives in Cambodia; they have no money. My 15-year-old refuses to go to school; I think he has joined a gang.
2	Bodily State
	<ul style="list-style-type: none"> a. Medical Conditions. Some examples would include the following: peptic ulcer disease, reflux, poor digestion, and/or excessive abdominal gas causing a slight sense of abdominal discomfort and nausea; and/or slight inner ear infection leading to a sense of imbalance. b. Somatic Anxiety. Somatic anxiety may lead to such symptoms as cold hands and feet, shortness of breath, dizziness, nausea, muscle tension, and soreness at the joints. Two main types of somatic anxiety can be discerned. <ul style="list-style-type: none"> i. <i>Acute.</i> A surge of somatic anxiety experienced due to some event or concern. ii. <i>Chronic.</i> A more long-standing somatic anxiety due to chronic concerns. c. Other Temporarily Induced Somatic Alterations <ul style="list-style-type: none"> i. Sleep Deprivation. ii. Overwork. iii. <i>Rotating the Head.</i> When I take care of my grandchildren, or walk along the street, my head frequently turns up and down and from side to side, leading to dizziness. iv. <i>Car Travel.</i> A slight sense of motion sickness leading to dizziness and nausea. v. Hunger or Overeating. vi. <i>Drugs.</i> Coffee or some other substance may induce lightheadedness, dizziness, and/or nausea. d. Trauma-Induced Startle to Olfactory Stimuli e. A Genetic Predisposition to Olfactory Reactivity
3	Reduplicative-Mediated Somatization
4	Metaphoric Resonances
5	Catastrophic Cognitions
6	Trauma Associations
7	Dysphoric-Associations to Odor-Induced Sensations