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The Case for Chimpanzee Religion

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Abstract

Do chimpanzees engage in religious behaviors? To date this question remains unanswered. I use methods from religious studies and anthropology of religion that demonstrate an answer in the affirmative. A comprehensive review of primatology reports reveals that chimpanzees do perform ritualized patterns of behavior in response to birth, death, consortship, and elemental natural phenomena. A structuralist analysis of these patterns shows that chimpanzees deploy similar formulaic action schemas involving recombination of syntagmatic and paradigmatic behaviors across all four of these life-situations. In the course of these performances, chimpanzees decontextualize and convert everyday communicative signals to express non-ordinary emotions of wonder and awe. The patterning of chimpanzee ritual behaviors evidences all the components of a prototypical trans-species definition of religion. These findings support hypotheses that propose religious behaviors for other species, including hominins prior to *Homo sapiens sapiens*.

Keywords

Religion, spirituality, evolution, animals, primates, chimpanzees, ritual, symbolic behavior, metaphor, structuralism, trans-species definition of religion

Introduction

In an article on primate spirituality in the *Encyclopedia of Religion and Nature*, Jane Goodall raises a question:

Often I am asked if the chimpanzees show any signs of religious behavior. I think perhaps their 'elemental' displays are precursors of religious ritual. [She then describes waterfall displays, water watching, and rain dance behaviors she has witnessed.]... Is it not possible that these performances are stimulated by feelings akin to wonder and awe? (Goodall 2005: 1304).

Anthropologists, ethologists, primatologists, religion scholars, and theologians have speculated whether chimpanzees have behaviors that might be categorized as 'religious' or 'spiritual'.¹ Anthropologist Barbara King (2008: 454) suggests religion is unique to our species and the chimpanzee capacity for empathy and compassion, non-linguistic meaning-making, and consciousness, as exemplified by Tai Forest chimpanzees in the Ivory Coast at the death of a group member, Tina, enabled the emergence of religion in our species. King gives no explanation of why it may have emerged in our species but not in theirs. Theologians debate whether great apes might have a god image. For example, Gregory Peterson (2008) proposes that given the complex social interactions and 'even some symbolic communication' for chimpanzees, the 'god image' may not be unique to humans, and he calls for more interdisciplinary dialogue, and J. Wentzel van Huyssteen (2008) seems to concur, claiming that there are both similarities and differences. Oliver Putz (2009) notes, however, that apes are capable of self-reflection, empathy, altruistic behavior, fairness in game playing, and moral agency and thus may share the 'god image' with humans. While admitting that chimpanzees 'might experience intense emotions in the presence of a natural phenomenon that many humans find awe-inspiring', Christopher L. Fisher (2005: 304-305) accuses Goodall of 'anthropomorphism' and 'emotive description' and asserts that chimpanzees cannot have spirituality 'because for us, there is no meaning without language', and chimpanzees only have 'intense emotions'.

Nancy R. Howell argues that primate studies suggest that chimpanzees and bonobos may have precursors for culture and spirituality, such as 'connectedness, interdependence, and sociality' and a level of 'symbolic capacity', which might serve as 'windows on transcendence' (2009: 602, 609) and challenge theological notions of human uniqueness, but Goodall's observations are 'far from sufficient to demonstrate religion or even spirituality in chimpanzees' (Howell 2003: 185). Ethologist Mark Bekoff considers Goodall's question but observes that 'currently, there are no detailed data to support or to refute intuitions about religious or spiritual experiences in animals' (2007a: 72).

1. In Harrod (2011) I advance a trans-species definition of religion, which characterizes the phenomena as reverence, careful observation, wonder, awe, and empathic intimacy.

While the preceding are interesting speculations, there appear to be no published studies that attempt to apply methods from the discipline of religious studies to review the primatology database for evidence that might actually answer Goodall's question whether or not chimpanzees have religious behaviors. A 2012 query of the *Academic Search Complete* for scholarly articles seeking to determine if chimpanzees have religious or spiritual behaviors yielded zero articles. Goodall has at least implicitly challenged the field of religious studies to demonstrate whether and if so to what degree certain observed chimpanzee behaviors that appear to be religious are similar to or different from human behaviors that appear to be religious. In the following analysis I take up her challenge.

To conduct such a study requires a clear, methodical definition of religion that might be applied to screen primatology reports for possible religious behaviors. In Harrod (2011) I conceptualize a non-anthropocentric, non-anthropomorphic, non-theistic, and non-logocentric transspecies prototype definition of religion. Here I begin with a comprehensive review and synthesis of primatology reports of chimpanzee behaviors that might be deemed religious. These reports show that chimpanzees engage in ritualized patterns of behavior in response to birth, death, consortship, and elemental natural phenomena. Second, I analyze the performance patterns for each ritual type. Third, a pattern analysis reveals an underlying combinatory matrix of syntagmatic and paradigmatic behaviors that inform performances across all four ritual types. Fourth, I show how chimpanzees decontextualize and convert everyday communicative behaviors by mimetic transferences to express complex emotional experiences of awe and wonder. Finally, I show how chimpanzee rituals evidence all components and thus meet the full requirements of a prototypical trans-species definition of religion.

Background

To set the stage for a hypothesis about chimpanzee religion, I briefly summarize research on the cognitive, affective, and semiotic capabilities of chimpanzees.² First, developmental studies of great ape (orangutan, gorilla, chimpanzee, bonobo) intelligence indicate that they achieve the stage of first-order symbolic behavior across cognitive domains, entertain symbolic and perceptual representations concurrently, and underpin their suite of abilities by a centralized generative process that operates using limited hierarchization with combinatorial mechanisms (Russon

2. For more detail see Supplementary File 1 at <http://www.originsnet.org/publications.html>.

2004: 92-93). This contradicts Fisher (2005), who seems to believe that chimpanzees lack any capacity for symbolic behavior.

Second, chimpanzees use a sophisticated array of communicative behaviors, including a repertoire of at least 32 distinctive vocalizations, as well as facial expressions, gestures, and postures to express both normative and novel categorical mental representations, which a receiver must interpret according to behavioral context (Goodall 1986: 114-45). The meaning of a particular display can be modified by varying its sequence of elements (syntax) (Slocombe and Zuberbühler 2005, 2006). Systematic analysis in the wild has found 66 distinct gesture types regularly used in series (Hobaiter and Byrne 2011a, 2011b). Chimpanzees can also innovate signals in display sequences and use symbol displacements onto iconic or token forms (Pika and Mitani 2006; Wrangham, in Cromie 1999). Callers can modify their own pant-hoots to signal their identity and status to others (Notman and Rendall 2005) and can imitate the pant-hoot of another individual (Boesch and Boesch-Achermann 2000: 234-35). In addition, chimpanzees can signal by combining pant-hoots and drumming on tree buttresses; they apparently modify drumming patterns in order to vary the signal's content, which is evidence for 'symbolic communication' (Boesch and Boesch-Achermann 2000: 235-37). Trained chimpanzees have acquired the ability to name objects, comprehend symbols as referents of objects, and exchange roles in tool use/tool request (Savage-Rumbaugh and Lewin 1994: 67, 81). Chimpanzee communicative signaling seems to activate their neural substrate that is analogous to Broca's area in humans, and this supports a hypothesis that neurological substrates underlying language production in the human brain were present in the common ancestor of humans and chimpanzees (Tagliabata et al. 2008).

Third, chimpanzees have a rich emotional life. Their call vocalizations express at least a dozen different emotions, including everyday emotions of social fear, body-contact enjoyment, food enjoyment, social excitement, puzzlement, and fear of strangeness (Goodall 1986: 127). I draw frequently on Goodall's decoding of these communicative behaviors. The behaviors I analyze as possible cases of religion all involve sequences of call vocalizations that appear modified to express non-everyday situations and non-everyday emotions.

Fourth, chimpanzees engage in play and miming at a level that developmental psychologists term symbolic play, including pretend play, pretense, and re-enacting actions (events, scripts) outside their usual context and without their usual objectives; symbolic object use; role play; and miming requests (Russon 2004: Table 6.2; Hirata et al.

2001; Savage-Rumbaugh and Lewin 1994: 276-78). They also engage in the chimpanzee analogue of anthropomorphism, playing with and grooming rocks and sticks as if they were chimpanzee infants (Wallauer 2002). In two captive groups, adolescent and adult chimpanzees frequently used the bipedal swagger component of aggression displays as an invitation to play (Goodall 1986: 144).

Fifth, while Fisher (2005) references Daniel J. Povinelli et al. (2000) and Michael Tomasello (2000) to argue that chimpanzees lack a theory of mind, current research, including that of authors cited by Fisher, indicates that chimpanzees have a capacity for a cognitive theory of mind somewhere between that of monkeys and humans, variously called first-order intentional states, behavioral abstractions, or partial theory of mind (Povinelli, Bering, and Giambrone 2000; Tomasello, Call, and Hare 2003; Call and Tomasello 2008; Herrmann et al. 2007; Bräuer, Call and Tomasello 2005). They can distinguish with respect to intentionality notions such as 'unable' vs. 'unwilling' (Call et al. 2004); they have limited analogical reasoning (Flemming et al. 2008; Russon 2004); they use deception and teach by imitation; and they also evidence a theory of mind (Boesch and Boesch-Achermann 2000: 242-52). Recent neuroimaging research differentiates the concept of theory of mind into cognitive, affective, moral, and agency theory of mind, each with its own distinctive neural networks. Brain imaging shows that chimpanzees—like humans—have a resting default network indicating they access emotionally laden, episodic memory and some level of mental self-projection into past, future, and another's individual perspective (Rilling et al. 2007).

Sixth, primatologists have arrived at a consensus that chimpanzees have cultural practices. With respect to common chimpanzees, Andrew Whiten et al. (1999) identifies 39 different behavior patterns, which, because they are customary or habitual in some communities but absent in others, can be called cultural (similarly Boesch and Tomasello 1998). Commenting on Whiten et al. (1999), Frans de Waal (1999) concurs that it is appropriate to apply to chimpanzees the broad life sciences definition of culture, that is, the passing on of unique suites of behavioral patterns that vary from one community to another by social learning, whether by imitation, teaching, or language. Whiten et al. (1999) confirm that the chimpanzee rain dance meets the strict criteria for a cultural form. Whiten and Erdal (2012) provide an up-to-date review of studies on the human socio-cognitive niche in relation to chimpanzees. In my analyses and interpretations of chimpanzee behaviors I keep within the bounds of these capacities.

Method

To detect chimpanzee behaviors that might be deemed religious, I propose a method with six interrelated procedures. The first is to proceed phenomenologically by bracketing questions about subjective vs. objective or overt vs. mental behavior as well as conjectures about whether religion functions in an ecologically adaptive way.

The second procedure calls for 'tuning in' to chimpanzee communicative behaviors, especially call vocalizations and the emotions they are communicating. All the types of chimpanzee ritual patterns discussed below involve special communicative behaviors, including calls and displays. Prior speculations appear to have overlooked these behaviors. To understand chimpanzee ritualizations it is necessary to take them into account, letting chimpanzee experience communicate and express itself, so that we as observers may enter the *terra incognita* of chimpanzee experience.

The third procedure identifies and analyzes ritual behaviors and their sequential and overall patterning along with evidence for combination, recombination, and permutation of actions and psychological aspects (emotions, feelings, moods, feeling-toned values, agency), as well as any patterning across categories of ritual practice. In this study I draw on a structuralist method from the field of anthropology of religion that involves identifying repetitive, combinatory, and permuted motifs of a ritual or other religious phenomena to discern their syntagmatic and paradigmatic features and detect any underlying algorithm that orders them (Lévi-Strauss 1967; Leach 1967; see recent theory and applications of the canonical formula or law of myth in Miranda 2001; Mosko and Damon 2005).

In a fourth procedure, I identify chimpanzee communicative behaviors that appear to be decontextualized from everyday situations and their meaning (abstract representations, affective intent, or expressed emotion) transferred to a non-everyday ritualization context. I suggest that such signals might be termed mimetic transferences, similar to what occurs in chimpanzee symbolic play, including pretend play, pretense, script re-enactments outside the usual context and without the usual objectives, role play, and miming requests. Throughout this study, to indicate my proposed meaning for a particular mimetic transference's intent or message, I use a clause beginning with the phrase 'as if' and seek to characterize the new semantic nuances on the basis of the new context. I leave open the question whether or not this kind of signaling might be considered evidence for a chimpanzee analogue of human sensorimotor

cognitive schemas that are evident prior to or independent of language (Johnson 2007, 1987), such as force-dynamic (Talmy 1988), similarity mapping or x is like y (Özçaliskan and Goldin-Meadow 2006), conceptual blending of mental spaces (Fauconnier and Turner 2002, 1994), or how each chimpanzee usage might evoke in human observers parallel existential metaphors of ‘absoluteness’, for example, as sensed by de Waal (1996: 56).

The fifth procedure asks, with respect to each identified ritualization pattern, if it expresses religious or spiritual behaviors. This requires identifying correspondences to a definition of religion, and for this I use the polythetic (multi-component), non-anthropocentric, non-anthropomorphic, non-theistic, and non-logocentric trans-species prototype definition of religion advanced previously (Harrod 2011), which is a building block for the present study. This trans-species definition has five dimensions:

- Reverence (showing devotion, intense love, deep respect), which may involve a hush;
- Careful observance, which may involve a calling-out announcement or remark;
- Experiencing or expressing emotion of dread (awe in its terror or astonishment aspect) before that which overwhelms the subject by its magnitude, grandeur, beneficence, or lethality; *mysterium tremendum*;
- Experiencing or expressing emotion of wonder (awe in its fascination, curiosity, or desire-to-know-more aspect) with respect to a phenomenon (especially a movement) which is surprising, non-ordinary, extraordinary, special, or ‘miraculous’; *mysterium fascinans*;
- Binding individuals together or back together in empathic intimacy or communion with respect to experiences of aliveness and animacy, including other living beings or things that appear to be alive, which may secondarily involve the witnessing of this by a collective social group.

This trans-species definition of religion does not overtly include beliefs as a component; thus it is subject neither to the objection of primatology that research must refrain from inferring the subjective mental states of primates nor the objection that equates beliefs with a form of language and infers that other species cannot have religion since they do not have language.

Table 1. Polythetic components of trans-species definition of religion vs. human definition.

Trans-Species Definition	Human Definition
Reverence	Piety, Worship
Careful Observation	Ceremonial Observance
Wonder	Holiness
Dread	Numinosity
Commune in Empathic Intimacy (with respect to animacy)	Intimate Communion Spirit (Breath of Life)
	The Sacred
	Sacrifice

As Table 1 indicates, the trans-species definition of religion contains analogues for the human experiences of the holy and the numinous, but not for two components prototypical of human religion, namely the sacred and sacrifice. A classic definition of human religion in Otto (1950) emphasizes the experience of the holy as the *mysterium tremendum et fascinans*, and these two paradoxical emotional responses are components of the trans-species definition of religion. Although Eliade (1959) drew on Otto's definition in defining the concept of the sacred, I argue (2011) that the concept of the sacred, with its sacred/profane dichotomy, is distinguishable from the concepts of the holy and the numinous and is only a component of human religion.

In the sixth procedure, ritualized behaviors are examined that might be analogues for categorical types of human religious ritual. I use a human folk taxonomy drawn from anthropological theory, which suggests the following possible categories of ritual:

- Birth rites
- Death rites
- Marriage (Alliance) rites
- Initiatory rites
- Sacrificial rites
- Culinary rites
- Healing rites
- Ecological (Reverence for Life/Nature) rites
- Hunting rites
- Foundation and creation rites

This serves as a heuristic checklist to identify hypothetical religious behaviors.

Results: Four Hypothetical Chimpanzee Religious Ritual Practices

A comprehensive review of primatology literature using the ritual typology checklist identified the following possible categories for chimpanzee religious behavior:³

- Death practices
- Birth practices
- Practices in response to elemental natural phenomena
- Consortship practices

Reports for each of these practices, an analysis of their ritual structure and semiotic strategies, and an evaluation of the degree to which they meet criteria of the trans-species definition of religion follow.

Death Practices

Across multiple populations, wild and captive, including those in Gombe and Mahale in Tanzania, Taï Forest of Ivory Coast, and the Burgers' Zoo, Arnhem, Netherlands, there are reports describing chimpanzee behavior in relation to the death of a group member; I examine eight of these responses:

(1) At the Arnhem Zoo, female chimpanzees wail, whimper, and sometimes burst out screaming after loss of an offspring. When one young adult female, Oortje, suddenly died, another adult female uttered a non-threatening scream; a female in the other hall made a similar sounding scream and 'then every chimpanzee in the building went completely silent' (de Waal 1996: 55-56).

(2) In another instance, an adult male, Luit, died in a fight. While his body remained in the cage that evening, the rest of the colony maintained 'absolute silence', even at feeding time the following morning. Vocal activity only resumed when the corpse was carried out of the building (de Waal 1996: 56; 1989: 66).

(3) At a New York University lab, when Pablo died and a researcher let in the other chimps alone or in pairs, they tugged at Pablo's arms, opened his eyes, groomed him, rubbed his swollen belly, and then wandered off hooting. The hoots turned into screams and chimps pounded the steel walls of the chimp house (Bekoff 2007b: 27).

(4) At a UK Safari Park, behaviors regarding the natural death of an elder included pre-death care (quiet, attentive, sleep-nest making, food bringing, touching, stroking, grooming); silence, viewing, sniffing,

3. For a full review of primatology literature, see Supplementary File 2 Literature Review Database and File 3 Literature Review – Full References, online at <http://www.originsnet.org/publications.html>.

tugging at arms, opening mouth (apparently to check for sign of life); male aggression displays before and after death, ranging from swagger, hair bristling, or running past the body, to repeated charging displays in which the male pounded fists on the torso of the corpse; post-death returning to the body, silent watching, touching, reassurance grooming, cleaning away straw; a male alarm call; and group post-death lethargy and eating less than normal (Anderson, Gillies, and Lock 2010).

(5) At the death of Gombe adult male Rix, caused by a fall from a tree, group members showed intense excitement, paused to stare at the corpse, made repeated sessions of *wraaaa* (great alarm as at lethal carnivore, fear of strangeness) and *waa-bark* (anger, rage, threat; defiant anger with sympathy for a victim, especially male attack on a female) calls. In addition, six males engaged in aggressive displays, running and brushing past the body (without hard contact) or full charging display (bristle, swagger, slap and stamp ground, tear and drag vegetation, throw large stones). Amidst all this, others engaged in reassurance actions—embracing, mounting, touching, and patting one another while grinning, whimpering, and making other expressions, while others copulated. After a lull the full cycle was repeated. This was followed by 12 chimpanzees gathering around the body, staring and gazing at the corpse in silence for a considerable time. One male made more *wraaaa* calls and later *whimpers*, and there were two more aggression displays. Others touched or sniffed Rix's remains. An adolescent female uninterruptedly gazed at the body for more than an hour, during which she sat motionless and in complete silence. After three hours of activity around the corpse, one of the older males finally left, walking downstream along the valley bottom. Others followed one by one, glancing over their shoulders toward Rix as they departed. One male approached the remains, leaned over for a final inspection, and then hurried after the others (Teleki 1973).

(6) At Mahale a death was announced by *wraaaa*-calls, signifying alarm at something exceedingly dangerous and strange. When the primatologists arrived on the scene,

...the entire group was up in the trees peering down... Several chimpanzees cautiously, almost reluctantly, approached for a look. A few individuals...spent several minutes each looking down at the body from the safety of the trees. The two young adults, Fanana and Linda, made day nests in the trees within three meters above the body. These two and later Cadmus, the five-year-old son of Calliope, softly vocalized *hoo, hoo* at the body. They were concerned and seemed almost mournful. Fanana would not stare directly at the body for long periods of time, but preferred to turn his back and [lie] there quietly, glancing back on occasion. Others were more fearful and tried to steal a glance from a distance (Huffman personal communication (cited in Engel 2002: 200)).

(7) In the Ivory Coast Tai Forest, Tina, a ten-year-old female chimpanzee that had lost her mother some four months earlier and was now associating with Brutus, died after being ambushed by a leopard. Four males and several females gathered quickly around the corpse, making loud calls. After a brief period, twelve adults sat in silence around the body. Some males made aggression displays and dragged Tina's body around for short distances, but Brutus pulled it back where it had been before. The males and the alpha female, Ondine, guarded the body, and they permitted higher-ranking females to approach and smell the body, while chasing off youngsters and lower-ranking females (with the exception of Tarzan, Tina's younger brother). Forty-five minutes after Tina died, Macho, the alpha male, lay down, and began grooming Tina; Brutus did the same from the other side. During a period of one hour and 20 minutes, Macho, Brutus, and a third male, Ulysse, groomed Tina's body for 55 minutes. Neither Macho nor Ulysse were ever seen to groom Tina alive, and other males seldom did so for even a few seconds. The beta-female, Salomé, sniffed the wounds and genitals and then lesser-ranking females were allowed to approach and smell the wounds. Brutus gently tapped Tina's chin while looking at her face, and later Macho and Ulysse 'softly shook one of her hands and legs, looking at her face. It looked as if they were testing for some kind of reaction' (Boesch and Boesch-Achermann 2000: 248-50). Occasionally, individuals grooming the body would play, make play faces, and laugh, possibly to release tension. Many left to feed and came back later, as did all females. Chimpanzees were constantly with the body for over six hours.

(8) In another Tai Forest case, when two-year-old Bambou died from a fall, his mother, Bijou, carried him against her chest making loud alarm calls for ten minutes. Arriving males displayed and then smelled the motionless body. The alpha male Kendo guarded the mother for almost three hours. The report describes Bijou's poignant reluctance to leave the body and rejoin the group, at which point five females came back to Bambou. Two of them, Mystère and Sirène, Ondine's infant and preferred playmate of Bambou, climbed a small tree above the body, looking down at it. Ondine, Mystère, Goma, and especially Sirène made a few soft *hoo* calls. Then, they all left silently. Leaving Bambou behind, Bijou started to catch up with the group. Brutus, Macho, Kendo, Fitz, and Ali were silently waiting for her. Then Bijou alone came back to Bambou and carried him over 20 meters. She hesitated in this way for another 80 minutes until leaving him definitively behind.

Reactions to dead individuals were 'strikingly similar' in three other cases in which 'the adult dominant group members seemed to require respect towards the dead'. Further, 'chimpanzees differentiate between

injured and dead individuals; the injured need to be tended, but dead ones do not' and they have a 'notion of death' that involves 'compassion and empathy' (Boesch and Boesch-Achermann 2000: 250). The notion of death is evident in the behavior of quietly tugging at the body, opening the eyes and otherwise attempting to elicit a reaction, and also in the whimper and *hoo* calls of distress with a mourning-like mood. Also, in contrast to how chimpanzees respond to injured individuals, none of the wounds of the dead individuals were ever licked, nor was dirt removed by any group member (Boesch and Boesch-Achermann 2000: 250). On the other hand, at Bossou, Guinea, there are at least three reports of mothers carrying their dead, mummified infants for weeks and grooming the corpses (Biro et al. 2010).

One way of looking at these reports would be to reject out of hand any non-objective speculation about the inner experience of chimpanzees, as if it were a deviation from the current consensus in the field of anthropology. Such a position is situated in the historic emergence of science, including the view of the philosopher Descartes that 'brute animals' have no consciousness and are mindless and soulless body machines, mere *automata* (Eaton 1955: 351-60). Current primatology has already gone beyond such a presumed consensus. De Waal argued in agreement with Robert Yerkes (Yerkes and Yerkes 1929: 297), Christophe Boesch (1992: 149), and Maurice Temerlin (1975: 165) that chimpanzees express sympathy, empathy, tenderness, consoling, and sensitivity to the distress of others (de Waal 1996: 53-62). Similarly, with respect to the Mahale death incident, Huffman describes three chimpanzees as 'almost mournful' (Engel 2002: 200). With respect to behaviors at the death of Pablo, cognitive ethologist Bekoff applies the terms 'grief' and 'sorrow' (2007b: 27). Boesch and Boesch-Achermann (2000: 250) speak of 'respect for the dead', 'compassion and empathy', and the ability to differentiate between injured and dead individuals and thus a 'notion of death'. I propose to go beyond the old objective/subjective binary by identifying the intricate, ritualized behavior patterns and their accompanying communicative signals that appear in primatology reports.

In the eight reports described above, chimpanzee death practices appear to enact a recombinatory and permutable set of formulaic behaviors (syntagms) and do so in pairs of opposite behavioral or emotional valence. These are listed below. The initials AO, AL, NY, UK, G, M, TaiT, and TaiB identify which reports contain the syntagm. Interpretations of the intent or message of communicative signals are taken from Goodall (1986) and are placed in parentheses.

- Interruption of everyday vocalizations and activities.
- Vocal announcement: *wraaaa*-call (great alarm as at lethal carnivore) [UK, G, M, TaiB]; *waa-bark* (anger, rage, threat; defiant anger with sympathy for a victim in a conflict, especially male attack on a female) [G]; or 'loud call' [TaiT] that announces a death has occurred.
- 'Non-threatening' *scream* (social fear, anger, or distress at being a victim, ambivalently social excitement, food enjoyment) [AO, NY];
- Social group or individual silence, 'absolute silence', which may last for hours [AO, AL, UK, TaiT, TaiB, G, M].
- Solemn visiting, inspecting, looking, observing, gazing upon, sniffing, touching the corpse [UK, G, M, TaiT, TaiB, (implied) NY].
- Respect for the dead, such as high-ranking individuals guarding corpse, while not allowing approach or touch by lower-ranking individuals and most youngsters [TaiT, TaiB].
- Grooming the corpse [NY, UK, TaiT], as well as mother carrying and grooming mummified infant [Bossou].
- Lamentation, 'almost mourning' or 'wailing', vocalized by *whimper* and/or *hoo* (distress) calls [G, M, TaiB (and if 'hoot' = *hoo*, also NY)].
- Hair bristling (chill/frisson) and aggressive displays by males: swagger, shake branches (rope), slap ground, run by, throw stones, and charge at, but with no actual opponent [UK, G, TaiT, TaiB (if wall pounding is captive chimpanzee variant, also NY); possibly pound chest of corpse, although this may be an attempt to restart breathing, UK].
- Contact reassurance: touch, pat, embrace, mount, copulate [G] or groom [UK]; perhaps also make faces and laugh [TaiT].
- Tapping, shaking, tugging, opening eyes or mouth for reaction [NY, UK, TaiT], analogous to human to detect sign of life.
- Departure (farewell) behaviors, such as lingering for a final touch or look, coming back to look again, glancing back as one departs, or even laying quietly turned away from the corpse while occasionally glancing back [UK, G, M, TaiT, TaiB].
- Resumption of everyday vocalization and activities.

The above pattern involves twelve formulaic action motifs in pairs with opposed valence, and these can be sequenced in variant ways. For example, a frequent pairing is that of announcement call and silence, and they can be permuted: silence may follow announcement [AO, G, M, TaiT, TaiB] or precede announcement [UK]. The three reports of captive

chimpanzees show how captivity fragments the cultural integrity of death rituals. In the AL report the entire ritual is reduced to only one syntagm, silence. In the NY report silence is not mentioned at all and the ritual ends with an announcement-like scream call. The overall structural pattern suggests there is an underlying rule-based competence that generates each ritual performance in response to death.

In addition to this patterning, the behavioral ritualization at death appears to decontextualize everyday communicative behaviors in a way that converts their signals into novel, non-everyday messages. First, there is the impressive intentional act of silence; de Waal calls it 'absolute silence' (1996: 56). Close attending to the dead is conducted in silence. This silence may be held for many hours. In the case of Luit's death, this absolute silence was maintained even during feeding time the next morning. This is a highly unusual behavior; everyday chimpanzee gatherings are typically noisy affairs. Chimpanzees normally maintain silence only when patrolling in a foreign territory or hunting. In the death ritual, chimpanzees deploy this silence, paradoxically, as a communication. Others receive the message and join in. I would not interpret this as silence induced by shock, because, as I demonstrate below, it occurs in birth rituals, ritual responses to elemental natural phenomena, and the consortship ritual. I suggest that such a signal might be termed a mimetic transference. If so, the novel message in the context of the death ritual means: as if in a hunt or foreign land, beyond the border, or the other side.⁴

The chimpanzee *wraaa*-call at a death occurrence is a second case of call transference. In its everyday usage this call signals alarm at a potentially lethal creature like a carnivore or other intense fear and would be a signal for flight. The death rite decontextualizes and reframes it into an announcement call intended to encourage others to gather around. Primatologists sometimes say this innovative usage of *wraaa* is intended to express fear of strangeness (e.g., Goodall 1986: 127). The dictionary definitions of 'strange' are 'unexpected, unfamiliar, out of the ordinary, hard to explain, curious, weird, and wonderful'. I suggest that the death *wraaa* signals the very opposite of its everyday message of lethal danger, take flight; rather, it signals for all to gather around for the most predatory, lethal, and uncannily strange event of all, death.

A third communicative strategy seems evident in four of eight reports in which males engage in hair bristling and charging displays. In everyday settings, hair bristling (piloerection) is an autonomic behavior

4. Hereafter, to indicate my proposed meaning for a non-everyday transference of a call's intent or message, I use a clause beginning with the phrase 'as if'.

indicating arousal level and a 'mood communicator' to assert dominance or scare away a threatening individual and may escalate into aggressive charging displays. In contrast, a chimpanzee that is nervous or fearful of a superior usually has very sleek hair. Piloerection also occurs in other contexts: social excitement, courtship display, and signaling others to join in a baboon hunt (Goodall 1986: 122, 286, 315-16, 334). Goodall adds that hair bristling may occur on seeing or hearing something strange or frightening, but she gives no specific examples of 'strange or frightening' other than situations of death and elemental natural phenomena. Piloerection occurs in many mammals, indicating arousal of sympathetic flight/attack or vigilance/seek instinct systems. This arousal is ambiguous in that it can occur in situations of dread (flight/attack dangerous forces) and in situations of wonder (alert, attentive, seeking and exploring novel, strange forces), and its signal (bristling) can be interpreted either way depending on the context. I suggest that for chimpanzees this arousal is a surge of force rising up—like the hair itself—out of the individual's being—to meet or confront something. In other words, it is a surge felt both subjectively—as something bigger than the individual ego coming through oneself, so to speak—and objectively, as a bigger force being confronted. In addition, such bristling may be understood as a frisson before that which is overwhelming and transcendent, indicating the paradoxical feeling or mood of being unable to dominate or escape that which is felt as awe-dread and being unable to resist the attraction of that which evokes awe-wonder. The not-so-different human frisson is defined as intense excitement: an almost pleasurable sensation of fright with chill and shudder, goose bumps, and neck hair standing on end, and of an emotion different from visceral fear associated with nostalgia, awe, admiration, and sexual arousal. It occurs in response to forms of music and religious experiences of awe, the *mysterium tremendum et fascinans* (Harrod 2011; Otto 1950). In other words, chimpanzees have a rich emotional life, and they also have a subset of rich non-ordinary emotional responses to death and other extraordinary life-events.

In everyday situations the charging display aggressively asserts dominance, but in the context of the death ritual there is no target for this aggression, not even a non-directed target aimed at anyone who might be in the vicinity. Thus the ritualization appears to decontextualize the aggression display and deploy it in a non-everyday manner. It may be compared to another mimetic transference in which the normally aggressive bipedal swagger serves as an invitation to play (Goodall 1986: 144). The intent of the charging display at death is open to question. Is it to express the instinct to compete and dominate in order to reassure oneself and others that one is still dominant and in charge, and if the

threatening 'opponent' passes by, to give the reassuring illusion of dominance over the threat? Does it express dominance aggression against an invisible or absent opponent that is to be kept at bay? Perhaps even a personified opponent? While one might imagine such explanations for displays at death or a frightening thunder and lightning storm, I suggest that these hypotheses cannot explain (a) the absence of display in half of the reports; (b) components of the display in the consortship ritual or in response to natural phenomena, such as waterfalls, or (c) females also engaging in 'male' dominance aggression displays, e.g., in the rain dance and at waterfalls. Given these variations, an alternative explanation seems needed. It may be more accurate to interpret the displays as miming the everyday aggression display, in short, as if mock aggression. If so, the non-everyday communication would appear to express a reversed message, something such as: 'I and we can neither dominate nor escape this awe-inspiring phenomenon, yet be reassured and at peace before that which is indomitable'.

Contact behaviors occur in two of the eight reports above in which dominance displays occur and are labeled 'reassurance' actions. Goodall (1986: 358-66) describes 'contact behaviors', including touching, embracing, mounting, and kissing, as occurring in three everyday situations: (1) when frightened or startled by unusual sound, nearby fight, or an unusual sight; (2) when there is high excitement at food availability (a huge pile of bananas or meat from a hunt kill); and (3) when the dominant individual wants to reassure an individual demonstrating submissive behavior. Curiously, copulating and grooming also occur in the two reports, and in a third report displays occur but without contact reassurance behaviors; rather, chimpanzees make play faces and laugh. Contact behaviors also occur during the birthing ritual and python watching, but displays do not. I suggest that these anomalies point to a ritualization that reconfigures and combines everyday responses to fright, food excitement, and a submissive other into a singular response of awe—one that at least in one report provides direct evidence of mimetic play behavior.

Finally, the glancing-back gesture displayed in five of the eight reports might exemplify a fifth kind of non-ordinary signal. The gesture of moving-off-and-glancing-back is used in everyday mother-child or male-male friendship relations to signal inviting and checking that a desired partner is following (R. Wrangham, email to author, 6 March 2006). In these death-ritual reports, the moving-off-and-glancing-back gesture seems to be decontextualized, permuted, and recombined in various ways: sitting turned away and then glancing back, lingering for a final touch or look, coming back to look again, and glancing back as

one departs. The sequence of gestures seems to express deeply ambivalent emotions, as if an acknowledgment that the dead will not follow. It seems to be a fourth mimetic transference communicating something such as: 'I want the dead to follow; s/he cannot follow; this is the final farewell, the final disconnection and separation'.

Although I have considered only eight reports, my analytical procedures have identified a basic recombinatory and permutable set of formulaic behaviors deployed in pairs of opposite valence in chimpanzee death rituals. This includes communicative behaviors that reconfigure and convert everyday calls into novel mimetic transfereces expressing mental states and messages that sometimes appear to reverse the everyday message of these calls. The array of behaviors corresponds to all five components of a prototypical trans-species definition of religion. I summarize the correspondences in Table 2.

Table 2. Chimpanzee ritualized behaviors at death.

Behaviors (including mimetic transference calls and interpretation indicated by 'as if')	Components of Trans-Species Definition of Religion
Silence, hush: group or individual, which may last for hours; 'absolute silence', as if in a hunt, or foreign land, beyond the border, the other side.	Reverence, showing deep respect, devotion, intense love, with hush, silence.
Respect for dead: high-ranking individuals guard corpse, refuse approach of lower-rank individuals or youngsters.	
Grooming the corpse.	
<i>Wraaa</i> call (great alarm as at lethal carnivore; loud call); <i>waa-bark</i> (rage, anger, threat, defiant sympathy for victim in a conflict), as if signal for flight converted to opposite signal to gather around to witness a predatory, lethal, or uncannily strange event, that is, death.	Careful observance, with vocal announcement for all to gather together.
Solemn visiting, sniffing, inspecting, looking, observing, gazing upon the corpse.	
Tapping, shaking, tugging, opening eyes or mouth for reaction.	Wonder, awe as fascination, curiosity, desire to know more with respect to surprising, non-everyday phenomenon; <i>mysterium fascinans</i> .
<i>Scream</i> call (social excitement, food enjoyment), as if something to relish.	
Hair bristling (frisson) and charging display: swagger, shake branches, throw stones, charge, but no opponent, as if mock aggression, frisson of transcendence, inability to dominate or escape the indomitable, death.	Dread, awe as terror, astonishment before that which overwhelms by its magnitude, grandeur, beneficence, or lethality; <i>mysterium tremendum</i> .

<i>Scream</i> call (social fear or anger or distress at being a victim), as if undefended and vulnerable before death.	
Contact behaviors (response to fright, reassurance of other after submission behavior), as if reassurance.	
Lamentation, 'almost mourning', 'wailing', vocalized by <i>whimper</i> and/or <i>hoo</i> (distress) calls.	Communion in empathic intimacy with respect to aliveness, animacy, binding-back-together.
Departure behaviors: sitting turned away and glancing back; lingering for a final touch or look; coming back to look again; glancing back as departing again, as if final farewell, never again to follow, final disconnection, separation, death.	

Birth Practices

Although my review found only one report of chimpanzee response to childbirthing, which might be considered anecdotal, I include it since it also appears to display recombinatory formulaic patterning similar to death and nature practices. At the Yerkes Regional Primate Research Center, Atlanta, de Waal (1996: 19-20) observed that the entire chimpanzee colony gathered in silence around Mai, the mother-to-be. All the apes were silent, staring closely at Mai's behind, some of them carefully poking a finger at it and then smelling their finger. Mai stood half upright, with her legs slightly apart, holding one hand between her legs. Remarkably, an attentive older female mimicked Mai by cupping her hand between her own legs in exactly the same fashion. After about ten minutes Mai delivered her baby catching it in both her hands. The crowd stirred and Mai's best friend, an elder female named Atlanta, in reaction to the birth let out a scream, looked around, and embraced a couple of chimpanzees next to her, one of whom uttered a shrill bark. Mai then cleaned the baby and consumed the afterbirth. Atlanta spent the next several weeks closely attending Mai and her offspring.

A subjective interpretation of this event would be to say that the chimpanzees are 'happy' or, as de Waal (1996: 20) infers, show empathy and sympathy, and leave it at that. As in the case of death practices, I argue that such an interpretation does not take into account the full sequence of physical and communicative behaviors, some of which again appear to be paired in behavioral opposites.

- Social group silence, hush.
- Vocal announcement, *scream* call announcing the birth has occurred.
- Gathering around and staring closely.
- Poking and sniffing at the mother's body at the place of birthing.

- *Scream* call and *bark* call (social fear, anger, or distress at being a victim).
- Contact behavior, mutual embracing (everyday greeting behavior or response to fright, reassurance from dominant other after submission behavior).
- *Scream* call and *bark* call expressing social excitement and food enjoyment.
- Cleaning; placing of newborn on abdomen; eating afterbirth.
- Miming the receiving of the newborn by older female, as if midwifing.
- Assistance tending infant by older female; postnatal care or allomothering.

Similarly to chimpanzee death practices, behaviors at birth appear to be structured by a syntactic patterning of paradigmatic behaviors, including hushed silence and loud announcement, and they correspond to all five components of a trans-species definition of religion (Table 3). The *scream* and *bark* calls at birth also appear to communicate decontextualized mimetic transferences of emotional/feeling state messages. In their everyday contexts, these calls express social fear and anger and also social excitement and food enjoyment (Goodall 1986: 127). Their usage at birth seems incongruous and out of context unless taken as expressing ambivalent wonder and dread—the state of astonishment at an event that has the potential for either lethality to the mother or newborn, or the beneficence of safe delivery. The mimetic transference suggests that the arrival of the newborn is also felt as the excitement of finding food, an edible fruit, as if one relishes the newborn.

Table 3. Chimpanzee ritualized behaviors at birth.

Behaviors (including mimetic transference calls and interpretation indicated by 'as if')	Components of Trans-Species Definition of Religion
Silence, hush, as if in a hunt, or foreign land, beyond the border, the other side.	Reverence, showing deep respect, devotion, intense love, with hush, silence.
Clean newborn and place on mother, bond.	
<i>Scream</i> call announcing birth (social excitement; see additional emotions/feelings expressed by this call below).	Careful observance with vocal announcement for all to gather together.
Staring closely while gathering around.	

Poking, sniffing at the mother's body at the place of birthing.	Wonder, awe as fascination, curiosity, desire to know more with respect to a surprising, non-ordinary phenomenon; <i>mysterium fascinans</i> .
<i>Scream</i> call (social excitement, food enjoyment); <i>Bark</i> call (social excitement, food enjoyment), as if something to relish.	
<i>Scream</i> call (social fear, anger or distress at being a victim); <i>Bark</i> call (social fear or anger), as if undefended and vulnerable at birth.	Dread, awe as terror, astonishment before that which overwhelms by its magnitude, grandeur, beneficence or lethality; <i>mysterium tremendum</i> .
Contact behavior: mutual embracing (everyday greeting behavior or response to fright, reassurance of other after submission behavior), as if reassurance.	
Miming with cupped hands receiving the newborn by older female, as if midwifing.	Communion in empathic intimacy with respect to aliveness, animacy, binding-back-together.
Eating afterbirth.	
Older female assists tending of infant; allomothering, postnatal care.	

Elemental Natural Phenomena Practices

Chimpanzees appear to express some sort of awareness of and awe before elemental natural phenomena in their living environment and communicate this through ritualized behaviors and mimetic transference calls. Practices include charging displays in response to sudden wind gusts, rainstorms, thunder and lightning, waterfalls and approaching fire. Chimpanzees also have ritualized responses to flowing water (water watching), pythons, the grandeur of sunsets, and, although only one anecdotal report exists, earthquakes.

Goodall has discussed how the possibility of chimpanzee religion emerged from her observations of the rain dance. She then wonders,

Are they defying the elements...awed and excited...is it something like awe? If the chimpanzee could share his feelings and questions with the others, might these wild elemental displays become ritualized into some form of animistic religion? Would they worship the falls, the deluge from the sky, the thunder and lightning—the gods of the elements? So all-powerful; so incomprehensible (Goodall 2001: n.p.).

About chimpanzee responses to snakes and other natural phenomena, Goodall Institute videographer Bill Wallauer observed, 'I honestly do believe that chimps have the capacity to contemplate and consider (even revere) both the animate and inanimate' (2002: 1). With this in mind, Goodall's questions may be answered affirmatively with two caveats. First, these behaviors are, as will be demonstrated, already ritualized. Second, a trans-species definition of religion does not require such

human religious behavior as animism or worship of god(s) to consider the religious dimensions of chimpanzee cognition, affect, and behavior.

Of the various chimpanzee responses to elemental nature, Whiten et al. (1999) examined only the rain dance but confirmed that it met the strict criteria for a cultural form. The rain dance is performed when a 'sudden, very strong wind springs up', when the 'first violent gusts of wind presage a storm', and at the 'onset of heavy rain' (Goodall 1986: 335; 2005, 2001), especially at the beginning of the rainy season (Wallauer 2002). Whiten et al. (1999: supplementary information) defines the rain dance cultural pattern as displays which 'tend to return the males to their starting position to be coordinated or in parallel, may include slow charges as well as rapid and may involve a variety of display patterns (e.g., ground slap, buttress-beat, branch drag, pant-hoots)'. Charging displays typically begin with hair bristling.

Goodall reports many observations of the rain dance. In the first, after a lightning strike and loud clap of thunder, an adult male stood upright, began moving rhythmically from foot to foot, charged down a slope to a tree he had just left, leaped into the low branches, and sat motionless. Two other males charged after him, broke off huge branches as they ran, dragging them and hurling them ahead. A fourth male charged, leaped into a tree, tore off a large branch, jumped down, and ran down the slope. Three other males and a few females in the group followed and watched as the males repeated their performances as the rain fell harder and jagged forks of lightning flashed in the sky (Goodall 2001). They sometimes made saplings sway or moved low branches rhythmically back and forth, stamped their feet on the ground, and threw rocks (Goodall 2005). Displays ranged from individual to multiple-participant events, performed by males of all age groups (unlike displays among adult males), and were prolonged, lasting up to five minutes, sometimes more; and dominance of others seemed to play no role or occurred only secondarily (Wallauer 2002). Females may also engage in aggression displays (Goodall 1986: 67).

Given these observations, the rain dance appears composed of a pair of oppositely valenced behaviors:

- Sitting motionless in silence.
- Charging display (hair bristling frisson plus aggressive threat behavior).

As in the case of death behaviors, the charging display during a rain dance is out of context because there is no target opponent. As primatologists note, dominance of others plays little if any role during the rain dance, there is no target for submission, and it is not a display to intimidate bystanders. If one suggests that the storm is seen as an

opponent, threat, or a dominant superior, one already concedes that the display is a non-ordinary call communication—a mimetic transference to an elemental power of nature that overwhelms. In the chimpanzee ritualization of death the ‘indomitable’ appears to be death itself; in the rain dance and other elemental performances it appears to be the overwhelming force of the environment in which we live. I suggest it is this ambivalent and mimetic emotional response of wonder and dread that Wallauer expresses with the term ‘reverence’ and Goodall with the term ‘worship’, and it corresponds to two components of a trans-species definition of religion, namely reverence and dread.

Chimpanzees engage in waterfall dances and water watching. At Gombe in Zambia, males and sometimes females perform aggression displays toward, play in, and gaze at for extended periods of time waterfalls and streambeds (Wallauer 2002; Goodall 2005, 2001; 1986: 67). A magnificent waterfall in the Kakombe Valley occurs thanks to a small, fast-flowing stream that plunges eighty feet down a sheer rock face, creating wind as the water is forced through a narrow fissure. ‘For me, it is a magical place, and a spiritual one’, states Goodall (1999: 188). Sometimes when a chimpanzee, most often an adult male, approaches the falls, his hair bristles slightly. As he gets closer and the roar of the falling water becomes louder, his pace quickens and his hair becomes fully erect, and upon reaching the stream he may perform a magnificent display in the streambed below the falls, swaying rhythmically from foot to foot, stamping in the shallow rushing water, picking up and hurling rocks and branches. Sometimes the male climbs up on the vines that hang from a tree high above and swings out over the stream in the spray of the falling water. This waterfall dance may last for ten or fifteen minutes (Goodall 2005: 1304; 1999: 188). Afterwards a male may sit on a rock at the edge of stream, looking up at the sheet of ‘living water as it falls, watching as it flows past him on its way to the lake. What is he thinking? What is this thing that is always coming from above, always going away, yet always there? Is it alive?’ (Goodall 2001). Wallauer recorded a waterfall dance performed by the alpha at the time, Freud:

Freud began his display with typical rhythmic and deliberate swaying and swinging on vines. For minutes he swung over and across the eight to twelve-foot falls. At one point, Freud stood at the top of the falls dipping his hand into the stream and rolling rocks one at a time down the face of the waterfall. Finally, he displayed (slowly, on vines) down the falls and settled on a rock about 30 feet downstream. He relaxed, then turned to the falls and stared at it for many minutes (Wallauer 2002: n.p.).

These waterfall- and water-watching behaviors, like the rain dance, combine pairs of contrasting valenced behaviors:

- Sitting motionless in silence.
- Watching for an extended period, gazing at the water falling and water flowing by.
- Frisson and charging display.
- Swinging out into the spray of falling water to contact, touch, feel, explore it.

Goodall raises the question whether the chimpanzees experience wonder and awe at the ‘aliveness’ of the moving water. I suggest these behaviors match components of a prototypical trans-species definition of religion. Maintaining silence corresponds to deep respect (reverence); water gazing, careful observation; charging display, awe-dread when encountering that which astonishes, overwhelms by its magnitude, grandeur, beneficence, or lethality; and the desire to touch and feel the spray, awe wonder for that which fascinates. With respect to the question of ‘aliveness’, water-gazing for long periods of time, an extraordinarily unusual chimpanzee behavior, suggests they may be experiencing the ‘flow of time’. In this regard chimpanzees have a neural substrate for the capacity to experience the ‘stream of consciousness’ and sense of past, present, and future, even in the absence of language (Rilling et al. 2007). It is even possible that chimpanzees may see flashing sparks of light in the waterfall spray and flowing water and sense this as a quality of ‘aliveness’ or animacy.

Pruetz and LaDuke (2010) report two occurrences of fire watching at Fongali, Senegal. A small party of chimpanzees encountered an approaching wildfire and most likely the alpha male twice gave ‘a variation on a *wraah-bark*, which may have been fire-specific’ (Pruetz and LaDuke 2010: 647). Upon seeing the fire the party ascended a baobab tree, while ‘the remaining dominant male exhibited a slow and exaggerated display toward the fire in a manner analogous to the rain-dance exhibited here and elsewhere’ (Pruetz and LaDuke 2010: 648). The party descended the tree, and as they moved away from the fire, often sat, rested, or ate fruit they carried with them. Rather than move long distances at once, they repeatedly moved short distances, waited until the fire neared—almost to the point at which the heat could be felt—and then moved a short distance again. This practice enacts a ritualized pattern of behaviors similar to those already discussed.

- Vocal announcement: *wraah-bark* (fire specific) = *wraah* (alarm) + *waa-bark* (rage, anger, defiant sympathy for victim).
- Male makes ‘exaggerated’ display like the rain dance.
- Group climbs into tree but does not eat its fruit and (implied) is silent or motionless.

- Group watches the fire as it approaches and rises up into the tree.
- *Bark* (social excitement, food enjoyment).
- Group moves away from fire approaching, but then waits until fire comes close enough 'almost to feel the heat'.
- Group walks calmly and sits, rests, or eats fruit together while fire approaches.

If Fongali calls can be interpreted similarly to Mahale and Gombe calls, the alpha male's *wraah-bark* seems a combination of everyday calls, including *wraaa* (great alarm); *bark* (social excitement and food enjoyment but also social fear, anger, or protest against an individual of the same or different species), and *waa-bark* (anger, rage, or threat) (Nishida et al. 1999; Goodall 1986: 127, 315). In this ritualization these everyday call meanings are transferred to the approaching fire, the *wraaa* component calling the group together to observe, the bark expressing the relishing of something wondrous and the 'exaggerated' display and *waa-bark*, awe-dread.

Air (windstorm), water, and fire, but where is the fourth element—earth? From Mahale there is a report that in response to earthquake tremors, chimpanzees vocalized predominantly *pant-hoots* (social excitement, food enjoyment) and secondarily *wraaa* calls (alarm) and rarely *scream* calls (social fear, anger), *pant-barks* (social fear), and *barks* (social excitement, food enjoyment, social fear). In one report, Tarnie, an adolescent female, responded in a unique way: at the start of aftershocks she climbed a tree, as did 20 neighboring chimpanzees of all ages and genders. She uttered a *wraaa*-call while all the other individuals kept still and silent. A minute or so later, she climbed down the tree, held onto it with her left hand, and stood up. Next she put her right palm on the ground and looked at her right hand. She then moved close to the trail and again extended her right arm and put her palm on the ground. As the tremor ended, she withdrew her hand, climbed up the tree, and began to feed. Then all the other individuals in the trees began to feed (Fujimoto and Hanumura 2008). Again this seems a case of ritual patterning with paradoxical actions pairs:

- Interrupt feeding and other everyday activities.
- Climb into tree and be silent and motionless.
- *Wraaa* call (great alarm as at lethal carnivore) as vocal announcement to gather together.
- Hold palm on ground (sensing) and look at it; *pant-hoot*, *bark*, and *scream* calls (social excitement, food enjoyment).
- *Scream* (social fear and anger of victim, S.O.S.); *pant-bark* (social fear).
- Resume feeding and other activities.

Chimpanzees appear to ritualize responses to two additional natural phenomena: python watching and sunset watching. Chimpanzees at Gombe were observed showing intense curiosity about snakes, particularly pythons, which are dangerous to juveniles. When spying a python, chimpanzees utter a *wraaa* calling others to gather around and stare at the snake. Typical facial expressions were those of fear and curiosity. Physical reassurance contact, especially mutual embracing, was often made, and eye contact among individuals was frequent. After tens of minutes, members finally began to disperse, although some chimpanzees were observed lingering, staring, and calling for as long as 30 minutes (Wallauer 2002). Chimpanzees also have been observed performing aggression displays toward pythons (Goodall 1986: 331). Here again is prototypical patterning with non-ordinary mimetic transference calls:

- *Wraaa* call (great alarm as at lethal carnivore) as vocal announcement to gather together.
- (Implied) silence.
- Extended period of observation, gazing up to 30 minutes.
- Facial expressions of curiosity (wonder).
- Facial expressions of fear (awe, dread).
- Aggression display.
- Contact behavior, mutual embracing, frequent eye contact.

Finally, chimpanzees have a performative non-ordinary response to magnificent sunsets. Kortlandt (1962: 132) observed a wild chimpanzee in the Congo gaze at a particularly beautiful sunset for a full 15 minutes, watching the changing colors until it became so dark that he had to retire to the forest without stopping to pick a customary pawpaw for his evening meal. Goodall observed chimpanzees at Gombe enjoying peaceful contentment and a spectacular sunset over the lake, playing gently with young ones, laughing, and sharing *spontaneous pant-hoots* before retiring to sleep. She interprets this scene as an 'intimate moment' during the evening's serenity and beauty (Goodall 1986: 594). Again, these behaviors appear to be a ritual patterning of oppositional pairs:

- Silence (implied), including break from everyday activities (not feeding, not yet going to sleep).
- Extended period of careful observation, gazing.
- Peaceful contentment, serenity, gentle play, laughter, 'intimate moment'.
- Mutual *spontaneous pant-hoots*, 'melodious, almost singing'.

Goodall identifies four kinds of pant-hoots. Three are everyday signals: (1) an inquiring pant-hoot in which an individual calls and waits for a response to see who is in the area; (2) an arrival pant-hoot, uttered on

arrival at a good food source or joining another party, functioning to proclaim the identity of the caller; and (3) a roar pant-hoot during high arousal, always accompanied by a charging display. The fourth is the spontaneous pant-hoot, uttered by peacefully feeding or even (less often) resting individuals, which has a ‘melodious, almost singing’ quality in which the callers do not appear to be motivated by a need for information (Goodall 1986: 134-35). In other words, the spontaneous pant-hoot is non-ordinary and of a higher-order affective state. It might be construed to be a mimetic transference—in this case, a singing call-and-response, miming as if to say: ‘Are you here/I am here, I have arrived to be with you, and here we are, in our mutual frisson, before that which is an awesome force bigger than we are, and yet also seeming to express serenity in the living world in which we are alive’.

Rain dance, waterfall dance and water watching, fire watching, earthquake touching, python and sunset watching—each involves recombinatory and permutable formulaic behaviors deployed in pairs of opposite valence. As a group these practices deploy at least eight non-ordinary communicative behaviors—mimetic transference calls—and as a group these practices contain behaviors that correspond to all five components of a trans-species definition of religion (Table 4).

Table 4. Chimpanzee ritualized behaviors before elemental natural phenomena.

Behaviors (including mimetic transference calls and interpretation indicated by ‘as if’)	Components of Trans-Species Definition of Religion
Rain dance; Water watching; Fire watching; Earthquake sensing; implied in Python watching, Sunset: silence, sitting motionless, as if in a hunt or foreign land, beyond the border, the other side.	Reverence, showing deep respect, devotion, intense love, with hush, silence.
Earthquake sensing; Python watching: vocal announcement, <i>wraaaa</i> (great alarm as at lethal carnivore); Fire watching: with <i>waa-bark</i> (rage, anger, defiant sympathy for victim) as if to signal to gather around to witness a potentially lethal, strange phenomenon.	Careful observance with vocal announcement for all to gather together.
Waterfall and stream water watching; Fire watching; Python watching; Sunset behavior: gaze, observe for extended period of time.	
Waterfall: swing out to touch and feel the spray. Fire: feel the approaching heat. Earthquake sensing: hold palm on trembling ground, sense it, look at palm. Python watching: face of curiosity	Wonder, awe as fascination, curiosity, desire to know more with respect to a surprising, non-ordinary phenomenon;
Earthquake and Fire watching: <i>scream call, bark, pant-hoot</i> (social excitement, food enjoyment), as if something to taste, enjoy, relish. Fire watching: combined with <i>wraah-bark</i> .	

Rain dance; Waterfall; Fire watching; Python watching: hair bristle (frisson) and perform charging display but with no opponent, as if mock aggression, inability to dominate the indomitable, nature.	Dread, awe as terror, astonishment before that which overwhelms by its magnitude, grandeur, beneficence or lethality; <i>mysterium tremendum</i> .
Python watching: face of fear; contact, embrace (response to fright, reassurance of other after submission behavior), as if reassurance. Earthquake sensing: <i>scream</i> call or <i>pant-bark</i> (social fear or anger), as if absolutely undefended and vulnerable.	
Fire watching: walk, sit, rest, eat together. Sunset watching: peaceful contentment, serenity, gentle play, laughter, 'intimate moment'.	Communion in empathic intimacy, with respect to aliveness, animacy, binding-back-together.
Sunset watching: mutual <i>spontaneous pant-hoot</i> , melodious, almost singing, as if here we are in this peaceful and beautiful serenity in which we are alive.	

Consortship Practices

A fourth category for chimpanzee religious practices is the consortship practice. Goodall (1986: 450-53) describes three chimpanzee mating strategies: (1) promiscuity, in which multiple males engage in a courtship display with erect penis and associated behaviors, including threats, to command estrous female rump presentation; (2) monopoly, or the possession of sexual rights by high-ranking males who drive off competitors, involving male courtship display and estrous female presentation; and (3) consortship, which is an exclusive-partner relationship away from the main group for up to three months taking place during estrous and even anoestrous phases. Consortship is the least frequent of the three. It is predominantly consensual and egalitarian. It is the only form of mating that combines courtship display with affiliative behaviors. To this extent it can be regarded as a non-everyday or non-ordinary behavior.

An analysis of Goodall's account of consortship indicates that it also involves recombinatory and permutable formulaic behaviors deployed in pairs of opposite valence and mimetic transference communicative behaviors in much the same ways as the death, birth and nature practices. Consortship appears to enact at least four of five components of a trans-species definition of religion, possibly lacking awe-dread. The latter emotion does not seem to occur in the fulfilled ritual, but might be interpreted as present in the act of refusal or termination, the S.O.S. scream call signifying distress (fear). For the sake of brevity, I leave aside for now a detailed analysis of this ritual.⁵

5. For details, see Supplementary File 4 Chimpanzee Religion: Chimpanzee Consortship Rituals at <http://www.originsnet.org/publications.html>.

Discussion

For each type of chimpanzee ritual practice the foregoing analysis reveals a basic recombinatory and permutable set of formulaic behaviors deployed in pairs of opposite valence, including everyday communicative calls that are decontextualized and converted into non-ordinary mimetic transference calls, sometimes with a message apparently opposite to the everyday call. Many of these behaviors occur across all four types of ritual. This indicates that the ritual behaviors are not random and that there appears to be some sort of underlying schema that is generative of the entire group of rituals and their variations.

Table 5 shows how the death, birth, and nature rituals discussed above appear to be organized syntagmatically and paradigmatically by an underlying generative rule. The table is organized on one axis by ritual type and on the other by ritual components according to the trans-species definition of religion. In the rows I have allocated behaviors for the most part in their actual syntagmatic sequencing in the field reports. In allocating behaviors to columns, appropriateness is fairly clear for some behaviors; others, which may be emotionally ambivalent, are more ambiguous.

Table 5 (overleaf) reveals that the most frequently observed non-ordinary mimetic transference calls during death, birth, and nature rituals are two valenced pairs, Silence (in all eight ritual types) and Announcement call (in five of eight; four with *wraaa*-call). Charging display and Bark (including *bark*, *waa-bark*, and *wraah-bark*) each occur in four of eight ritual types. The *Scream* call also occurs in death, birth, and nature rituals (three of eight). The ritualization of these five vocalizations decontextualizes their everyday basic emotions, intensifies their arousal states, and combines them in opposite valences, simultaneously positive (foreground attraction) and negative (background fear). For this reason, I suggest that these five calls express not only mimetic transferences but complex or higher-order emotions, which correspond to the mood expression components of a trans-species definition of religion, namely deep respect (reverence), careful observation, awe-wonder, and awe-dread.

The cross-ritual field generative capacity for expressing both formulaic pairing of instinctive behaviors and communicative signal transferences appears to be an example of what ethologists term ritualization of instinct, which among other species is known to convert an aggression display into one with a more pacific intent, typically in the arena of courtship (Wilson 1980: 110-13; Lorenz 1963: 54-80).

Table 5. Cross-Ritual Syntagmatic and Paradigmatic Analysis of Chimpanzee Religious Behaviors.

	REVERE	OBSERVE CAREFULLY	WONDER	DREAD	COMMUNE, INTIMACY	EMPATHIC
DEATH RITUAL						
		Announcement: <i>wraaaa, wan-bark</i>		Hair bristle/frisson mock aggression		
	Absolute silence		<i>Scream:</i> excitement, food enjoyment	<i>Scream:</i> social fear and anger		
	Guarding, respect for dead	Gaze, sniff, inspect, observe	Tap, shake for response	Reassurance contact	Wail, <i>whimper</i> , soft <i>hoo</i> calls of mourning	
	Grooming corpse				Glance-back: farewell	
BIRTH RITUAL						
	Silence	Stare closely	Poke and sniff		Mime cupped hands (as midwife)	
		Announcement: <i>scream</i> call, <i>bark</i>	<i>Scream, bark:</i> excitement, food enjoyment	<i>Scream, bark:</i> social fear, anger	Allomother	
	Clean, bond			Embracing, reassurance	Eat afterbirth	
ELEMENTAL NATURE RITUAL						
Rain dance	Silent, sitting motionless			Hair bristle/frisson, mock aggression		
Waterfall dance, Water watching			Swing into spray, touch it, feel it	Hair bristle/frisson, mock aggression		
	Sitting in silence	Gaze, observe	watch,		Witness together	

Fire watching	Climbing up tree	Announcement: <i>wraah-bark</i> Observing fire from short distance away	<i>Bark:</i> excitement, food enjoyment Feeling the heat	Hair bristle/ frisson, mock aggression	Walking, sitting, resting, and eating fruit together
	Climbing up tree, sitting in silence	Announcement: <i>wraaaa</i>	<i>Pant-hoot, bark, scream:</i> excitement, food enjoyment Palm on ground, sense, look at it Face: curiosity	<i>Scream, pant-bark:</i> social fear, anger	Witness together
Python watching		Announcement: <i>wraaaa</i>		Face: fear	Witness together
	Silent	Gazing		Reassurance contact	
Sunset watching	Silent	Gazing	<i>Spontaneous pant-hoot</i> before magnificence		'Intimate moment', Contentment, serenity

This cross-ritual field capacity further appears to be the chimpanzee analogue for the human capacity to use algebraic strategies to organize and perform myth and ritual. Human religious ritualizations are more complex than those of chimpanzees in that the latter only pair opposing behavioral valences and their reversals, while human ritualizations, as suggested by Levi-Strauss's canonical formula of myth and ritual, involve permutations of paired terms of relations (functions) and their reversals as well as what Miranda (2001) refers to as the 'double twist', that is, recombination resulting in mediation of opposites plus inversion of functions. Chimpanzee religious rituals do not appear to involve either mediation or inversion; they do not involve two inverse functions prototypical of human religion, namely the sacred and sacrifice. Thus each component of chimpanzee religion is simpler than the human analogue. The chimpanzee ritualization of dread, for example, is an emotive response to an overwhelming phenomenon, while the human ritualization of numinosity is a dialectical relation involving consent and command between agent and numen (e.g., augury, divine will). Table 6 summarizes these similarities and differences with respect to polythetic components of a trans-species definition of religion and a definition of human religion based on a Western folk taxonomy (Harrod 2011).

Table 6. Chimpanzee vs. Human Religion: Comparison of Components.

Chimpanzee Religion	Human Religion
Reverence	Piety, Worship
Careful Observation	Ceremonial Observance
Wonder	Holy
Dread	Numinosity
Commune in Empathic Intimacy (with respect to animacy)	Intimate Communion Spirit ('Breath of Life')
	The Sacred
	Sacrifice

A further difference is that there are fewer major categories of chimpanzee ritual compared to those of humans. While both human and chimpanzee religions have rituals practiced during death, birth, extraordinary natural phenomena, and consortship, human religion appears distinctive in having at least six additional types: initiatory, sacrificial, culinary, healing, hunting, and creation/foundation rites. At what point in hominin evolution these distinctive features arose is a question for future research.

I suggest that this evidence for an apparent generative competence that spans religious ritualization types, and may have a mathematical

formulation, further supports an affirmative answer to Jane Goodall's question about whether chimpanzees show any signs of religious behavior or precursors of religious ritual.

Conclusion

Based on a comprehensive review of primatological reports of chimpanzee behaviors and application of multiple heuristic procedures, including a non-anthropocentric, prototypical trans-species definition of religion, it may be concluded that:

1. Chimpanzees engage in complex ritualized patterns of behavior in response to death, birth, elemental phenomena of nature (wind, water, fire, earth), and consortship.
2. These patterns display recombinatory and permutable sets of formulaic behaviors and calls, which appear to be deployed in pairs of opposed emotional valence.
3. In each ritual type, everyday communicative behaviors, such as charging displays, alarm calls, and pant-hoots, appear to be decontextualized and recontextualized in ways that modify and convert them into non-ordinary mimetic transferences expressing novel meanings and experiences of awe-dread and wonder.
4. These behaviors appear to be examples of the biological ritualization of instincts.
5. The formulaic behaviors are shared across ritual practices—death, birth, response to elemental natural phenomena, and consortship. This cross-ritual matrix of syntagmatic and paradigmatic behaviors organized by binary valences and reversals appears to be evidence for an underlying algorithmic generative competence that structures the various ritualizations.
6. Chimpanzee ritual behaviors in response to death, birth, consortship, and elemental natural phenomena correspond to and thus meet the full criteria for a prototypical trans-species definition of religion (Harrod 2011).

With this I have responded to Goodall's initial question affirmatively: yes, there appears to be chimpanzee religion. I contend that this finding contradicts the assertions by Howell (2003) that Goodall's observations are far from sufficient evidence for chimpanzee religion and Bekoff (2007a) that there is no detailed data to support or refute chimpanzee religious behavior. The results contained herein would seem to provide a strong case for chimpanzee religion as defined.

Limitations and Implications

My literature review is necessarily limited, and important reports may have been missed. However, although the number of reports analyzed may be limited, I suggest they are sufficient for the conclusions proposed. Future field research might make new observations that would expand the database, especially with respect to birth-attending behaviors in the wild. Further, additional candidates for religious behaviors may have been overlooked due to bias in the heuristic methods or the trans-species definition of religion. I have not considered a number of 'social' behaviors of chimpanzees that do not seem categorizable as 'religious', such as food sharing, caretaking for the injured and orphaned, reparation and reconciliation practices, medical/healing practices, and psychoactive substance use.

My methodological procedure has aspects drawn from religious studies, phenomenology, and structuralist anthropology and is open to suggestions for alternative analytical approaches to the behavioral patterns discussed. Further, in suggesting how to interpret the meaning of mimetic transferences of chimpanzee communicative signals, I have added to Goodall's interpretation of a call's everyday semantics some nuances that seem to me appropriate on the basis of their novel context. This necessarily requires using some empathy and imagination, but I suggest not to an extent greater than that used by primatologists cited in this study. Future primatological research on such transferences or similar cognitive schemas might further clarify their role.

A finding of the existence of chimpanzee religion would have profound implications for religious studies, theology, anthropology, archaeology, ethology, and evolutionary psychology, including efforts to understand the evolution of symbolic behavior and the origins of religious perception and belief. Specifically, a finding of chimpanzee religion would:

- imply a new distinction between religion and theology, the former applicable across species, the latter applicable only to *Homo sapiens sapiens*;
- challenge assertions that religion constitutes the uniqueness of the human species (King 2008; van Huyssteen 2008; Fisher 2005);
- challenge assertions that theology is uniquely human (Fisher 2005; Bering 2001), which would only hold if theology is defined by perceptions and behaviors that appear to belong only to humans, such as perceptions of the sacred, theistic beliefs, and sacrificial practices;

- call into question views holding that great apes might have some sort of god image (Peterson 2008; Putz 2009) or that all species worship the same divinity;
- question theories asserting that religion is rooted in anthropomorphism (Guthrie 1993, 1980);
- provide critical support for theories that hypothesize religion or spirituality for hominins prior to *Homo sapiens sapiens*, such as Neanderthals, archaic *Homo sapiens*, *Heidelbergensis*, *Erectus*, *Habilis/Rudolfensis*, and Australopithecines;
- contradict the hypothesis that religion originated with the emergence of *Homo sapiens sapiens* (Mithen 1996; Fisher 2005);
- support researchers in the fields of palaeoanthropology and the evolution and prehistory of religions to triangulate between chimpanzee and recent human religious behaviors to reconstruct early hominin religious behaviors;
- open the door for research on religious rituals among bonobo and other primates and non-primates (with all the caveats noted in Sayers and Lovejoy 2008); and
- suggest that speculation about the human socio-cognitive niche in evolutionary origins (Whiten and Erdal 2012) needs to add religious perceptions and behaviors into its principal components in order to have more balanced hypotheses.

My findings underscore the need for the preservation of the earth's chimpanzees that are facing extinction, which is due in part to anthropocentric value systems and our often predatory response toward other species and even our closest evolutionary kin. Anthropocentrism is, moreover, laced into both popular and academic definitions of religion as well as the ways into which we construct our differences with non-human organisms. Given the ever more urgent situation of the world's endangered species, it is my hope that these findings on chimpanzee religion will contribute to greater empathy, respect, and protection for chimpanzees and all life forms participating in the ongoing evolution of life.

References

- Anderson, James R., Alasdair Gillies, and Louise C. Lock. 2010. 'Pan thanatology', *Current Biology* 20.8: R349-51. Doi: <http://dx.doi.org/10.1016/j.cub.2010.02.010>.
- Bekoff, Marc. 2007a. 'Reflections on Animal Emotions and Beastly Virtues: Appreciating, Honoring and Respecting the Public Passions of Animals', *Journal for the Study of Religion, Nature and Culture* 1.1: 68-81.

- . 2007b. *The Emotional Lives of Animals: A Leading Scientist Explores Animal Joy, Sorrow, and Empathy—and Why They Matter* (New York: New World Library).
- Bering, Jesse. 2001. 'Theistic Percepts in Other Species: Can Chimpanzees Represent the Minds of Non-Natural Agents?', *Journal of Cognition and Culture* 1.2: 107-37. Doi: <http://dx.doi.org/10.1163/156853701316931371>.
- Biro, Dora et al. 2010. 'Chimpanzee Mothers at Bousou, Guinea Carry the Mummified Remains of their Dead Infants', *Current Biology* 20.8: R351-52. Doi: <http://dx.doi.org/10.1016/j.cub.2010.02.031>.
- Boesch, Christophe. 1992. 'New Elements of a Theory of Mind in Wild Chimpanzees', *Behavioral and Brain Sciences* 15.1: 149-50. Doi: <http://dx.doi.org/10.1017/S0140525X00067959>.
- Boesch, Christophe, and Hedwige Boesch-Achermann. 2000. *The Chimpanzees of the Tai Forest: Behavioural Ecology and Evolution* (New York: Oxford University Press).
- Boesch, Christophe, and Michael Tomasello. 1998. 'Chimpanzee and Human Cultures', *Current Anthropology* 39.5: 591-614. Doi: <http://dx.doi.org/10.1086/204785>.
- Bräuer, Juliane, Josep Call, and Michael Tomasello. 2005. 'All Great Ape Species Follow Gaze to Distant Locations and Around Barriers', *Journal of Comparative Psychology* 119.2: 145-54. Doi: <http://dx.doi.org/10.1037/0735-7036.119.2.145>.
- Call, Josep, Brian Hare, Malinda Carpenter, and Michael Tomasello. 2004. "'Unwilling" Versus "Unable": Chimpanzees' Understanding of Human Intentional Action', *Developmental Science* 7.4: 488-98. Doi: <http://dx.doi.org/10.1111/j.1467-7687.2004.00368.x>.
- Call, Josep, and Michael Tomasello. 2008. 'Does the Chimpanzee Have a Theory of Mind? 30 Years Later', *Trends in Cognitive Sciences* 12.5: 187-92. Doi: <http://dx.doi.org/10.1016/j.tics.2008.02.010>.
- Cromie, William J. 1999. 'Chimpanzee Behaviors Surprise Scientists', *Harvard University Gazette*, June 17.
- Eaton, Ralph M. 1955. *Descartes Selections* (New York: Charles Scribner's Sons).
- Eliade, Mircea. 1959. *The Sacred and the Profane: The Nature of Religion* (New York: Harper & Row).
- Engel, Cindy. 2002. *Wild Health: Lessons in Natural Wellness from the Animal Kingdom* (New York: Houghton Mifflin).
- Fauconnier, Gilles, and Mark Turner. 1994. *Conceptual Projection and Middle Spaces* (La Jolla, CA: University of San Diego).
- . 2002. *The Way We Think: Conceptual Blending and the Mind's Hidden Complexities* (New York: Basic Books).
- Fisher, Christopher L. 2005. 'Animals, Humans and X-Men: Human Uniqueness and the Meaning of Personhood', *Theology and Science* 3.3: 291-324. Doi: <http://dx.doi.org/10.1080/14746700500317289>.
- Flemming, Timothy M. et al. 2008. 'What Meaning Means for Same and Different: Analogical Reasoning in Humans (*Homo sapiens*), Chimpanzees (*Pan troglodytes*), and Rhesus Monkeys (*Macaca mulatta*)', *Journal of Comparative Psychology* 122.2: 176-85. Doi: <http://dx.doi.org/10.1037/0735-7036.122.2.176>.
- Fujimoto, Mariko, and Shunkichi Hanamura. 2008. 'Responses of Wild Chimpanzees (*Pan troglodytes schweinfurthii*) toward Seismic Aftershocks in the Mahale Mountains National Park, Tanzania', *Primates* 49: 73-76. Doi: [10.1007/s10329-007-0052-3](https://doi.org/10.1007/s10329-007-0052-3).

- Goodall, Jane. 1986. *The Chimpanzees of Gombe: Patterns of Behavior* (Cambridge: Harvard University Press).
- . 2001. 'Rain Dance', *Science and Spirit* (May/June). Formerly online: http://www.science-spirit.org/articles/Articledetail.cfm?article_ID=229 (link no longer active).
- . 2005. 'Primate Spirituality', in Bron Taylor (ed.), *Encyclopedia of Religion and Nature* (New York: Continuum): 1303-306.
- Guthrie, Stewart. 1980. 'A Cognitive Theory of Religion', *Current Anthropology* 21.2: 181-94. Doi: <http://dx.doi.org/10.1086/202429>.
- . 1993. *Faces in the Clouds: A New Theory of Religion* (New York: Oxford University Press).
- Harrod, James. 2011. 'A Trans-species Definition of Religion', *Journal for the Study of Religion, Nature and Culture* 5.3: 327-53.
- Herrmann, Esther et al. 2007. 'Humans Have Evolved Specialized Skills of Social Cognition: The Cultural Intelligence Hypothesis', *Science* 317: 1360-66. Doi: <http://dx.doi.org/10.1126/science.1146282>.
- Hirata, S. et al. 2001. 'Capturing and Toying with Hyraxes (*Dendrohyrax dorsalis*) by Wild Chimpanzees (*Pan troglodytes*) at Bossou, Guinea', *American Journal of Primatology* 53.2: 93-97. Doi: [http://dx.doi.org/10.1002/1098-2345\(200102\)53:2<93::AID-AJP5>3.0.CO;2-X](http://dx.doi.org/10.1002/1098-2345(200102)53:2<93::AID-AJP5>3.0.CO;2-X).
- Hobaiter, Catherine, and Richard W. Byrne. 2011a. 'The Gestural Repertoire of the Wild Chimpanzee', *Animal Cognition* 14: 745-67. Doi: <http://dx.doi.org/10.1007/s10071-011-0409-2>.
- . 2011b. 'Serial Gesturing by Wild Chimpanzees: Its Nature and Function for Communication', *Animal Cognition* 14: 827-38. Doi: <http://dx.doi.org/10.1007/s10071-011-0416-3>.
- Howell, Nancy R. 2003. 'The Importance of Being Chimpanzee', *Theology and Science* 1.2: 179-91. Doi: <http://dx.doi.org/10.1080/1474670032000124586>.
- . 2009. 'Embodied Transcendence: Bonobos and Humans in Community', *Zygon* 44.3: 601-12. Doi: <http://dx.doi.org/10.1111/j.1467-9744.2009.01018.x>.
- Johnson, Mark. 1987. *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason* (Chicago: University of Chicago Press).
- . 2007. *The Meaning of the Body: Aesthetics of Human Understanding* (Chicago: University of Chicago Press). Doi: <http://dx.doi.org/10.7208/chicago/9780226026992.001.0001>.
- King, Barbara J. 2008. 'Primates and Religion: A Biological Anthropologist's Response to J. van Huyssteen's Alone in the World?', *Zygon* 43.2: 451-66. Doi: <http://dx.doi.org/10.1111/j.1467-9744.2008.00927.x>.
- Kortlandt, Adriaan. 1962. 'Chimpanzees in the Wild', *Scientific American* 206.5: 128-38. Doi: <http://dx.doi.org/10.1038/scientificamerican0562-128>.
- Leach, Edmund. 1967. *The Structural Study of Myth and Totemism* (New York: Tavistock).
- Lévi-Strauss, Claude. 1967. *Structural Anthropology* (New York: Basic Books).
- Lorenz, Konrad. 1963. *On Aggression* (New York: Bantam).
- Miranda, Pierre. 2001. *The Double Twist: From Ethnography to Morphodynamics* (Toronto: University of Toronto Press).
- Mithen, Steven. 1996. *The Prehistory of the Mind: The Cognitive Origins of Art, Religion and Science* (New York: Thames & Hudson).

- Mosko, Mark S., and Frederick H. Damon. 2005. *On the Order of Chaos: Social Anthropology and the Science of Chaos* (New York: Berghahn Books).
- Nishida, Toshisada et al. 1999. 'Ethogram and Ethnography of Mahale Chimpanzees', *Anthropological Science* 107.2: 141-88. Doi: <http://dx.doi.org/10.1537/ase.107.141>.
- Notman, Hugh, and Drew Rendall. 2005. 'Contextual Variation in Chimpanzee Pant Hoots and its Implications for Referential Communication', *Animal Behaviour* 70: 177-90. Doi: <http://dx.doi.org/10.1016/j.anbehav.2004.08.024>.
- Otto, Rudolf. 1950. *The Idea of the Holy: An Inquiry into the Non-Rational Factor in the Idea of the Divine and its Relation to the Rational* (New York: Oxford University Press).
- Özçaliskan, Seyda, and Susan Goldin-Meadow. 2006. 'X IS LIKE Y: The Emergence of Similarity Mappings in Children's Early Speech and Gesture', in Gitte Kristiansen, Michel Achard, René Dirven, and Francisco J. Ruiz de Mendoza Ibáñez (eds.), *Cognitive Linguistics: Current Applications and Future Perspectives* (New York: Mouton de Gruyter): 229-62.
- Peterson, Gregory R. 2008. 'Uniqueness, the Image of God, and the Problem of Method: Engaging van Huyssteen', *Zygon* 43.2: 467-74. Doi: <http://dx.doi.org/10.1111/j.1467-9744.2008.00928.x>.
- Pika, Simone, and John Mitani. 2006. 'Referential Gestural Communication in Wild Chimpanzees (*Pan troglodytes*)', *Current Biology* 16.6: R191-92. Doi: <http://dx.doi.org/10.1016/j.cub.2006.02.037>.
- Povinelli, Daniel J., Jesse M. Bering, and Steve Giambrone. 2000. 'Toward a Science of Other Minds: Escaping the Argument by Analogy.' *Cognitive Science* 24.3: 509-41. Doi: http://dx.doi.org/10.1207/s15516709cog2403_7.
- Pruetz, Jill D., and Thomas C. LaDuke. 2010. 'Brief Communication: Reaction to Fire by Savanna Chimpanzees (*Pan troglodytes verus*) at Fongoli, Senegal: Conceptualization of "Fire Behavior" and the Case for a Chimpanzee Model', *American Journal of Physical Anthropology* 141.4: 646-50.
- Putz, Oliver. 2009. 'Moral Apes, Human Uniqueness, and the Image of God', *Zygon* 44.3: 613-24. Doi: <http://dx.doi.org/10.1111/j.1467-9744.2009.01019.x>.
- Rilling, James K. et al. 2007. 'A Comparison of Resting-State Brain Activity in Humans and Chimpanzees', *Proceedings of the National Academy of Sciences USA* 104.43: 17146-51. Doi: <http://dx.doi.org/10.1073/pnas.0705132104>.
- Russon, A. E. 2004. 'Great Ape Cognitive Systems', in A.E. Russon and D.R. Begun (eds.), *The Evolution of Great Ape Intelligence* (Cambridge: Cambridge University Press): 76-100. Doi: <http://dx.doi.org/10.1017/CBO9780511542299.008>.
- Savage-Rumbaugh, Sue, and Roger Lewin. 1994. *Kanzi: The Ape at the Brink of the Human Mind* (New York: John Wiley & Sons).
- Sayers, Ken, and C. Owen Lovejoy. 2008. 'The Chimpanzee Has No Clothes: A Critical Examination of Pan Troglodytes in Models of Human Evolution (with Comments)', *Current Anthropology* 49.1: 87-114. Doi: <http://dx.doi.org/10.1086/523675>.
- Slocombe, Katie E., and Klaus Zuberbühler. 2005. 'Functionally Referential Communication in a Chimpanzee', *Current Biology* 15: 1779-84. Doi: <http://dx.doi.org/10.1016/j.cub.2005.08.068>.
- . 2006. 'Functionally Referential Calls in Chimpanzees: Abstract #103', XXI *Congress of the International Primatological Society*. Online: <http://www.asp.org/ips/IPS2006/abstractDisplay.cfm?abstractID=1476&confEventID=1308>.

- Tagliatalata, Jared P. et al. 2008. 'Communicative Signaling Activates "Broca's" Homolog in Chimpanzees', *Current Biology* 18.5: 343-48. Doi: <http://dx.doi.org/10.1016/j.cub.2008.01.049>.
- Talmy, Leonard. 1988. 'Force Dynamics in Language and Cognition', *Cognitive Science* 12.1: 49-100. Doi: http://dx.doi.org/10.1207/s15516709cog1201_2.
- Teleki, Geza. 1973. 'Group Response to the Accidental Death of a Chimpanzee in Gombe National Park, Tanzania', *Folia Primatologica* 20: 81-94. Doi: <http://dx.doi.org/10.1159/000155569>.
- Temerlin, Maurice K. 1975. *Lucy: Growing up human* (Palo Alto: Science & Behavior Books).
- Tomasello, Michael. 2000. 'Primate Cognition: Introduction to the Issue', *Cognitive Science* 24.3: 351-61. Doi: http://dx.doi.org/10.1207/s15516709cog2403_1.
- Tomasello, Michael, Josep Call, and Brian Hare. 2003. 'Chimpanzees Understand Psychological States: The Question Is Which Ones and to What Extent', *Trends in Cognitive Sciences* 7.4: 153-56. Doi: [http://dx.doi.org/10.1016/S1364-6613\(03\)00035-4](http://dx.doi.org/10.1016/S1364-6613(03)00035-4).
- van Huyssteen, J. Wentzel. 2008. 'Primates, Hominins, and Humans: From Species Specificity to Human Uniqueness? A Response to Barbara J. King, Gregory R. Peterson, Wesley J. Wildman, and Nancy R. Howell', *Zygon* 43.2: 505-25. Doi: .
- de Waal, Frans. 1989. *Peacemaking among Primates* (Cambridge: Harvard University Press).
- . 1996. *Good Natured: The Origins of Right and Wrong in Humans and Other Animals* (Cambridge: Harvard University Press).
- . 1999. 'Cultural Primatology Comes of Age', *Nature* 399: 635-36. Doi: <http://dx.doi.org/10.1038/21310>.
- Wallauer, Bill. 2002. 'Do Chimpanzees Feel Reverence for Nature?' Online: http://www.janegoodall.org/chimp_central/chimpanzees/behavior/rain_dance.asp.
- Whiten, Andrew, and David Erdal. 2012. 'The Human Socio-Cognitive Niche and its Evolutionary Origins', *Proceedings of the National Academy of Sciences USA* 367: 2119-29.
- Whiten, Andrew et al. 1999. 'Cultures in Chimpanzees', *Nature* 399: 682-85. Doi: <http://dx.doi.org/10.1038/21415>.
- Wilson, Edward O. 1980. *Sociobiology: The Abridged Edition* (Cambridge: Harvard University Press).
- Yerkes, Robert M., and Ada W. Yerkes. 1929. *The Great Apes: A Study of Anthropoid Life* (New Haven: Yale University Press).