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Jürgens, Uta M.; Hackett, Paul M.W.

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Wolves, Crows, and Spiders: An eclectic Literature Review inspires a Model explaining Humans' similar Reactions to ecologically different Wildlife

Uta Maria Jürgens^{1,2*} and Paul M. W. Hackett^{3,4}

¹Department of Environmental System Science, Swiss Federal Institute of Technology ETH, Zürich, Switzerland, ²Social Science in Landscape Research, Swiss Federal Research Institute WSL, Birmensdorf, Switzerland, ³School of Communication, Emerson College, Boston, MA, United States, ⁴School of Health Sciences, University of Suffolk, Ipswich, United Kingdom

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Edited by:

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*Correspondence:

Uta Maria Jürgens
u.m.jurgens@uta.info

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Coming from the vantage point of managing human relations to potentially problematic wildlife, we bring the following questions: Where do people's emotionally vigorous and polarized reactions originate? Why do these reactions to different scenarios of human-wildlife conflict appear similar? In this paper we provide the findings from an eclectic review of purposefully sampled literature on human relations to wolves, corvids and spiders. Based on this synthesis, we propose three answers to those questions: 1). The emotional vigor inherent in human-wildlife conflicts is caused by the activation of deep-seated and emotionally loaded factors, specifically worldviews on human-nature relations more broadly, an integral human motivation for seeking control, and symbolic associations to darkness. 2). The opposing attitudes on human-wildlife relations derive from people's diverging worldviews and different degrees of wanting control in a situation of human-wildlife conflict. 3). Despite ecological specificities, various cases of human-wildlife conflicts may evoke similar mental processes and, accordingly, the same reactions in people. Consequentially, it is possible to develop transferable solutions that may contribute to managing challenges in different instances of human-wildlife encounters.

Keywords: human dimensions, human-wildlife relations, wolves, corvids, spiders, mental representations, control, worldviews

INTRODUCTION

Many forms of conflict arise between human society and wildlife. They are as varied as wild boars ravaging parks, wolves and lynx preying on livestock, spiders roaming in basements and bathtubs, or deer affecting crops and forests by browsing. City-dwelling rooks have been the focus of the first author's fieldwork for many years. In mediating the conflicts between proponents and opponents of urban rookeries and in creating win-win solutions, she learned about people's motives toward human-rook coexistence. It occurred to her that people's reactions, and the challenges that she encountered in managing the human and non-human dimensions of conflict, seem to correspond to those in other human-wildlife conflicts. Despite vast differences in wildlife ecology and the unarguable genuine economic and sociocultural sequelae of every conflict, there appear to be common features. Themes portrayed in media reports include: wildlife invading the human sphere,

challenging human dominion and terrorizing people; but also reflections on animals' right to exist (e.g. Dame, 2012; Grünberg, 2018; Satorius, 2018; Schäfli, 2014; Schröder and Hesse, 2015)

It appears that potential similarities between human relations to different types of wildlife have not systematically been addressed in academia. Research tends to focus on one species or on groups of similar wildlife (e.g. "large carnivores") in each study. Likewise, there seem to be no attempts to integrate the results arising from the many academic disciplines that investigate human-wildlife relations, including: biology, sociology, psychology, philosophy, literature, linguistics, and anthropology.

We are convinced that a comparative and integrative approach to human-wildlife relations would further our understanding of the human dimension and leverage wildlife conservation. Specifically, the following questions merit investigation: Why do vastly different sorts of human-wildlife conflicts seem to share common features, e.g. vigorous and polarized reactions in people? Can these shared features be traced to common causes in people's perceptions of these wildlife? If so: What are these common causes, and how do they operate?

After years of practical work in the field, we approach these questions with strong intuitions as to how they may be answered. We bracket these assumptions (Fischer, 2009; Tufford and Newman, 2012) clearly as they are our entry point into assessing the literature. They structure the sampling and shape our perspective on analyzing and synthesizing the information:

- (1) We assume that in human wildlife conflicts, people's deeply held convictions of how wildlife should be dealt with, their symbolic associations (particularly of "darkness") to wildlife, and beliefs about nature more broadly are touched. Hence their intense reactions to practical challenges in human-wildlife coexistence.
- (2) We think that humans react in polarized ways to problematic wildlife because those convictions, valences of association, and beliefs differ. Specifically, the perspectives on nature and their motivation for controlling natural phenomena seems to vary markedly between people.
- (3) We believe that different kinds of wildlife may stir similarly intense and polarized reactions in people because they trigger the human mind in similar ways.

METHODS

We discuss wolves, corvids and spiders¹ as model cases and employ an eclectic literature review of works on human-wildlife relations in order to illuminate the shared features of ecologically dissimilar human-wildlife conflicts.

¹Throughout this paper we will use the term "corvid" to denote three species of birds from the Corvidae family, which we explain more fully in *Ecological Facts on Corvids*. Likewise, the term "spider" subsumes different species of the Arachnidae class who tend to dwell in human households as described in *Ecological Facts on Spiders*.

Research Objective

We are interested in a psychological perspective on the proximate factors and mechanisms that bring forth the reactions to wildlife on the level of individual minds. Given the scarcity of primary research on this (Urquiza-Haas and Kotrschal, 2015), our research objective is to explore whether perspectives on nature, control motivation and symbolic associations play a part at all in human relations to potentially problematic wildlife like wolves, corvids, and spiders. We do not seek to claim that these are the only impacting issues. Alternative factors have been found to shape human-wildlife relations. For example, socioeconomic aspects and people's knowledge of wildlife determine much of the factual framework in which the human-wildlife relation unfolds. Also, a significant urban-rural split can be observed, e.g. with regard to pro- and anti-wolf attitudes (Skogen and Thrane, 2007). Moreover, pure phobia or a fear for one's life (e.g. Johansson and Karlsson, 2011) forms human encounters with wolves, crows, and spiders, probably constituting a legacy of human evolution (Schaller et al., 2003). Quite some evidence exists on these factors, yet, the degree of their impact on people's reactions to wildlife compared to the deeper-seated mental mechanisms is not yet fully illuminated (e.g. Hunziker et al., 2001), and they leave much to be explained with regard to the intensity and polarization in human-wildlife conflicts. Based on our practical experience, perspectives on nature, control, and symbolic associations are reasonable candidates to markedly shape human-wildlife relations and we realize that they are under-explored in human dimension research. Our paper is meant to be an initial contribution to filling this gap. Therefore, we did not launch an exhaustive meta-study weighing different variables in human dimension research against each other. Instead, we synthesize purposefully sampled works that highlight the relevance of those three aspects, bringing our intuitions stemming from practical engagement with the subject matter into a dialogue with these texts (cf. Soeffner, 1979). We seek to refine our initial assumptions and to gain a deeper understanding of the nature of the potentially underlying factors and processes, in order to develop a set of neat hypotheses that are backed by extant knowledge and pinpoint what remains to be explored. Thus, we hope to invite primary research on the matter.

Rationale of choosing Literature to review

Rationales of sampling literature for a review depend on the research discipline and the field of study. For example, in a natural scientific meta-analysis, researchers often seek to provide quantitative measures as well as a qualitative merging of all available studies on a given subject. Therefore, exhaustive sampling is an imperative. In contrast, in a qualitative evidence synthesis (Saini and Shlonsky, 2012) that provides an interpretative synopsis of primary qualitative research, so called "purposeful sampling" techniques are widely used and accepted as bearing strategic advantages over exhaustive sampling (Ames et al., 2019). From the vast corpus of research that addresses human-wildlife relationships, the first author purposefully sampled literature from natural sciences and the humanities, as well as cultural sources that offer complementary perspectives. Specifically, she chose references according to the combined strategies of criterion

sampling and theoretical sampling as described by Suri (2011) for research syntheses. Criterion sampling denotes the strategy of selecting works for review that match a certain epistemic interest of the reviewer. In our case, these were thematic criteria: We were interested in works on wolves, corvids, and spiders that preferably investigate deep-seated reasons for appraising these animals positively or negatively. Theoretical sampling denotes the strategy of sampling sources that consider concepts which are meaningfully related to the initial hypotheses and emerging insights. In our case, the initial assumptions suggested by practical work in the sphere of human-wildlife relations, embraced the concepts of (world-)views on nature, control motivation and/or symbolic associations to darkness. Therefore, we included works into the review that fulfilled two or more of the following characteristics:

- 1) works on wolves, corvids, and spiders;
- 2) works that explore variables or issues related to deep-seated sentiments toward wildlife;
- 3) works whose topics are related to the initial assumptions, i.e. the role of worldviews, control, symbolic associations (particularly darkness) in human-wildlife relations.

We sampled references in an opportunistic manner (Suri, 2011) and then sorted them into broad categories of academic disciplines: ecological facts, social scientific perspectives, and cultural views. These build the sub-sections of the review chapters headlined by kind of wildlife.

Ways of analyzing the Literature

Our review is akin to a qualitative evidence synthesis (Saini and Shlonsky, 2012) in form and intention, yet we include not only qualitative, but also quantitative primary research as well as cultural works in our synthesis. We use a content analytic approach to interpret and interrelate information from the different sources (Lamnek, 2010, p. 434–497). Specifically, for interpreting the meaning of the texts with regard to our research objective, we rely on the rationale of Objective Hermeneutics (Oevermann et al., 1979). This means that the act of interpretation is aimed at deducing an objective truth inherent in the text, which thus may serve as a standard against which the adequacy of the initial hypotheses can be measured. For synthesizing and interrelating the various works, we pursue the meta-ethnographic approach of translating concepts from different references into each other by metaphoric correspondences (Benoot et al., 2016). This means that texts differing in genre and objective, e.g. research studies and cultural narratives, may still be analyzed with regard to potential common themes if a reasonable metaphoric correspondence can be established between their key concepts.

REVIEW

Wolves

Ecological Facts on Wolves

Natural scientists' research on Central European populations of wolves (*Canis lupus*) has largely focused on wolf ecology from

perspectives such as behavioral biology (Reinhardt et al., 2013), e.g. foraging (Ansorge et al., 2010), the potential value of wolves as apex predators for ecological networks (e.g. Painter et al., 2015), or wolves' dispersing behavior (Reinhardt et al., 2019). They are also devoted to the question of whether wolves pose a threat to humans that is loaded with significant potential for raising intense and polarized reactions in people. Linnell et al. (2002) state that most documented cases of attacks on humans have been committed by wolves affected by rabies or have occurred in defense, but that predatory attacks cannot be ruled out today. Still, they point out that the probability is quite low and "wolves are among the least dangerous species for their size and predatory potential" (ibid.: p. 5). Another potential source of strong emotions is human-wolf competition for the same resources, particularly game and livestock (Ansorge et al., 2010). Albeit wolves do not regularly have a significant quantitative impact on the bag of game shot by human hunters (Wotschikowsky, 2006; Nitze, 2012), and at least for red deer, do not affect choice and use of habitat (Nitze, 2012), the presence of wolves is suspected to impede the harvesting of game animals (Gärtner and Hauptmann, 2005). While livestock constitutes a small fraction of wolf diet, potential depredation on livestock that is kept grazing in open pastures has become a serious issue in areas recolonized by wolves (Ansorge et al., 2010), necessitating protective measures for livestock herding (Reinhardt and Kluth, 2007). As a review by Bruns et al. (2020) shows, the likelihood of livestock falling prey to wolves can be considerably lowered by effective protection measures, namely a combination of electric fences equipped with freely moving flags, and guarding dogs. Complementarily, different forms of compensation schemes are proposed, e.g. the concept of "payments to encourage conservation", suggesting to pay local communities affected by the presence of predators to represent and ensure the arguable "existence value" of predators for society at large (Dickmann et al., 2011).

Management practices have moreover focused on monitoring wolf and prey populations, and marginalizing the potential for wolf attacks on humans by maintaining wolves' fear of humans (Linnell et al., 2002). Also, with packs being established across national boundaries and individual wolves migrating over large distances, researchers address the need for trans-boundary cooperation in managing the Central European wolf population (e.g. Reinhardt et al., 2013).

There is growing awareness in the natural sciences of the importance of the human dimension in managing wolves: The source of emotionally intense and polarized debates not just lies in socioeconomic considerations, but differing management practices and political concepts align with two opposing perspectives on wilderness, either as being separated from or as coexistent with human land use (Chapron et al., 2014).

Social Scientific Perspectives on Wolves

A recent representative survey on attitudes toward wolves in Germany (Institut für Demoskopie Allensbach, 2020) shows that 21% of the population favor expansion and strict protection of wolf populations. 54% of respondents endorse a controlled expansion and a restricted protection of wolves, whereas 24% of people advocate that the recovery of wolf populations be

prohibited altogether. Compared to a list of 18 further wildlife species with expanding populations in Germany, this makes wolves range among the four species whose unrestricted recovery Germans favor the least (after racoon, brown bear and racoon dog). When asked explicitly, 38.5% of respondents say they are delighted about wolf recovery, 33.5% say they are worried and the remaining 28% say they are undecided. These topical results from Germany are in accordance with studies that correlate sociodemographic variables with pro- and anti-wolf attitudes. These studies show that societies are split in about half with regard to strictly positive or negative attitudes (Bjerke et al., 1998; Williams et al., 2002), with quite a large number of people accepting wolf recovery under certain restrictions. Higher age, rural residence, ranching, farming and hunting occupations tend to be associated with dislike of wolves, whereas science-based knowledge of wolves, higher education and income, and pro-ecological political stances tend to go with more positive attitudes (Kellert, 1980, Kellert, 1985; Hunziker et al., 2001; Williams et al., 2002; Skogen and Thrane, 2007; Arbieu et al., 2019; Institut für Demoskopie Allensbach, 2020). Some of the results seem to be contradictory: For example, in some studies, living in an area where wolf populations have recovered, attitudes are more negative, while other studies find the reverse (Hunziker and Mondini, 2013). In any case, not only spatial, but “social distance” to wolf issues needs to be taken into account: Wallner and Hunziker (2001, p. 195) propose that the degree to which people in an area identify and solidarize with local groups holding strong pro- or anti-wolf attitudes also impacts their personal position. For a detailed overview of results of years in sociodemographic research on humans and wolves, see Williams et al. (2002) and Hunziker and Mondini (2013).

However, Hunziker et al. (2001) found that sociodemographic variables only explain a small portion of the existence or lack of acceptance of large predators and that “more deeper-seated reasons play an important role” (ibid.: p. 302). Namely, generalized nature-related attitudes, in particular whether people understand nature “as a partner” or as an “enemy” (ibid.: p. 324), and broader value orientations, i.e. post-modern or traditional values, or a personal sense for orderliness, shape pro- and anti-wolf attitudes.

In a similar vein, Skogen and Thrane (2007) show how the sociocultural factors are associated with pro- and anti-wolf attitudes via deeper-seated “latent” variables such as the values associated to nature, political traditionalist views, and (dis-)trust in scientific vs. local knowledge. Kaltenborn and Bjerke (2002) find: “Negative attitudes toward large carnivores have as their value basis a concern for personal and family security, health, respect and loyalty for elders and traditions, and for economic income and social power. In contrast, positive attitudes toward carnivores seem to be related primarily to concern for the ecocentric values, but also to values like curiosity, excitement, and variation in life.” (p. 60–61). Wilson (1997, p. 453) concurs: “Wolves are merely symbols delineating the battle lines of a much larger conflict. Three underlying social issues drive the debate: 1) differential access to social power, 2) conflicting ideas about private property, and 3) divergent beliefs about nature.”

Hunziker and Mondini (2013) point to a specific deeper-seated factor—control—as relevant to human-wolf relations: “[N]ature values stressing the importance of manmade control [...] are associated with negative attitudes toward large carnivores.” (ibid.: p. 18). There are tangible and symbolic layers to “control”: Bjerke et al. (2000) investigate a variable called “locus of control”, which expresses the antithetic beliefs that either external factors, e.g. other people or fate, govern one’s personal situation (external locus of control) or that the decisive power lies within oneself (internal locus of control). They show that negative attitudes toward large carnivores tend to be predicated on an external locus of control; a recurring finding thus stated by Tønnessen (2016): “the wolf is a symbol [...] of governmental interference in local issues”, as well as for the themes pervasive in political and societal discourses: “freedom and authenticity” (ibid.: p.76). “Control” as a factor is also tangibly present people’s perception of wolves as being dangerous: Notably, a significant component of fear of wolves is the appraisal of them as uncontrollable and unpredictable in their behavior (Johansson and Karlsson, 2011; Johansson et al., 2012). Other authors suggest that human-wolf conflicts may be underpinned also by a symbolic reading of “control”: Kellert (1985) says: “The American settler [...] perceived wilderness as Godless and an obstacle to subdue and conquer. The wolf, as denizen of the wilderness, symbolized all that needed to be vanquished. Subjugation became for many a sign of moral duty and obligation, as well as expressive of one’s power” (ibid.: p. 168). Kellert argues that the negative associations of the past continue to be influential today and impact on current thinking about and acting toward nature: “the wolf and coyote, and the predator in general, have become a symbolic focus for our ongoing debate regarding the goals of wildlife management, as well as human ethical and moral relatedness to the nonhuman world.” (ibid.: p. 168). Against this background, his summary of the attributes that polarize public opinion of wolves can still be considered canonical: “Negative perceptions of the wolf [...] could be related to fears regarding their dangerousness, responsibility for causing human property damage, predatory and carnivorous nature, wilderness association, and cultural and historical antipathies. On the other hand, more positive impressions of these animals might derive from their large size, advanced intelligence, phylogenetic relatedness to human beings, and complex social organization.” (ibid.: p. 173–174). Based on concurring assumptions, Caluori and Hunziker (2001) have identified three types of attitude structures toward wolves: First, the “modern wolf opponent”, for whom “the wolf is a symbol of the wilderness, which for them has negative connotations and which they contrast with a tamed inner nature”. Second, the “postmodern wolf proponent”, to whom “the wolf symbolizes the wilderness [...] with positive connotations. It represents “power”, “strength”, “self-assertiveness”, “change” and the opposition to the destruction of the environment and the demystification of nature.” Third, they identified a type termed “ambivalent wolf proponent”, who “sees the wolf as a positive symbol with a Janus head, where one face is that of the socially conformist member of a pack and the

other that of a self-reliant and independent animal.” (ibid.: p. 169).

In sum, the authors reviewed in this section trace the emotional intensity and controversy with which wolves are met to people’s diverging views on the human-nature relationship more general, in particular on the desired degree of control exerted over nature, as well as to different people’s diverging metaphoric associations to wolves.

Cultural Views on Wolves

Blatantly opposing depictions of wolves can be found between cultures. Within the universal animistic idea of ontic continuity between human and animal essences (Tylor, 1871; Pedersen, 2001; Descola, 2014), wolves are often regarded as kin to humans, or as mutually sharing traits with humankind. For example, in many Native American tales (e.g. in the corpus collected by Burke, 2013), wolves are outstanding hunters and benevolent helpers to humans. For the Roman culture, the she-wolf nursing Romulus and Remus is an integral part of its founding myth, and there is positive heroic association between warriors, wolves and the Roman God of War, Mars (Wallner, 1998). Norse and Germanic mythology knows of numinous wolf figures, e.g. the god-devouring beast Fenrir and wolves Geri and Freki who accompany the principal god Odin and whose names translate to “greedy” and “ravenous” (Tønnessen, 2016). Conversely, the Saami have singled out the wolf among other predators threatening their reindeer as particularly threatening, cruel and horrific, yet as being endowed with unparalleled magic powers (Lindquist, 2000). Navajo stories speak of witches who are wolves, and according to Russian, Eastern European and Scandinavian tales, it was the devil who created wolves or helped malignant human beings turn into werewolves (Wallner, 1998; Meurer and Richarz, 2005). The werewolf myth is one of the most prominent expressions of the idea that the ontological realms between humankind and wolves are permeable, which “can be traced back to the earliest records of civilization” (Frost, 2003, p. 3–4). Either as a modern-day legacy—or as an ongoing instantiation of the underlying anthropomorphizing mechanisms (Urquiza-Haas and Kotschal, 2015)—of this projection of attitudes, physical and metaphorical wolves are often judged in human moral terms, e.g. as criminals (Knight, 2000). In traditional Han Chinese (Teng and Yin, 2008) and in many European cultural renderings, pertinently in Grimm’s fairytales, but notably also in Aesop’s fables (Aesop and Gibbs, 2008), the wolf exclusively appears as a mischievous villain: At best he is an uncultivated, dumb scoundrel, at worst, he is an inherently wicked creature. Opposing depictions of wolves can also be found in Operas (Keller, 2001): “German operas of the earlier romantic convey mostly a positive image of the bear, lynx and wolf, but in operas from Slavic countries and in German 20th century operas all three animals have a negative image.” - representing the respective Zeitgeist of those eras (ibid.: p. 105).

Analytic Psychologist Brigitte Egger (2001) lays out how such ambivalent meanings within and across cultures may constitute a pattern: The mental image of predators symbolically contains the opposing yet interwoven poles of masculine self-assertion and

feminine self-renewing connectedness to creation. Wolves, in this reading, are symbols for the creative life force that shows itself in those contrasting ways. Egger proposes that a person’s and a society’s attitudes toward wolves are mirror images of their attitude toward self assertion and self-renewal. “A lack of acceptance of wolves thus mirrors people’s repudiation [...] of their own predatory nature and the darkness within themselves.” (ibid.: p. 76–77). In a strikingly similar manner, the figure of the werewolf is thought to represent the shadow aspect of human nature. Literally translating into “man-wolf”, the image implies that buried within the human mind lies our beastly legacy that may break through the civilized surface at any time (Frost, 2003).

Predominantly the negative parts of ancient cultural prejudices also express themselves in—and are in turn inspired by—the images, phrases and words employed in common language: Tønnessen (2016) and Dingwall (2001) provide comprehensive discussions of the wolf-symbolism ingrained in different languages, for example:

- “varg” in modern Swedish is derived from Old Norse and Old English words for “felon”, “criminal”;
- pertinent phrases in everyday language draw on the image of wolves’ proverbial voraciousness and dangerousness, e.g. “hungry as a wolf”, “to be “thrown to the wolves””, “to keep the wolf away from the door”, to be “dancing with wolves”, and to be “a wolf in sheep’s clothing”;
- “wolfish”, “wolf-whistle” and other expressions in British English that refer to sexual desire are the most frequently occurring proverbs featuring the wolf; likewise “in French “avoir vu le loup” [to have seen the wolf] used to refer to a girl who was no longer a virgin” (Dingwall, 2001, p. 111, p. 111)
- in some languages, wolves are associated to real and metaphoric darkness: the Norwegian “ulvetid” signifies a “time of no peace [...] everyone in combat [...] with each other” (Tønnessen, 2016); in Swedish, “vargtimmen” is “the hour of the wolf”, i.e. “the hour before dawn when people often die”; and in French, “entre chien et loup” signifies the twilight that is still “so dark you cannot distinguish a dog from a wolf” (Dingwall, 2001., p. 111).

Much of the emotional vigor inherent in negative wolf imagery has its origin in Christian religion (Dinzelbacher, 2012). Particularly, in Europe, Christianity literally demonized wolves, presumably in order to antagonize ancient pagan practices of worship (Tønnessen, 2016). Albeit religion itself has ceased to pervade people’s lives, the meanings which Christianity ingrained in collective imagery of European societies arguably persist. Despite the fact that we know many objective facts about wolf ecology today, in growing up, children pick up the meanings inherent in that shared set of symbols, metaphors, proverbs and stories (Tomasello et al., 1993; Papoušek, 2007). Perpetuating these meanings, recent western stories also depict wolves as epitomes of evil. For example, the well-known tale “the Wizard of Oz” (Baum, 1900) recounts how the Wicked Witch of the West sends out a pack of great wolves to devour Dorothy and her companions. In Tolkien’s “The Lord of

the Rings” (2012), Sauron breeds wolves into a demonic form called “wargs” that fight in the armies of the evil side. Likewise, a rich corpus of existing wolf symbolism can be found in media accounts which are fueled by and in turn reinforce the stereotype of a “Big Bad Wolf” (Jürgens and Hackett, 2017).

Yet, an ancient veneration for wolves seems to have tacitly defied a negative imprint in many common given names like Wolfgang, Rudolph, or Ulf. Also, positive wolf-symbolism revives today. Wilson (1997) states that “the wolf is much more than just the wolf—it is a symbol of ecological reconciliation, a return to wholeness” (ibid.: p. 463). He says that physical wolves embody “potent metaphors” (ibid.: p. 454) that ultimately raise a question about “the ‘proper’ role of humans in the natural landscape” (ibid.: p. 464). In this respect, wolves, as animals and as symbols, are intimately related to the notion of biophilia. Biophilia describes the idea that “[b]uried within the human species lies a deep and enduring urge to connect with living diversity”, an “affinity for live and lifelike process” (Kellert, 2003, p.1). When wolves are symbols for primordial wilderness, pro-wolf attitudes neatly align with the concept of biophilia. Conversely, this concept seems to be challenged by instances of human-wolf conflict, as despising of elements of nature, e.g. wolves, seems to contradict the idea of an ingrained human connection to nature. Kellert offers several ways to reconcile this challenge. For example, conflicts could constitute particular ways of “connecting” to nature, e.g. by “fear and loathing” (ibid.: p. 152), or can be traced to ways of (re)negotiating that connection, e.g. by “the urge to master” (ibid.: p. 121). He suggests also that biophilia might be competing with other basic human needs, e.g. the “tendency” to “avoid [...] injury and death” (ibid.: p.152), or that human-nature conflicts reflect an ontogenetic development in which the allegedly natural inclination to biophilia is perverted, e.g. when certain animals are imprinted with a negative association, as the wolf in fairytales. Any way, the assumption that some form of deep connection to nature is ingrained in humankind would readily explain why people are so intensely affected by, e.g., human-wolf conflicts, and that their reactions to these conflicts are polarized as they evoke people’s different individual expressions of biophilia. As Kellert notes: “The common link between those who love wolves and those who loathe them is the intensity of their feelings and reactions to this animal. The wolf reflects how certain natural elements, such as large predators, tend to provoke strong passions” (ibid.: p. 152).

Summary on Wolves

Wolves whose populations recover in Central Europe challenge people’s relation to nature and upset many deeply held beliefs and sentiments associated with that relation. As predators, wolves potentially impact game density and livestock and could harm humans, and they are metaphorically associated with notions of evilness and numinousness. The emotional vigor with which wolves are received is related to the fact that they activate practical considerations about whether and how humans may stay in control of wolf behavior and wolf-related political issues. People’s polarized attitudes refer to diverging core beliefs about the role of humans in nature.

We conclude that people’s reactions to wolves may be so intense and polarized since discussing wolves necessitates negotiating subconscious imagery and worldviews.

Corvids

Ecological Facts on Corvids

In this paper, we focus on the common raven (*Corvus corax*); rook (*Corvus frugilegus*); and carrion crow (*Corvus corone*). Having similar appearances, the three species are not accurately differentiated from each other by the general public or by the media. There are four widely reported areas of conflict that humans may have with these corvids: 1) Ravens and carrion crows are accused of killing or injuring newborn livestock, and of endangering small game and passerines; 2) parliaments of rooks nesting in city parks bother some of their human neighbors; 3) rural rooks are held responsible for destroying crops; and 4) and all three species often outsmart many human attempts to stop their unwanted behaviors.

- (1) For laypeople, it seems almost habitual to charge corvids with murder given the upsetting sight of large flocks of black birds roaming pastures and feeding on the carcasses of newborn lambs. However, years of research in different parts of Germany show that they mainly feed on stillborn animals, feces and afterbirths. Corvids do take advantage of adverse conditions (for example, due to cold weather, a weakness at birth, disease, or insufficient motherly care) allowing them to prey upon moribund lambs and calves in flocks that are not well tended (Brehme et al., 2001; Hennig, 2018). Dwyer et al. (2016) assert that losses can be minimized or averted by improving husbandry practices. Similarly, observing corvids preying on other passerines and small game may appear dreadful. Yet, an alleged damage that corvids afflict on small game and singing bird breeding populations is not confirmed by scientific investigation (Côté and Sutherland, 1997; Madden et al., 2015; Lachmann and Arnold, 2019).
- (2) Regarding the impact of corvids on crops, Gerber (1956) found that rooks do feed on unprotected seeds and germs. However, their preference for animal protein also resulted in the birds eliminating large numbers of insects and small mammals and thus protecting crops against pests. While the extent of losses and benefits show large variations across geographic areas, different soil conditions and the types of crops being grown, rooks have a net positive effect on crop growth. Veh (1981) replicates these findings for a region in southern Germany. Yet she notes that the use of insecticides reduces corvids’ benefits to farmers.
- (3) Townspeople rarely are affected by corvids’ potential impact on livestock and crop farming but may come into direct contact with corvids in their immediate neighborhood: Over the past twenty-years, parliaments of rooks have abandoned their traditional nesting sites in the open landscape and resettle in cities (Kegel, 2013). Possible reasons for their and other corvid species’ rural exodus include loss of and structural changes in their previous habitats through deforestation and intensification of agriculture, hunting (Krüger and Nipkow, 2015) and food availability in cities.

Some of the people living adjacent to rookeries often complain about the noise the birds generate. Objective measurements of sound intensity find that the noise of rooks' croaking is usually less intense than the nearby traffic (Hold 2010) and rarely exceed the DIN-guideline values for noise control in settlements (Haferkamp and Kiwitz, 2015). However, no guidelines exist for what are expectable levels for natural sounds which, due to their particular sound profile and the discontinuous nature, may be more difficult to ignore. Moreover, neighbors of rook colonies often find themselves adversely affected by the birds' feces fouling cars, pavements and terraces (Dame, 2012). Conversely, others who also live in proximity to rook colonies tolerate the birds' presence either with equanimity or even greet them as an example of nature amid the city.

- (4) Another potential reason for corvids to garner ambivalent reactions from humans is their ability to solve cognitive problems, providing them with the ability to circumvent repelling measures. Corvids exhibit a wide range of complex cognitive and emotional skills in both laboratory setting and their natural environments. These range from tool-making (Weir et al., 2002), elaborated social cognition (Clayton et al., 2007), Theory-of-Mind-like abilities (Dally et al., 2010) to episodic-like memory (Clayton and Dickinson, 1998), future-planning (Raby et al., 2007), a sense of fairness (Massen et al., 2015) and quantitative reasoning (Ditz and Nieder, 2015). Ravens have been found to cooperate, not only with conspecifics, but arguably also across taxonomic classes, e.g. they associate and have been found to cooperate with wolves (Stahler et al., 2002; Heinrich, 2014). Corvids' intelligence is also demonstrated in often unsuccessful attempts to repel them from crops or human neighborhoods (Krüger and Nipkow, 2015). Their persistence may appear as intentionally defying human control (Despret, 2015); interpretations that may help to explain strength of emotions and the disagreement between peoples' reactions to them.

Social Scientific Perspectives on Corvids

Probably due to the relatively small impact of corvids on human life—e.g. compared to wolves – there is a relative paucity of research on the human dimension in conflicts with corvids. Kellert (1985) compiles a list of the least-liked animal species. In this list, crows score third after wolves (least liked) and coyotes (second least liked). In his interpretation of results, however, Kellert does not discuss the case of crows further. The only study that we could muster that is specifically targeted at human-corvid relations is a thesis by Hereth (2003). She finds that in Germany, all social groups investigated show low levels of knowledge of corvid biology, for example people ignore that corvids belong to the sub-order of passerines and instead expect them to be birds of prey. Concordantly, the pertinent prejudices—that ravens and crows kill livestock and endanger small game and songbirds—are pervasive. Hereth proposes that the societal debate about lamb-killing ravens and crows may be a

“surrogate war” (ibid.: p. 206, first author's translation) that evokes emotional vigor based on a symbolism that has conventionalized lambs as epitomes of purity and innocent sacrifices, thus rendering corvids malicious murderers. Here, we may draw a connection—not drawn by Hereth—to Terror Management Theory (Rosenblatt et al., 1989; Greenberg et al., 1990): Terror Management Theory traces manifold human motivations to the fear of dying. The “terror” of corvids' scavenger nature may be sourced also from the fact that crows—proverbial gallows birds—are implicitly related to human mortality. Interestingly, Fritsche et al. (2008) found that the terror of mortality and its effects are even more pronounced when people's sense of control is low.

Human-corvid relations may be impacted by another deep-seated mental dynamic: Schaller et al. (2003) investigated “fear of the dark” and found that “[d]arkness may be associatively linked to thoughts of evil, death, and danger; it may automatically precipitate emotional responses consonant with those thoughts.” Their study is targeted at social stereotypes, but we may assume that the negative connotation of darkness may have practical consequences for human-animal relations. For example, black-coated animals in shelters wait longer for adoption (Bodderas, 2014). Corvids as black-feathered creatures may evoke the tendencies to dread darkness which spurs part of the emotional vigor in reactions to corvids.

These studies shed light on why corvids may evoke intense negative reactions. The following section offers clues as to how that same symbolism may evoke intense positive sentiments toward corvids as well.

Cultural Views on Corvids

A multitude of cultural displays in various cultures feature corvids (Riechelmann, 2013), and they appear as ambivalent characters both across and within stories. The most striking example is Raven, the “principal mythical figure” (Goodchild, 1991, p.1) in the mythology of many cultures at the North-West Coast of North America, Eastern Siberia and other sub-arctic groups. Raven is a trickster, a powerful jester-like character. Raven is the creator of the word and of all its entities, but at the same time, as a “benevolent mischief-maker” and “affable scoundrel”, he breaches the rules of his own creation and suffers the consequences. His traits include “audacious wit”, a strong ego, shape-shifting, love of play, greed, mannerlessness, an inclination to lying, theft, gluttony and imprudence (Nelson, 1983, p. 19).

As evidenced in the corpus collected by Burke (2013), many further Native American societies profusely tell tales of corvid figures which strikingly often deal with the question of how corvids earned their black feathers. One of the recurring themes in these tales is that a corvid brought the light into the previously dark world by stealing the sun from a potent spirit. Likewise, Greek mythology explains how corvids turned black: A raven divulges to Apollo that his beloved Korone has been unfaithful. The god stains the previously white bird black upon killing Korone and regretting his deed. Obviously the blackness of ravens, rooks and crows is a particularly salient feature that calls for etiological accounts. There are many more parallels in

corvid stories across vastly different cultural groups: For example, traditional Japanese and Australian indigenous cultures tell raven tales similar to Native American peoples (Riechelmann, 2013), and some of the creation-myths associated to Raven bear striking resemblance to biblical tales, e.g. of the deluge which in its Christian version also features a corvid as a side-character.

In Central European cultural traditions, ravens occupy an important role in Norse and Germanic mythology: Odin is not only accompanied by two wolves, but also by two ravens, Hugin and Munin, whose names mean “thought” and “memory”, signifying parts of the god’s soul (Meurer and Richarz, 2005). The Valkyries that guide the chosen ones of fallen heroes to Valhalla are said to bear black-feathered dresses (Würdinger, 1988).

Christian traditions tended to demonize the birds that have taken such a strongly positive role in Heathen belief, despite the fact that the Christian bible knows of benevolent corvids that, e.g. bring food to several starving saints and prophets. In medieval Europe, crows have been associated to witchcraft (Reichholf, 2013). Consequently, as for wolves, Christianity contributed to substantiating the negative side of Western people’s collective images of corvids (Würdinger, 1988). Another strand of mythological heritage that inspires modern corvid symbols are Aesop’s fables (Aesop and Gibbs, 2008). They depict corvids in a double-edged way. Ravens are portrayed as wise and endowed with prophetic powers, or as rather complacent, awkward creatures with a jester’s license. Stories often contain deprecating references to his scavenger nature. Crows are depicted as using their cunning to satisfy their voraciousness in manifold malicious ways, and to augur unfavorable fates.

More recent renderings of corvids draw on the same strands of ambivalent symbolism. Notably, Edgar Allan Poe’s (1845) widely known poem is an outstanding depiction of “the raven” as the epitome of darkest other-worldly numinousness that with his hope-shattering wisdom augurs inescapable despair. In “The Wizard of Oz”, Baum (1900) lets the Wicked Witch of the West send out “a great flock of wild crows” as an augmented menace to Dorothy and her comrades after the wolves have failed to kill them. In “The Lord of the Rings”, Tolkien (2012) also employs the pertinent symbolism of corvids being the henchmen of evil: The crebain spy for Saruman after he has pledged allegiance to Sauron. The inarguable most pertinent piece of art that draws on the proverbially “dark” side of the collective image of crows and, in turn, shapes it, is Hitchcock’s thriller “the birds”. This film “in a way does for corvids what Steven Spielberg’s ‘Jaws’ did for white sharks: it popularizes the connotation of these animals with evil” (Riechelmann, 2013, p. 88, first author’s translation). Simultaneously, charming jester-like crows also find their expression in artwork, like Wilhelm Busch’s “Hans Hucklebein” (Reichholf, 2013). The impact the powerful depiction of a three-eyed raven in the widely-received “Game of Thrones” saga on the collective image of corvids, remains to be seen. One uncanny association to corvids recurs across times and cultures and seems to be of particular importance: the ecologically founded connection of corvids to human death (Reichholf, 2013). The collective image of corvids appears to bear traces of an ancient, yet transgenerationally

conveyed past when the scavengers accompanied ravaging hordes and fed on publicly executed persons (Kegel, 2013). Evidently, the symbolic significance of blackness as visual expression of evil and death has been fueled by artwork throughout Western cultural history and is still vibrant today (Würdinger, 1988; Reichholf, 2013). One uncanny association to corvids recurs across times and cultures and seems to be of particular importance: the ecologically founded connection of corvids to human death (Reichholf, 2013). The collective image of corvids appears to bear traces of an ancient, yet transgenerationally conveyed past when the scavengers accompanied ravaging hordes and fed on publicly executed persons (Kegel, 2013). Evidently, the symbolic significance of blackness as visual expression of evil and death has been fueled by artwork throughout Western cultural history and is still vibrant today (Würdinger, 1988; Reichholf, 2013). More generally, the very same features that fascinate and polarize people with regard to corvids today—their intelligence, their perkiness, their black feathers—seem to mirror the very qualities artfully portrayed in the raven tales of ancient cultures. Correspondingly, the current instances of human-corvid relations are as ambivalent as the mythological depictions within and between societies. Some authors actually suggest that the mythological “subtexts” associated to corvids shape people’s perceptions of corvids’ behavior and vice versa (e.g. Nelson, 1983; Riechelmann, 2013). When mythology and appraisal of physical corvids mutually inform each other, also the lines between animistic sentiments and the findings of ethology and comparative psychology become blurred (Urquiza-Haas and Kotrschal, 2015; Jürgens, 2017).

Given that beings which have pursued a different evolutionary path than humans still exhibit analogous mental lives, corvids may be seen to pose a threat to the human self-image. Riechelmann (2013) explains people’s intense reaction to corvids by referring to the fact that their intelligence shatters the phylogenetic lineage which presumably runs from the simplest to the most highly evolved mammal. In this vein, Nathan Emery (2004) opens his 2004 paper entitled “Are corvids feathered apes?” with a citation by Rev. Henry Ward Beecher: “If men had wings and bore black feathers, few of them would be clever enough to be crows”. Corvids seem to point to the fact that the “scala naturae”—which after all constitutes a deeply ingrained implicit rationale in humans’ appraisal of other species (Urquiza-Haas and Kotrschal, 2015)—needs to be revisited. Humans who entertain a self-image that depicts humans as the pride of—linear—creation may tend to disdain corvids, whereas those who believe in a network of nature containing knots of similar inherent value may tend to view corvids in a positive light. In any event, on a practical level, the flexibility in corvid behavior and the ways in which they routinely outsmart all sorts of antagonizing measures (Krüger and Nipkow, 2015), make them tangible instances of nature defying human sovereignty. Corvid “recalcitrance” (Despret, 2015, p. 58) to human dominion may moreover evoke deep-going sentiments of a loss of control that evoke emotionally intense reactions (Fritsche et al., 2008): Those who love to recognize and witness indomitable agency in non-human species will rejoice, whereas those who hold that non-human life ought to comply to human will, may be enraged.

In manifold ways, corvids also may be powerful in evoking biophilic sentiments. It is easy to see how they speak to the nine dimensions of biophilia explored by Kellert (2003): In direct positive ways, they relate to “empirical knowledge and understanding”, as when crows invading cities force humans to reconsider their position within and interaction with the non-human world; “communication and thought”, as corvids yield strong metaphors, “exploration and discovery”, since they profusely inspire research; “bonding and companionship”, when people feel in good non-human company in cities and on the apex position of the *scala naturae*; and “moral and spiritual connection”, as they richly populate mythology. In aversive ways, corvids relate to the dimensions of “material utilization”, when they are thought to bring about economic loss for farmers; “physical beauty”, given their black plumage; “mastery and control”, in light of their recalcitrance to antagonizing measures, and “fear and repression”, through their connection to death.

Summary on Corvids

Corvids who resettle in human spaces or whose voraciousness arguably contributes to increasing the economic hardships of farming professions, pinpoint how natural and human-made realms are interwoven. On a practical level, their resistance to antagonizing measures challenges the leverage of human land use planning. On a deeper level, their intelligence and recalcitrance challenge the idea that humans are the major agents or even sovereigns in nature, while their black feathers seem to underscore the somber intention allegedly motivating their deeds. Therefore, people’s intense and polarized reactions may stem from the fact that the practical challenges feed those deeper-seated and emotionally loaded dynamics.

Spiders

Ecological Facts on Spiders

There are at present thought to be 120 families, 4,149 genera, and 48,307 species of spiders (World Spider Catalogue 2019 <https://wsc.nmbe.ch>). The four commonly known genera and families in Central Europe probably are garden spider, longbodied cellar spider, domestic house spider, and wolf spider. To our knowledge, there are no empirical studies of how sophisticatedly spider species are recognized and differentiated by the general public. Based on the premise that with regard to the challenges in human-spider coexistence, virtually all spiders of the same size arguably are considered much the same by the average person, we will not differentiate between them in this discussion. Like wolves and corvids, spiders populate every continent (Bellmann, 2006) and have been pervasively present in the cultural history and ontogenetic development of humans (Lindeman and Zons, 1990). Still, most people know little about spiders. The most commonly known facts are the most alienating ones, for example many species’ use of webs and all spiders’ external digestion in foraging. Conversely, many ignore that spiders exhibit flexible behavior requiring elaborate cognitive skills: For example, their hunting in three-dimensional space involves elaborated spatial cognition and object permanence (Harland and Jackson, 2004). Instead of knowledge, many

people in Central Europe hold strong prejudices against spiders (Satorius, 2018). Their major concern seems to be the menace by spider bites. However, even poisonous species whose mandibles can pierce human skin will not attempt to bite humans unless they are squeezed. Still, spiders inadvertently evoke disgust and fear, and are perceived as dramatic by many humans—emotions that tend to outshine the fact that overall, humans rather profit from spiders as pest control instead of needing to fear potential economic loss (as with wolves or corvids).

Social Scientific Perspectives on Spiders

A representative survey of the sociodemography of pro- and anti-spider attitudes conducted in 2015 in Germany exhibits ambivalent attitudes in the German population: Half of the respondents consider spiders useful to humans; women report to be more fearful of spiders than men; 20% of respondents despise of spiders so much that they would immediately kill them, whereas 12% of respondents are convinced that spiders are fascinating animals. There is a high number of experimental studies on spider phobia. Phobic fear of spiders contrasts with, e.g., fear of carnivores which is based on cognitive elaboration (Johansson et al., 2012), however, brain imaging studies exhibit that spider-fear is based on similar brain functions than, e.g. fear of snakes (Åhs et al., 2009). Many studies employ visual-search paradigms and conclude that spiders, as “potentially threatening animal stimuli” are powerful in capturing people’s attention (Miltner et al., 2004; Öhman et al., 2001, p. 474). Another common experimental paradigm is the implicit association task. It shows patterns of prolonged reaction times when subjects are required to associate positive attributes to spiders, and comparatively shorter reaction times for spiders being associated with negative attributes. This provides evidence that many people implicitly appraise spiders negatively. Even people who report not to be fearful of spiders show pejorative associations; only spider-enthusiasts associate spiders with as positive attributes as butterflies (Ellwart et al., 2006).

Experimental studies moreover show, e.g., that fear of spiders causes spider-fearful participants to intuitively adjust their trajectory of movement to avoid approaching a spider picture (Buetti et al., 2012); and that “fear makes you stronger”, i.e. the physical strength of pushing a response button is higher when spider-fearful subjects thereby indicate that a spider target is present in a matrix, compared to indicating that a neutral target is present (Flykt et al., 2012).

These results showcase the subtlety and intensity of spider-fear which may explain part of the vigorous reactions of some people in human-spider encounters. Yet, there is virtually no empirical research that may explain the polarized reactions toward spiders, and why it is spiders and not, say, beetles or butterflies that cause these reactions. Öhmann et al. (2001) speculate about the “existence of specific [visual] threat features that are preferentially picked up by an automatic significance evaluator [...]. However [...] their nature still remains to be specified.” In other words: Social scientific research yet has no clue as to why and which specific features potentially cause phobic fear of spiders. We may tentatively draw on Serpell’s (2004) and

Kellert's (1985) research on there being two dimensions of appraisal for animals: utility and affect. Spiders score particularly high on "utility", but simultaneously meet many of the criteria that cause negative "affect": small size, -presumed-low intelligence, lack of aesthetics, low phylogenetic relatedness and dissimilarity to humans. Pointedly expressed, spiders seem to pit utility and affect against each other. Probably, whether people like or dislike spiders is predicated on which of these dimensions they consider more important.

Also, since spiders prosper in places deserted by humans, they may trigger notions of human mortality and loss of control in the sense of Terror Management Theory (Fritzsche et al., 2008), and thus evoke polarized and emotional vigorous reactions in humans.

Cultural Views on Spiders

Individual spiders are out-gunned by vacuum cleaners and brooms in human-spider conflicts, which often end up to be lethal for the spider. As an animal order, however, spiders seem virtually invincible and will always intimately coexists with humans. Kegel (2013) proposes that "in a world dominated by shining facades and modern technology, we experience bugs in the house as inopportune" (ibid.: p. 119, first author's translation). He complements these sentiments of many Westerners with reporting how other cultures have cherished spiders for their assistance in vermin control: from proglacial groups who, according to Kegel, painted spiders as beneficial helpers at cave walls, to contemporary societies in tropical countries who allow spiders "of monstrous size, as measured by European standards" (ibid.: p. 190, first author's translation) to live in their homes. As evidenced by those ancient cultural portrays, spiders seem to always have fascinated humans and human-spider relations are highly ambivalent within and across individuals and cultures.

Spiders do not star in any of Grimm's fairytales. One single fable of Aesop as recounted by Aesop and Gibbs (2008) features a spider and explicitly deems her an "insignificant creature". In Europe, the only pertinent reference to spiders is the myth of Arachne, the skilled weaver who is transformed into a spider by Athene in retaliation for outperforming the goddess's artistry. Contrasting the paucity of spider stories in ancient European traditions, spider characters richly populate the mythology and occupy a prominent role in the animistic worldviews of many native cultures: For example, Western-African societies tell tales of the spider spirit Anansi who is, i. a. credited with bringing the wealth of stories into the world (Horowitz and Bedrischka-Bös, 1993). Anansi bears striking similarities to Iktome, a trickster figure of the Lakota and other Native American groups. Iktome and Anansi are depicted in much the same way as Raven (see *Cultural Views on Corvids*): as an amiable, yet highly ambivalent character whose fleshly vices unceasingly lead them into difficult situations from which they recalcitrantly reemerge due to ingenious wits and power (see the stories collected by Burke, 2013). A different but equally awe-inspiring spider character is "Spider Grandmother" in Hopi culture, who is worshiped as a co-creator of the world and a benevolent care-taker of humankind (Malotki, 1998).

Other Native American groups tell variants of the story how the light came into the world not with a corvid, but with a spider as the principal character. Virtually all of these stories depict spiders as particularly wise and powerful beings, and are etiological accounts presenting the spider as a (co-) creative force.

The more recent cultural history of Europe provides a number of spider stories. A significant piece of work is Jeremias Gotthelf's (2007) novel "The Black Spider". In this tale, an obstinate woman makes a pact with the devil ending up birthing a plague of spiders and transforming into the cardinal "black spider" herself. The spider plague brings hardship and disease over the village and can eventually only be banned by a woman's virtuous self-sacrifice. Gotthelf depicted the "black spider" as an the epitome of the disastrous consequences of abandoning traditional Christian values and a god-fearing way of life. Gotthelf endows the black spider with many of the attributes that appear to be artistically articulated renderings of the physical qualities perceived in real spiders: a sense of them being "no where and everywhere" (ibid.: p. 73); the impression of menacing omnipresence and omniscience (p. 96) emerging from their seeming furtively lurking; their "horrendous", uncontrollable speed and unpredictable trajectory of movement (p. 76); an all-embracing dread of this alien, merciless and indomitable creature that seems to rejoice "gleefully" (p. 94) in the powerlessness of humans.

Similarly, in "The Wizard of Oz", after having allowed his heroes to defeat the wolves and crows, Baum (1900) worsens the threat to Dorothy and her companions by making them confront a "most tremendous monster, like a great spider" (p. 154). A similar trial awaits Frodo and Sam in *The Lord of the Rings* when they have to face the terrifying spider-demon Shelob on their way to Mordor (Tolkien, 2012).

A comprehensive collection of works on spiders has been edited by Lindemann and Zons (1990). They recognize four threads of recurring themes:

1. spiders as hideous creatures connected to physical and metaphorical darkness, e.g. Berthold von Regensburg's 12th century expiation sermons who uses the spider as a metaphor of evil against which he measures human vices (ibid.: p. 41);
2. spiders as allegory of impure and beguiling femininity, e.g. Paracelsus' *Tractatus Quartus* in which he describes how spiders emerge from women's menstrual blood (ibid.: p. 52);
3. spiders as symbols of political and societal upheaval, beginning with Ovid's Arachne who revolts against the supremacy of the gods over mankind (ibid.: p. 9);
4. spiders as emblems of artists' creative ingenuity, e.g. by Barthold Heinrich Brockes who in his early natural scientific book "Irdisches Vergnügen in Gott" praises that "nothing seems as rich in wonders as this repudiated animal [the spider]. Can any artist bear comparison to her?" (ibid.: p. 78, first author's translation).

While the first two threads are clearly negative in valence, the third is at least ambivalent and the fourth positively portrays spiders. The authors cite Schopenhauer who proposes that the

repudiation of spiders “seems to be caused by a deep metaphysical and mysterious reference of these animals” to “death, anguish and devilish sorcery” (ibid.: p. 154, first author’s translation). It seems that another way of putting this idea is that the “terror of death” (Rosenblatt et al., 1989; Greenberg et al., 1990) evoked by spiders overshadows the positive valence that might emerge from a neutral consideration of spider biology: For example, the fact that spiders’ webs are made to capture and strangle prey overshadows the diligence, ingenuity, and artistry of their weaving.

Thus, spiders cause a striking intensity and ambivalence of emotions. Contemporary authors writing on human-nature relations also refer to spiders as noteworthy cases: For example, Kegel (2013) states that our patterns of liking and disliking wildlife is irrational and may, i. a., be due to an animal’s “ways and speed of locomotion” that in the case of spiders with their “fast and abrupt moves” may seem particularly “threatening” (ibid.: p. 117). Kellert (2003) dedicates long paragraphs to spiders as examples for challenges to the notion of biophilia: “Insects, spiders and other invertebrates often defy human notions of normality [. . .]. Perhaps most disturbing, these creatures appear to lack a mental life: they reveal neither human-like emotions of warmth and affection nor the intellectual characteristics of rationality and choice. The mind and soul appear irrelevant to their existence.” He goes on to remark that “Our homes, offices, buildings, even hospitals, are routinely invaded by insects and spiders, defying our notions of human sanctity and omnipotence. Most mammals, birds, and other vertebrates flee from human presence; insects and spiders frequently seem unaware, possibly disdainful, of our existence” (ibid.: p. 155–156). Kellert’s consideration accords with a finding in the empiric research on mind perception: that people attribute minds to beings that they perceive as exhibiting agency, experience and affection (Urquiza-Haas and Kotrschal, 2015; Waytz et al., 2010). Simultaneously, “entities that act unpredictably evoke the need for control, and therefore seem more mindful than entities that behave predictably” (ibid.: p. 384). So, the unpredictability of spiders, which as a salient feature has profusely become the subject of cultural attention, makes them candidates for being perceived as possessing a mind. Thus, spiders seem to be a dilemma for human perception: Their alien nature makes us deem them mindless, whereas their uncontrollability makes us attribute them with “mind-ful” intentionality and agency. Also analogously to wolves and corvids, spiders’ uncontrollable and unpredictable behavior may challenge the “basic human desire” for control (Fritsche et al., 2008).

Summary on Spiders

Spiders are omnipresent in human spaces, and have the potential to evoke intuitive feelings of fear and disgust on virtually an everyday basis. Thus, they are constant reminders of the futility of human attempts to control nature. Useful as they may be, their secretive lurking for prey evokes associations of physical and metaphoric darkness that are deeply ingrained in Central European collective image of spiders. The vehemence and polarization of attitudes toward spiders may derive from

people’s diverging wants for control over a situation and from the fact that such a tiny animal seems to be capable of triggering controversial questions about the human-nature relation in general.

DISCUSSION

Synthesis of the Literature Review

Why do human encounters with wolves, corvids, and spiders tend to be so vigorous and polarized, and why do they appear similar in many ways despite the striking ecological dissimilarities between these animals? Our review suggests that ecological facts, social scientific perspectives and cultural views converge on three common threads that run through human-wolf, human-corvid, and human-spider relations: 1) people’s self-images and worldviews on the human-nature relation are involved; 2) differing wants for control over situations of human-wildlife conflicts are activated; and 3) symbolic associations to darkness form a part of the overlapping mental images that people hold of wolves, corvids and spiders. We now establish the meaning of these constructs by relating them to pertinent extant concepts of cognitive and environmental psychology, and philosophy.

The Idea of Man in Nature

As reviewed, different fundamental ways of relating to nature impact on the human relation to wildlife. Specifically, people’s “idea of man in nature”, seems to be triggered by encounters with wolves, corvids, and spiders. With that term, we tie in with the idiom “idea of man” to denote the worldview of a person with regard to the role or mission of humans toward the non-human world. This worldview serves as an “interpretation pattern” (Oevermann, 2001): a system of “knowledge, norms, values and interpretations” (p. 9, first author’s translation) on a deep level of consciousness. Interpretation patterns are lenses through which people view and understand reality, against which they measure behavior and by which they give direction to their actions. People’s “idea of man in nature” can be as fundamental as native cultures’ animistic worldviews (Harvey, 2017), in which wolves, corvids and spiders often are prominent numinous figures and are in close relation to humankind. A person’s “idea of man in nature” can also more subtly be expressed in the types of environmental attitudes coined by Kellert (1980): naturalistic, ecologicistic, humanistic, moralistic, scientific, utilitarian, dominionistic, aesthetic, neutralistic, negativistic; or in the types proposed by Bauer et al. (2008): “nature lovers”, “nature sympathizers”, “nature-connected users” and “nature controllers”. The “idea of man in nature” may embody values and beliefs pertaining to anthropocentrism vs. eco-/biocentrism (Callicott, 2004). And it might evoke a self-view of being either connected to or of being distinct from nature, e.g. as expressed in the opposing views of nature described by Linnell, et al. (2015) dualistic vs. biocultural view of wilderness), or by the separation vs. coexistence model of wilderness as described by Chapron et al. (2014). Strong yet potentially ambivalent biophilic sentiments that inextricably tie humans in to the

natural world (Kellert, 2003) may provide the emotional animation of “the idea of man in nature”.

Want for Situational Control

A want for control can be understood as an intrinsic motivation oriented toward the basic human needs for mastery and self-direction (Ryan and Deci, 2000). The strength of the motivation for control differs between people: Some seek strong influence, whereas others genuinely and deliberately choose to cede control and are willing to limit their own free hand in consideration of other agents. Wanting to control natural phenomena (e.g. the return of wolves, the settling of a rookery, or the encounter with a spider in the basement) constitutes a specific circumstance of instantiating the general motivation for control. Different degrees of “wanting situational control” in a specific human-wildlife encounter may express themselves in the form of practical control (e.g. the willingness to avoid littering in order not to attract wolves to a village); visual control (e.g. the wish to assess the trajectory of movement of a spider); cognitive control (e.g. assembling knowledge about how to behave in wolf encounters (cf. Johansson and Karlsson, 2011)). Within the framework of human-wildlife encounters, a “want for situational control” may thus range between the extremes of 1) seeking complete control over one’s own and the wildlife’s behavior, and 2) allowing for unrestricted unfolding of the ecological and social dynamics. People who seek high situational control over wildlife can be thought of as being motivated to realize their want for control directly. Conversely, the motivation of people who do not seek to control wildlife may be explained by the process of internalizing external values, whereby new quasi-intrinsic motivations are formed: People ceding situational control over wildlife probably have “integrated” environmental values to a degree that “transforms” the need for self-direction and renders the wish not to keep a check on wildlife a motivation in its own right that “emanate[s] from their sense of self” as if it was a genuine intrinsic motivation (cf. Ryan and Deci, 2000, p.60).

Mental Image of an Animal

We consider the “mental image” of an animal as a stereotype (McLeod, 2015): a system of physical to figurative attributes that describes the essence or a prototypical instance of the animal. This includes not only the biological criteria necessary to identify the animal as belonging to a particular species or genera, but also prejudiced pseudo-scientific qualities as well as culturally established and transmitted anthropomorphisms (Knight, 2000), and symbolic associations. For example, the “Big Bad Wolf” stereotype—a potential “mental image” that people may have of wolves—is formed by the merging of selected aspects of wolf ecology to a coherent mental figure (Jürgens and Hackett, 2017).

Notably, the literature review shows that people’s mental images of wolves, corvids, and spiders exhibit striking similarities. This is true with regard to the first two factors we just defined—“idea of man in nature” and “want for situational control”. Wolves, corvids, or spiders furthermore are all associated to darkness in a physical or metaphorical sense (cf. Egger, 2001; Schaller et al., 2003): Not only have wolves and

corvids, as scavengers, actually historically associated to dark times of warfare and despair throughout the centuries (cf. Meurer and Richarz, 2005). Wolves, corvids and spiders also seem to metaphorically evoke the shadow aspects of destruction and death in collective and individual human existence (cf. Frost, 2003). They thus serve as a powerful “memento mori” (Lindemann and Zonz, 1990, p. 3). However, the association to darkness may have a positive valence as well, as darkness is also a symbol for regeneration and renewal (Egger, 2001). If people’s mental representations of wolves, corvids and spiders thus overlap with regard to key factors determining the human relation to these wildlife, then these different animals may evoke similar mental processes and, accordingly, similar reactions in people. If this is true, as an application, it would be possible to transfer solutions found in, say, human-wolf conflicts to instances of human-corvid conflict.

Similarly intense and polarized Reactions to different Wildlife: A hypothetical Model

In this section, we explain how the three factors just defined, hypothetically operate in bringing about people’s reactions to human-wildlife encounters.

We assume that when people encounter a wolf, corvid, or spider, either physically or “virtually”, e.g. in a media report, their response is not just defined by the objective criteria of the situation.

Rather, encounters with these animals tie into subjective truths, confront us with existential motivations, and even cascade down deep into the archetypal semantics of our mental images. Vigorous reactions may result since human-wildlife conflicts touch on sensitive aspects of the *idea of man in nature*, raising questions of whether humans are part of or prescinded from nature, which rights and duties with regard to non-human beings result from our role, and whether we ought to be sovereigns over or sufferers from wildlife’s behavior. Thus, encounters with wolves, corvids, and spiders challenge an integral part humans’ individual and collective self-image. Moreover, people’s *want for situational control* is called upon permanently, as most forms of conflict with wolves, corvids or spiders constitute ongoing challenges that at the same time exhibit surges of becoming urgent. For example, with wolves expanding their territory continuously in Central Europe, both wildlife enthusiasts and shepherds in zones through which wolves migrate are latently strained. Likewise, neighbors of rookeries are entertained or “terrorized” (Wieland, 2013) non-stop during breeding season. Similarly, spider phobics live a life in fearful tension of the next appearance of a spider, being certain that it will happen, being left ignorant and seemingly at the spiders’ mercy of when it occurs. This constant internal and societal occupation with the (in)ability and (un)desirability of control over wildlife provokes an arousal that is considerable and likely contributes to the intensity with which wildlife are received. This might be further exacerbated by the symbolic associations to darkness and death that our *mental images* of wolves, corvids and spiders carry, particularly when the physical presence of these animals is actually perceived as threatening: when a suburban

citizen encounters a wolf near their backyard at night; when corvids are observed probing the vitality of a moribund lamb; or upon encountering a giant house spider lurking in the shady untidy corner of one's basement, or mind.

The polarization of people's reactions, we think, stems from the fact that the mental processes that underlie the overt response, operate according to the same mental logic, but operate on concepts of dissimilar contents for different people. For example, choosing how to deal with a wolf depredating livestock requires everyone involved to consult their *image of man in nature*, and interrogates every one's want for control. People consciously or subconsciously confront questions like "As humans, what are our rights and duties toward the non-human world?", "How much control am I willing to cede to wildlife?" Different answers to these questions result in polarized positions. Likewise, the eerie association to darkness as part of the *mental image* of the animal may lead to opposing reactions: The symbol of darkness is in itself ambivalent, and people may differ in whether they focus more on the pole of darkness as self-assertion, death and decay, or on the pole of connectedness, restful healing, renewal and recreation (Egger, 2001). Moreover, a person's individual mental stance with regard to mortality symbolized by darkness may make a difference: In someone who has confronted and integrated her mortality, darkness-associations triggered by wolf-, corvid-, and spider-encounters are less likely to evoke feelings of despair and fear than in someone who suppresses, disowns and denies her mortality. For an extreme example, in Gothic, Heavy-Metal and Neo-Shaman sub-cultures, that "dark side" of darkness is worshiped, i.e. quite paradoxically evokes positive reactions. Concordantly, wolves, corvids and spiders are specifically cherished by members of these sub-cultures (Lindquist, 2000; Moynihan and Söderlind, 2002).

Thus, differences in worldviews, needs for control and associations become actualized when the practical necessity to manage human-wildlife conflicts requires people to take a stance and result in polarized positions.

Furthermore, we assume that these factors interact and thereby reinforce the intensity and polarization of people's reactions. For example, if a person has a strong anthropocentric *idea of man in nature*, their reaction to the uncontrollable roaming of a spider might be particularly vigorous. Yet, if despite their intense emotional repudiation, they hold a *mental image* of spiders as useful, the vigor of their resulting overall response might be attenuated. Likewise, the variables' interactions might exacerbate or abate polarization: For example, in a heated controversial debate on indomitable wildlife, the worldviews about *man in nature* of members of opposing groups may become even more clear-cut and pronounced in the process of justifying and defending their respective positions (cf. Knight, 2000; Wallner and Hunziker, 2001). In turn, given the solidified opposition of the other side, people's perception of lacking *control* over the process may be aggravated.

Finally, the similarity of responses to wolves, corvids and spiders may stem from the fact that they have a similar potential to activate the aforementioned processes. When a person encounters a wolf, corvid or spider, these instances are

mapped onto the mental representations that people hold of those animals and may further elaborate these *mental images*. If the *mental images* of wolves, corvids and spiders exhibit congruences with regard to, at least, three key facets that shape human-wildlife relations—people's *idea of man in nature*, a *want for situational control* and associations to darkness—these wildlife concepts have the same mental causes and effects on thoughts and actions (cf. Fodor, 1998). In this way, dissimilar wildlife may cause a similar inner-mental reality to arise which, in turn, produces comparable reactions.

In sum, people's responses to wolves, corvids, spiders and arguably to other potentially problematic wildlife are the result of mental processes that run through conscious, reflective, as well as unconscious, implicit, layers of the human mind (cf. Egger, 2001; Hunziker et al., 2001), and likely involve iterative interactions between these (cf. Cunningham et al., 2007). Our theory is thus in accordance with (Urquiza-Haas and Kotrschal, 2015) explanatory framework for brain mechanisms forming representations of animals; and with "cognitive hierarchy models" that have been proposed to explain humans' reactions to nature (Stern and Dietz, 1994) and toward large carnivores (Bjerke and Kaltenborn, 1999; Kaltenborn and Bjerke, 2002).

Potential Applications for Management and Conservation

We have discussed wolves, corvids and spiders as three examples of wildlife that are dissimilar in terms of biology, but still evoke strikingly similar reactions in people. Since we hypothesize the three variables and the mental processes linked to them to be universal and latent in the human mind, potentially any animal may trigger them. If we assume that different species of wildlife evoke similar mental processes, we may draw on the same knowledge about the human dimension when conceiving of solutions to various sorts of human-wildlife conflicts, and some solutions derived in one instance of human-wildlife conflict may be transferred to seemingly different instances. We exemplify this by three creative ways to deal with wolves, corvids or spiders:

- **Letting off steam:** If the involvement of worldviews and potent metaphors cause human-wildlife encounters to be loaded with emotional vigor, then recognizing, accepting and giving vent to these emotions is an integral part of a solution, instead of seeking to circumvent or invalidate them. A brilliant example of this is a parade in (dis-) honor of crows in Charlottetown. This allows "everyone to let off some steam" with regard to the conflict in the community and to their contempt or fascination toward the crows (Duong, 2018). This is a perfect instance of what Egger (2001) proposes as a constructive transformation of the life force inherent in the symbolism loading people's mental images of those animals.
- **Active participation implements control:** If an integral factor in human-wildlife relations is people's want for control, a lot is gained by devising constructive measures

for people to exert control over the situation. Allowing for active participation in monitoring, e.g. by establishing, supervising and maintaining publicly accessible wildlife cameras (filming, e.g., wolves' dens), would help to gain a sense of control about "what is happening" and also to spread knowledge of wildlife. Moreover there are numerous non-conventional options that engage the local population in "controlling" wildlife, e.g. developing creative and fun antagonizing measures like a class of musical students giving a concert near a pasture frequented by wolves in order to chase them off the sheep, or near a site where rooks seem to begin nesting in order to drive them off.

- Endorsing the power of narratives: If the processes eliciting intense and polarized reactions operate on mental images, not on biological animals, then it is essential to carefully shape the collective and individual images of wildlife. Specifically, environmental education needs to start early and needs not only to provide factual knowledge and first-hand experience, but also needs to focus on positive metaphorical aspects. Specifically, awe-inspiring attributes and associations of the wildlife that are featured in myths should be showcased: In doing so, we can capitalize on the fact that the positive aspects highlighted in mythical tales are the attributes that people have found particularly striking and fascinating in those animals across times and cultures. This means that these attributes have proven to be particularly powerful in touching the human psyche.

CONCLUSION

In this paper, we integrate the results of various works on human-wildlife relations, and develop three hypotheses that explain people's comparably vigorous and polarized reactions to ecologically different wildlife:

- (1) We propose that the intense emotions arising in human-wildlife conflicts may be caused since human-wildlife encounters trigger people's "idea of man in nature", i.e. their overarching beliefs about humans' relation to the non-human world; activate a want for exerting control in challenging situations; and evoke symbolic associations to darkness.
- (2) We proffer that people's polarized reactions to human-wildlife conflicts derive from the fact that their worldviews and their degrees of seeking control differ markedly.
- (3) We show how ecologically different wildlife may evoke similar mental processes and, accordingly, the same

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reactions in people. We conclude that, therefore, transferable solutions can be developed based on those shared principles of different human-wildlife relations that may help to appease different cases of conflict.

Our hypotheses await scrutiny by investigations specifically targeted at a comparative analysis of human relations to ecologically different wildlife. Primary research may illuminate not only the nature and specific modes of operation of the factors which we identified, but also the impact of these factors relative to other co-determinants of human-wildlife relations, such as socio-economic aspects, knowledge, or plain fear. Our own research into these questions is underway. Yet, since our basic proposition, that ecologically different animals map onto similar mental representations and therefore evoke similar reactions in people, is wide in scope, we chose to offer it to a broad audience of fellow researchers that may be interested in investigating its merit. We hope to inspire interpretative as well as qualitative and quantitative empirical research. Judged by the yield of our eclectic synthesis, we believe that multi- and transdisciplinary approaches would greatly benefit the elucidation of the subject matter. After all, our results show that a cross-talk between disciplines and between managers of very different human-wildlife conflicts promises to be fertile for furthering our understanding—and the implementation—of human-wildlife coexistence.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

UJ developed the hypotheses, collected, reviewed and analyzed the literature and drafted the manuscript of this article. PH supervised and supported her work, provided complementing references, assisted with the writing of and honed the text.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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