

WOLF (*Canis lupus*) & RAVEN (*Corvus corax*):
The co-evolution of “team players” and their living-together
in a social-mixed group

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Summary Reference Document: Wolf (*Canis lupus*) & Raven (*Corvus corax*):

The co-evolution of “team player” and their living-together in a social-mixed group.

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The forming of “mutualistic relationships” between different species:

There are a lot of respectable examples from studies in the wild, which emphasize regular cooperation's between different species: polar bear & arctic fox, grizzly & red fox, coyote & badger or honey-display-bird & honey badger (Ganslosser 1998). Some mutualistic relationships are limited by time; others are long-lasting (Dugatkin 1997). In fact, a lot of different species are prepared to coordinate their predatory- and feeding behaviours. Kill sites are magnets for all meat-eaters. Wolves and bears tend to avoid each other; altercations between the two species are not unusual (Mech et al. 1998). Nonetheless, mutual tolerance may predominate. Consequently, grizzly bears and wolves were observed feeding together at kill sites. Afterwards, they often were resting in a distance of only 100 m to each other (Bloch & Radinger 2010). Wolves and magpies were observed near ungulate carcass, occasionally feeding together side by side. Magpies also mobbed and pecked wolves while resting.

On several occasions, wolves appeared even tolerant of coyotes. According to P. Paquet (1990) “two coyotes were seen within 5 m of wolf Midnight as he fed alone on a kill”. Additionally, juvenile wolves were sighted sharing food resources with adult coyotes (Bloch & Bloch 2002). The occurrence of interspecific dominance relationships between different species is by no means excluded. However, serious fights are occurring rather rarely. What we never see is some sort of “annoyance”: Not dominance in general, or the general confiscation of a large carcass through one predator, no uncalculated assessment of risk (Bloch & Radinger 2010).

Coordinated hunting efforts and interspecific communication:

Depending on both- individual personality and conditions, signalling and communicating their needs in a more or less “far-sighted way” is quite common in the animal-world. Under field conditions, the time window for well considered arrangements is never closed. Instead, every day it opens up a little more – for the advantage of all involved, who don't want to miss a great opportunity (Bloch & Dettling 2009). However, at kill sites aggressively underlayed body postures may be expressed (Bloch & Gibeau 2010). The striking intention for co-operation often transfers into coordinated efforts. Astonishingly, the “magic formula” for a time-limited partnership between coyote and badger at mutual hunts seems to be: Sometimes you win (and can finally consume small prey such as ground squirrels), and sometimes you loose. Nevertheless, you wait unimpressed and patiently for your next chance.

There is a lot of cooperation among different animals (Dugatkin 1997). However, smart chosen behaviour adaptations present some welcome options for both species involved in a mutualistic relationship. Encounters between bears and coyotes or bears and red foxes often go the same way. Most of the time, such encounters are completely thought through. There is always a possibility of forming successful food-partnerships near carcasses.

P. Paquet (1990) documented that coyotes also respond to real and simulated wolf howls. In one case, a coyote located 50 m from an occupied wolf den, joined a wolf chorus howl. To communicate for an indefinite time, creates some useful opportunities for both species: a better interspecific understanding, a more energy-efficient way of discovering/consuming food resources, as well as a balanced relation between competition and tolerance (Bloch 2009). On several occasions coyotes were observed feeding on an elk-carcass while two or three wolves rested only 50 m away. Nearly two decades ago, P. Paquet (1993) concluded that the benefit accrued by all secondary consumers (of wolf kills) outweighed potential risks associated with direct predation by wolves.

The uninformed might wonder about the partly extreme will to form committed relationships between all kinds of different species. However, “long-term dominance structures” are rarely needed. For canids (wolves, coyotes or foxes), to eventually share food resources with grizzly bears is the opposite of radical irresponsibility. Canids take the responsibility to avoid injuries very seriously. Especially when it comes to communicate with grizzlies. Instead of dangerously trying to take all and not give anything, they rather consider mutual, non-aggressive arrangements with these giants (Bloch & Dettling 2009). On the other hand, reciprocal displacement at kill sites does occur regularly (Smith et al. 2009).

The age-old intertwined relationship of wolf- and ravens:

B. Heinrich (1999) suggests that ravens evolved with wolves in a mutualism that is millions of years old, so that they have innate behaviours that link them to wolves, making them uncomfortable without their presence. Interestingly, many native tribes knew as long as anyone can remember what close relationship exists between wolves and ravens (Challenger 2004). Until today, a lot of natives refer to ravens as the “eyes of the wolves”. Wolves and ravens have an ancient evolutionary history. Only we “modern” humans (as ignorant as we often are) have not paid the appropriate attention to the real extend of the biological reason of wolf-raven-relationships. However, the cooperation between these different species was not only observed by natives. Their team spirit has also been described in northern mythology: Odin, for instance, the god of war, was always accompanied by his two ravens (Hugin & Munin) as well as by his two wolves (Geri & Freki). B. Heinrich (2000) points out, that “because ravens have been living in close proximity to wolves since millions of years, their desire of doing so may be already genetically fixed”.

The emotional lives of wolves and ravens:

Wolves and ravens may be different as a species, but their “mixed-communities” seem to be based on more than a short-term mutualistic relationship. Both species do share a lot of behavioural similarities such as a social, collective, habitat, technical and emotional intelligence. The latter might sound “anthropogenic”, but according to M. Bekoff (2006) “there is mounting evidence that joy, love, grief,

jealousy, and embarrassment ,for example, are all experienced by individuals of many species”. B. Heinrich (1999) wrote, that “since ravens have long-term mates, I suspect they fall in love like we do, simply because some kind of internal rewards is required to maintain a long-term pair bond. The same should be presumed for wolves.

Zoologist G. Schaller once said: “Only by looking at gorillas as living, feeling beings was I able to enter the life of the group with comprehension, instead of remaining an ignorant spectator”. D. Griffin (1992) wrote, that “dismissing the mind as trivial because one cannot personally prove it with precision by a simple test is like the denial of the role of inheritance before genes were elucidated”. Accordingly, there seems to be a strong emotional tendency among wolves and ravens of living together in “social mixed groups” (Bloch & Dettling 2009).

Mutualistic relationship versus real symbiosis:

The partnership between wolves and ravens can be best described as an “authentic symbiosis”, because both species profit from each other long-term (Gansloser 2011, pers. commun.). Some wolf- and raven families seem to build up permanent social-mixed groups, which are based on durable, informal bonding. “Wolf birds”, how B. Heinrich (2000) calls them so convincingly, rely on the permanent extension of their social relationship while living closely together with wolves. As culturally social and intelligent animals, wolf families pass information between generations, and their behaviours reflect established traditions related to their environment (Paquet 2011, written comm.). Ravens do too. The raven-wolf association may be close to a symbiosis that benefits the wolves and the ravens alike (Heinrich 1999). Perhaps, in the old days of starting a profitable cooperation with wolves, ravens were just egoistically reflecting on how to consume large amounts of bio-mass effectively. B. Heinrich (2000) pointed out, that “ravens are using vital food-calls in order to communicate their frustration and that, over time, wolves have learned decoding those special “Jaaa-huaaa-calls” (see details under b.). However, the co-evolutional symbiosis of wolves and ravens is based on a number of advantages for both sides:

a.) **Advantages for wolves:** Ravens, sitting high up in the trees, discover potential hazards very fast. On several occasions ,ravens were observed functioning as an “early warning system“, alarming wolves of potential hazards when bears, cougars, or humans were present (Bloch & Radinger 2010). According to H. Heinrich (2002) ravens are using their special “kek-kek-kek”- alarm calls not only for communicating with each other but also with wolves. According to J. Brandenburg (1993) “at a kill site, ravens are more suspicious and alert than wolves. In many instances, I have seen ravens become nervous at one of my small movements where the wolves seemed unaware. I believe that the birds serve the wolves as extra eyes and ears”. Ravens convey this sort of exact defined special warning call ery eagerly. As the “air force of the wolves” (Bloch 2009), they call out the alert whenever necessary.

As a result, adult and juvenile wolves, which are being informed ahead that way, do have time to escort their offspring to a secure location.

All animals involved seem to know, if a food resource is worth an inspection, and what kind of hazards could be close by (Bloch 2009). When alert, wolves react to the movement pattern of ravens immediately. They also seem to recognize what kind of alert their feathered livepartners have called for. Depending on the situation, the complete wolf family is constantly calculating disturbances and possibilities of escape. Each wolf seems to know, how much time he has left until an unwelcome competitor becomes a hazard. Wolves and ravens are very creative when it comes to strategies for retreat (Bloch & Dettling 2009).

b.) Advantages for ravens: The flight-response of nesting ravens in areas of different human densities might be described as highly flexible (Knight 1986). In principal, however, ravens are shy and cautious (Heinrich 1999). Without the presence of wolves, ravens do not feel very comfortable around carcasses. Ravens seem to recognize wolves as their guardians. Whenever wolves are present, huge flocks of ravens (up to 50 individuals), were found at 90-95% of all documented wolf kills (Mech 1998, Paquet 1993). Ravens share food among each other, but being on their own it is not possible for them to open up the thick skin of large ungulates. Ravens need active help for that from predators such as wolves (Heinrich & Marzluff 1995). J. Brandenburg (1993) described ravens coming to an unopened carcass. The ravens then started yelling, and soon a wolf arrived and tore the carcass open. Very often, they fly to the next possible treetops. There they wait and watch until “their” wolves move through the forest or an open meadow while approaching a carcass (Bloch & Bloch 2002). To sit out potential hazards can be a very effective and energy-saving strategy.

Do ravens actually get killed by wolves?

Wherever wolves gather, ravens gather too (McTavish & Nunn 2003). Especially around kill sites. Even though individual, mostly juvenile “bold-type” wolves did chase certain “impudent” ravens on several occasions we were unable to document any serious predation on ravens by wolves (Bloch & Radinger 2010). D. Mech (1970) noted, that “when the (observed) wolf retaliated by stalking the raven the bird allowed it within a foot before arising. Then it landed a few feet beyond the wolf, and repeated the prank”. In Yellowstone, data on dozens of very recent kills were collected by Dan Stahler, and ravens were feeding at all in minutes. The ravens routinely fed within feet of wolves.

Sometimes, an adult wolf may demonstrate that he is “in charge” by pretending to attack the most daring raven-individuals. “Dominant” wolves imposed their own demands without showing offensive aggression, because their primary “trump card” is serenity (Bloch 2009). All observed ravens living together with wolves, seem to know this very well. Nonetheless, some ravens might be killed by

wolves, but such occasions seem to happen more or less accidentally. McAllister (2007), who has been studying coastal wolves in B.C./Canada over years, wrote: “Although many species of birds have been found in wolf scat, raven is notably absent”.

Principal remarks on the imprinting-process between wolf pups and ravens:

Based on our data collection, we hypothesize that all observed wolf pups and ravens, present at three monitored homesites, had been running through a classic imprinting-process. K. Lorenz (1961) originally developed the concept of social imprinting. A. Hess (1973) and E. Klinghammer (1994) later expanded the concept to include “food and habitat imprinting”.

During six early-summer monitoring sessions (see details under 1), each observed wolf pup grew up in close proximity to the same individual ravens near the den and rendezvous sites (see details under 1.). Once all of the wolf pups had left the natal den (commonly by the age of about 3 weeks), pretty soon it was inevitable for them to meet their “own” raven family. At all den sites, each pair of “house ravens”, was observed stealing small bones, flesh and pieces of ungulate fur (Bloch 2009). Each pup not only had a visual of the ravens but also seemed to store the “strong odour of raven feathers”, as described by B. Heinrich (1989), in its brain: For ever, irrefutable, for its whole life. After wolf pups and ravens had met “personally” on a daily basis, they soon were romping around together. More importantly, they were interacting: Tricking each other, stealing of food resources, and running in circles became part of their regular life.

At first, ravens were highly superior of wolf pups. Obviously, they were teasing them by pulling their tails. In June 2001, a young raven was spotted even sitting on the back of a totally confused wolf pup. Young pups are vulnerable and could potentially be killed by ravens. Yet the ravens, which occasionally walk behind a young pup, only gently yank its tail (Heinrich 1999). In order to get to know each other individually and become an “unbeatable team” in the future, each pup and raven has to learn communicating and interacting wisely. Ravens are known to be very playful animals (Heinrich & Smolker 1998). Play-time is fun-time (Bekoff 1974). Interactions between wolf pups and ravens were also documented by I. McAllister (2007): “As pups played and explored on their daily beach walks (rendezvous sites), one of them contemplated making a playful lunge at their constant travel companions, the ravens”. Adult wolves watching such brazenness usually refused to participate in short term quarrels between pups and ravens, which were slowly deepening their relationship (Bloch 2009).

Principal remarks on the socialization of wolves and ravens:

Based on our well-documented behaviour information, wolves and ravens seem to socialize at a very early age. Interactive communication dictates their normal daily routine. This is no surprise because ravens were observed by P. Paquet (1993), “mobbing wolves, displaying to them, and pecking at resting wolves”. D. Mech (1970) noted, that both species “must possess the psychological mechanisms necessary for forming social attachments, and that individuals of each species include members of the other in their social group, forming bonds with them”. Accordingly, their social bonding should be recognized as a course of “classic socialization”.

Over years, we have been observing all sorts of wolf-activities. Some exceptions aside, ravens were always involved in their traveling, resting, chasing prey, feeding at kills and interacting (Bloch 2009). According to R. Peterson (1995), “there is more than playfulness between wolves and ravens. Ravens make their living by scavenging wolf-killed moose and as we start the day, flying along wolf tracks, we often overtake a raven doing the same thing”. Interactive communication, obviously learnt during a socialization-process, seem to be the fundamental basics of understanding each other. F. Harrington (1978) found out, that “ravens are attracted by wolf howling. The wolves’ howls before they go on the hunt are a signal that the birds learn to heed. Conversely, wolves may respond to certain raven vocalization or behaviour that indicates prey”. On four occasions we saw ravens flying directly above a family of wolves chasing prey (Bloch 2009).

Some ravens were sighted when interacting with red foxes (Nero 1993). Additionally, there are innumerable reports of ravens showing their interest to interact with coyotes. However, all of these encounters seem to be short-term. In contrast, ravens and wolves maintain significant amounts of symbiotic relationships. Hard-wired behavioural responses seem to cause them to socialize with each other. Based on their socialization-skills, ravens and wolves have been living together because they want to. Of course, as indicated by B. Heinrich (1999) correctly, “there are always data to prove or disprove almost any hypothesis”.

1.) Homesite monitoring of three wolf families in Banff National Park:

The purpose of our efforts was to obtain some detailed insights into the denning behaviour and interactive behaviour of wolves and ravens through continual observations in an unobtrusive manner. In order to determine the symbiosis of wolves and ravens, we set up observation spots in the vicinity of three wolf homesites: in the “Panther Valley” (May/June 1993-1995), the “Fairholme Benchlands” (May/June 2000-2002) and the “Bow Valley” (May/June 2004-2006). Raven-bests were discovered in the immediate neighbourhood of all three wolf-homesites (maximum 500 meters).

At each homesite (den & rendezvous site) where a wolf family resided and was raising their pups, we remained stationary at a designated hiding location. Accordingly, most observations were carried out by using binoculars. However, we made photographic and audio recordings when the weather (and light condition) permitted and when wolves and ravens were close enough. The late-spring, early-summer temperatures in May and June varied from a low of -6 degree C to a high of + 26 degree C. Film footages were recorded by using several camcorders with up to 35 x optical-zoom lenses. Field notes were collected and written up on specially prepared behaviour sheets. The primary method of data collection was “ad libitum” or “scanning” sampling of observed events.

Behavioural investigations on the socialization of “Panther wolves & ravens”:

1.1) Homesite monitoring 1993: After having documented the mutual “hustle and bustle” of wolves and ravens (7 adults, 2 pups and 2 ravens) at a homesite in 1992, the scenery was mostly the same: All wolves and ravens practiced some sort of “ritualized act”. Observers of wolves take the presence of ravens near den sites for granted, usually only recognizing that wolves and ravens are “somehow together”. Naïve as we were in 1992, we thought so too. Ravens, hanging around at the wolves’ dens, were also observed by researchers in Yellowstone National Park /USA. But what did that tell us about a comprehensible process of socialization? Some researchers argued that “situative observed interactions” were not proof for socialization between wolves and ravens. They were right.

That all changed at the end of May 1993: While carrying out ground observations at the traditional “Panther den”, we could not help but also watching a local pair of ravens. Soon we learned to distinguish the birds individually (Bloch & Bloch 2002). One of the ravens who was interacting with several pups daily, had a gap in his right wing (“Gap”), the other one did not (“Ngap”). Five adult wolves were identified at the den site: The light grey leading female, her dark grey male mate, two “classic” grey males and one nearly all white female. In total, six pups were observed: 3 brownish-grey females and 3 brownish-grey males (Bloch & Callaghan 2000).

The first analyses of our field notes showed that interactive behaviour patterns could be recognized between all adult wolves, pups and both ravens (see appendix: table 1). First presumptions were made about a possible socialization between the “Panther wolves” and their own “Panther ravens”. On the other hand, we could not determine anything final yet, as we were only observing one wolf den and one pair of ravens. Nevertheless, the relationship between those particular wolves and ravens seem to work on a basis of: “explore, discover, experience, communicate, interact, and learn” (Bloch & Bloch 2002)

1.2) Homesite monitoring 1994: After having experienced first evidence of a social-bonding process in 1993, the same pair of ravens and the same wolf family became a familiar sight to us in the following year. In 1994, two additional wolves were sighted (2 grey juvenile males), increasing the number of the “Panther wolf family” to a total of seven individuals. Five pups (3 brownish females + 2 grey males) were also observed (Bloch & Callaghan 2000). Because all wolves and ravens were interacting on a daily base once again, it turned out that their “social-mixed family world” was inordinately more complex than had been previously assumed (see appendix: table 2).

1.3) Homesite monitoring 1995: During the early-summer of 1995, the “Panther wolf family” was reduced to six members. “Snowy”, one of the adult females, was not to be found at the homesite. Over and above that, only one brownish-grey male pup was sighted (Bloch & Callaghan 2000). Whatever it was that had excited the “Panther wolf & raven family”, but the same type of interactive courses were recognized (see appendix: table 3).

After three sessions of summer-monitoring, we concluded that the social- and emotional relationship between the “Panther wolves” and their familiar “house-ravens” had stabilized. By all appearances, an even stronger social bond had been developed between the “Panther- ravens” and the single pup. Unfortunately, our continuous behaviour observations in the backcountry of Banff came to a sudden stop. The National Park Service refused to extend our research permit. We kept asking us, if the socialization of those “Panther wolves” with the same pair of ravens was only a coincidence or if there was any system to it?

Behavioural investigations on the socialization of “Fairholme wolves & ravens”:

1.4) Homesite monitoring 2000: What we saw at the “Fairholme den” in the Benchlands of Banff, was the same as we had been discovering before: A pair of ravens, their nest (approx. 200 meters away from the den) and a wolf family interacting with ravens at a daily routine. Fortunately, we were able to identify the ravens individually (“Grey-Feather” & “Black”). In total, there were three adults (2 males + 1 female) and six pups (3 grey females + 3 grey males) present. Often, the two “Fairholme ravens” either were flying across the heads of “their” wolves, or they stayed in close proximity to them. Whenever they were sitting on nearby treetops, at least one wolf pup was following or watching them (Bloch & Bloch 2002). The documentation of their ritualized interactive behaviour continued (see appendix: table 4).

1.5) Homesite monitoring 2001: Based on our observational insights, the presence of the same three adult wolves (plus their complete offspring from 2000) could be confirmed. Meanwhile, all six pups had developed into nearly full grown family members. Based on their distinguishable looks, we

assumed the present two ravens to be identical to those observed the year before. Whenever one of the six new pups (4 grey males + 2 grey females) had decided to leave the natal “Fairholme den”, it was accompanied by the pair of ravens. On regular terms, what followed was a communicative “getting to know each other”. The wolves later migrated to a second den within the same homesite area (200 meters), followed by both ravens. Whenever an adult wolf or the pups made an excursion into a nearby forest-clearing, the ravens were interacting with them (see appendix: table 5)

1.6) Homesite monitoring 2002: While observing the traditional “Fairholme den”, three pups (2 grey males + 1 grey female) were taken care of by a total of eleven adult wolves. All individuals were familiar to us, including five of last-years pups. However, four adult wolves were missing: two of them (1 male + 1 female) had dispersed; two others (1 male + 1 female) had been killed on the Trans-Canada-Highway. Assuming it is true, the same pair of “Fairholme ravens” was observed when interacting and playing with the new three pups. On several occasions the pups were either interacting directly with the ravens or running in circles around them. This, as well as regular observed interactions between adult wolves and the ravens, was again indicative of the fact that there was a great deal of social interest among both species involved (see appendix: table 6).

Behavioural investigations on the socialization of “Bow wolves & ravens”:

1.7) Homesite monitoring 2004: Eventually, a pair of ravens had established their nest within a nearby distance of only 100 meters from the natal and second den of the “Bow wolf family”. This was more than fascinating. Besides the fact that we always look twice, we were not able to identify the ravens individually. Nonetheless, the two adult wolves, six pups and two ravens present at the densite, were performing the same ritualized behaviour-sequences already familiar to us. All in all, seven common behaviour patterns were noted once more. In one main pattern, the “opportunistic-grab”, the ravens rushed in to pick up a bone or stealing food from the wolf pups. In two others, the “social-interaction”, ravens and pups would circle around each other or were observed play-running (see appendix: table 7).

1.8) Homesite monitoring 2005: Probably the same ravens that had been around in 2004 were present at the “Bow den site” in 2005. To us, the simplest assumption was that those ravens had already done their homework of socialization: They acted among the two adult wolves as though they knew them individually. Five pups were observed, three black one two grey-ones. Even though all pups had not even seen their feathered family members yet, the ravens were there within seconds. Soon, both pups and ravens had prior opportunity to learn all interactive behaviours necessary for an early social-bonding-process.

Furthermore, they were tricking each other out and play-running around a huge fir tree. Most of the time, the whole procedure appeared to be a “reciprocal testing”. All individuals involved seem to figure out how far they could go (see appendix: table 8).

1.9) Homesite monitoring 2006: As described by B. Heinrich (1999), “any one behaviour is a combination of innate programming of blind or unconscious responses, learning, and insight”. Presumably, the ravens’ decision to nest and stay in the same area as did the “Bow wolves”, fulfilled their behavioural needs of bonding and socializing in a mixed society with canids. Needless to say, that the local “Bow ravens” also playfully tested the new four black pups (females + 2 males) by displaying to them. Learning a whole bundle of favoured interspecific communication skills obviously paid off for all of the members of the “Bow community”: after long periods of rest, they often set off together from the densite straight to their rendezvous area. All observed social-events, emotions, and interactions between the “Bow wolves & ravens” seemed to regulate and guide their family-bonding behaviour patterns (see appendix: table 9).

2.) Excursion monitoring of two wolf families in Banff National Park:

The purpose of this important part of our field work was to obtain detailed knowledge on the travel and hunting undertakings of wolves and ravens via daily ground observations. In order to determine their mutual excursions, we followed the “Fairholme wolf & raven family” (November-April 2000/2001, 2001/2002, 2002/2003) as well as the “Bow wolf & raven family” (November-April 2004/2005, 2005/2006, 2006/2007, 2007/2008) along the Bow River Valley by using an AWD-vehicle. While keeping a respectful and undisturbing distance of approx. 100 meters towards travelling wolves, we always remained stationary in the car. Whenever the wolves stopped travelling or were staying in a forest-clearing or open meadow (including feeding on a carcass), we parked our car and turned off its engine immediately.

Most observations were carried out by using binoculars. Most importantly, specially socialized and trained dogs (West Siberian Laiki “Chinook”, “Jasper” & “Timber”) were used in order to sniff and detect any possible presence of wolves. Winter temperatures varied from +15 degrees C to -36 degrees C. We made photographic and audio recordings when the weather permitted. Because video recordings were carried out relatively unbroken by using several camcorders at the same time, field notes were taken only sporadically. The primary method of data collection was “ad libitum” sampling of observed events.

Principal remarks on the mutual excursions of wolves and ravens:

In the past, there have been some sporadic sightings and anecdotal reports, suggesting that ravens actually were following wolves. Nobody really knew the extent to which ravens may observe and follow wolves, or if the sharp-eyed birds were only opportunistically appearing at wolf-kills. B. Heinrich (2002) noted that “ravens get significant of prey by hunting, scavenging, and by association with predators. According to D. Mech (1970) “ravens appear to follow wolves”. D. Allen (1979) wrote that “ravens accompany wolves in their travel, feed at their kills, and sometimes even eat their scats”. R. Peterson (1995) remarked: “When wolves pause, ravens also stop, roosting in trees or swooping on the ice where they can watch and harass the wolves at close range”. Dan Stahler saw ravens following wolves on their hunts in Yellowstone. B. Heinrich (1999) wrote: “Ravens seek wide exposure and experience, and profit from it. For that they have evolve curiosity”. Without indulging in endless speculation, but perhaps it was just curiosity that once forced ravens following wolves.

2.1) Behavioural investigations on the mutual excursions of “Fairholme wolves & ravens”:

Excursion monitoring 2000/2001-2002/2003: During all three winter sessions of observations, the joint-travelling of “Fairholme wolves & ravens” was noted on multiple occasions when approaching or leaving the traditional rendezvous area. Mutual excursions inside their core territory were also observed. On eleven occasions, we saw the “Fairholme wolves” gathering and getting ready for a hunt. Whenever they howled, a minimum of two ravens started to vocalize as well. Soon afterwards, the two “Fairholme ravens” actively following the wolves by flying above their heads. If the two familiar ravens were not seen visibly following the wolves, then they were there within a minute. During two wolf-hunts on small herds of elk, all of a sudden there was a flock of ravens (10 individuals) flying directly above the chase and watching the wolves very closely (see appendix: tables 10-12).

2.2) Behavioural investigations on the mutual excursions of “Bow wolves & ravens”:

Excursion monitoring 2004/2005-2008/2009: During all four winter sessions of ground observations, “Bow wolves & ravens” were observed over a hundred times, when mutually approaching/leaving their rendezvous site. They also were seen regularly, when travelling together and scent-marking inside their core territory, the Bow River Valley. All of that even did not change after the leading females “April” (2003-2205), or “Delinda” (2005-2008) had died. Depending on their individual personality, some wolves were seen jumping into the air with ravens close by. Especially “bold-type-characters” like “Fluffy” or “Silvertip” were even observed while snapping at low-operating ravens, which sometimes were flying only one meter above the travelling wolves.

However, most of the time, the “Bow wolf family” had been travelling together with ravens without paying much attention to them (see appendix: tables 13-17).

On fifteen occasions, the “Bow wolves” were observed killing prey-ungulates such as elk or deer. During eight of nine predatory chase-runs a flock of ravens (5 to 9 individuals) was soaring directly above the hunting wolves. Whenever the wolves had made a recent kill, there was a flock of ravens circling around them. As soon as the wolves had stopped feeding, ravens were present on the carcass. Occasionally, some “bold-type” ravens were feeding within five feet of wolves. On nine occasions, bold ravens were observed pecking the tail of resting wolves, and jumped aside as soon as those wolves were staring at them.

From presumption to certainty?

All of our recording-arrangements on wolf and raven behaviour worked well as long as the observed were on the move, travelling along the Bow Valley. Accordingly, a comparison of all excursions of “Fairholme wolves” and “Bow wolves” with or without the presence of ravens was made. In regards to the joint-excursions of wolves and ravens, the first analyses of our data showed an astonishing accordance of up to 80 percent (see appendix: tables 18-25). Unfortunately, it all ended up in a fiasco at any given ungulate carcasses. Even though we are used to tell wolves apart, but to identify individual ravens in a huge flock seemed to be hopeless. On average, 20 to 30 ravens were gathering around a wolf-kill. The birds were landing at record speed only to fight for the best feeding positions. Perhaps, the “Fairholme ravens” or “Bow ravens” were among them. What to do when a huge “black horde”, all excited and screaming, is blending into one big lump?

A chance out of such a dilemma could be achieved by catching and marking individual ravens. Maybe, some time in the future we will be able to answer the challenging question: Who is who? This would be fascinating in order to get more behavioural insights into another exciting, but unanswered question: After a socialization-process of certain wolf- and raven families, will the grown up birds disperse together with individual wolves that leave their families? Will these new formed social-mixed groups then stay together for good? The fact of the matter is: So far, all of this still remains a mystery.

Final remarks and conclusions:

After years of homesite monitoring in the Panther-, Benchland- and Bow Valley, we conclude that a clear tendency of wolves and ravens for long-term cooperation was evident. In 1993-1995 and 2000-2002, an imprinting and socialization-process among the same wolf families and pairs of ravens was recorded. Probably, the “long-term nesting” of pairs of ravens near wolf dens was common because both, wolf and raven parents, each live monogamous. Even though, we could not identify the “Bow ravens” individually, we conclude that most likely the same two ravens were present at the “Bow den”

in the years 2004-2006. The documentation of ritualized interspecific behaviour patterns of wolves and ravens became our most successful source of information. Most of the time, we found wolves where ever we saw ravens. Although the degree of all mutual excursions of wolves and ravens seemed to be defined through occasional separations, their principal intentions for travelling together were verifiable. All observed “wolf-raven-societies” were based on a long-lasting base. Perhaps, they are the most valuable mixed-societies in the wild.

Likewise, we conclude that such a “life style” was not central to all wolves and ravens, resident in Banff National Park. In late spring of 2009, for instance, a new wolf-clan (the “Pipestone family”) had established their territory in the Bow Valley. Intensive ground monitoring has been carried out since. Although, there might be no apparent limit to the complexity of wolf and raven behaviour that can be learned, the surprising thing was that the “Pipestones” did not live together with ravens permanently. Based on our investigations, the wolves were newcomers to the Bow Valley. Their den site had been established only two years ago. We conclude that basic interspecific behaviour rituals necessary for a symbiotic relationship of wolves and ravens had not been developed yet. Thus, there was a lack of communicative understanding. In the meantime, the wolves’ attachment to ravens seems to be restricted to gathering around kill sites or travelling together only short-term.

Last but not least, we conclude that a lot of dog people are being wrongly informed, that the human-dog-relationship is something unique, because two different species are living together in a long-term symbiosis. Unfortunately, dog owners suffer from the refusal of some critics to accept clear proof for a social commitment between different species in the wild. Some people even argued that dominance-relationships among different species were „biologically not planed“. All of these arguments are based on the presumption that wolves only socialize with wolves and no other species. Our conclusion: Apparently, we were wrong!

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Appendix: (Summary of research results 1993-2010)

Tables 1-9: Frequency of seven interactive behaviours expressed by the “Panther wolves & ravens” (1993-1995), the “Fairholme wolves & ravens” (2000-2002) and “Bow wolves & ravens” (2004-2006) in close proximity to their den and rendezvous sites.

Tables 10-17: Frequency of the mutual excursion behaviour of the “Fairholme wolves & ravens” (2000-2003) and “Bow wolves & ravens” (2004-2009) when approaching/leaving their homesite or travelling through a core territory.

Tables 18-25: Comparison of the mutual excursion behaviour of the “Fairholmes wolves” (2000-2003) and “Bow wolves” (2004-2009) when approaching/leaving their homesite or travelling through a core territory with or without the presence of ravens (frequency/in %).

Behaviour ethogram: (summary of seven interactive behaviours expressed by ravens and wolves when interacting with each other).

1. **Approach (“App”):** A raven approaches purposely one (or several) wolf pups or an adult wolf by landing close by or approaching with “hopping steps”.
2. **Tail-pulling (“Tp”):** A raven pecks one (or several) wolf pups or an adult wolf intentionally in a hitting way or pulls at its tail..
3. **Coat-pinching (“Cp”):** A raven purposely pecks one (or several) wolf pups or an adult wolf in its neck, shoulder or back.
4. **Opportunistic-grab (“Og”):** A raven approaches one (or several) wolf pups either from the ground or out of the air, grabs a bone, piece of flesh or fur and flies away immediately.
5. **Play-run (“Pr”):** One (or several) wolf pups or an adult wolf run after a raven in neutral body posture. The ravens flies up briefly and lands immediately in close proximity to the wolf pups. Often, pups and ravens exchange their roles of “hunter and hunted”.
6. **Circle-run (“Cr”):** One (or several) wolf pups or an adult wolf run in a typical “zig-zag-movement” or in a circling movement in front of a raven, who flies up briefly and lands again immediately.
7. **Chase (“Ch”):** One (or several) wolf pups or an adult wolf run in typical “hopping steps” in some sort of a bluff charge directly towards a raven and chase him away from the immediate den area.

Tables 1-3: Interactive and play behaviours of “Panther wolves” and the two ravens “Gap” & “Ngap” in May/June 1993-1995 within their traditional homesite.

Table 1: Frequency of all interactions of “Panther”- wolf pups and adults with the two ravens “Gap” & “Ngap” in May/June 1993 (n = 147)

Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & “Gap”	11	5	3	8	2	2	3
Wolf pups & “Ngap”	9	5	6	10	2	3	4
Adult wolf & “Gap”	8	2	2	4	1	3	8
Adult wolf & “Ngap”	10	3	3	5	2	2	11
Total	38	15	14	27	7	10	26

Table 2: Frequency of all interactions of “Panther”- wolf pups and adults with the two ravens “Gap” & “Ngap” in May/June 1994. (n = 124)

Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pup & “Gap”	6	5	4	8	2	1	3
Wolf pups & “Ngap”	5	4	4	6	3	2	1
Adult wolf & “Gap”	12	3	3	5	1	2	7
Adult wolf & “Ngap”	8	4	4	7	2	3	9
Total	31	16	15	26	8	8	20

Table 3: Frequency of all interactions of “Panther”- wolf pups and adults with the two ravens “Gap” & “Ngap” in May/June 1995 (n = 145)

Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & “Gap”	5	4	3	9	4	2	4
Wolf pups & “Ngap”	5	4	5	7	3	3	3
Adult wolf & “Gap”	10	4	5	9	2	2	8
Adult wolf & “Ngap”	11	3	4	11	1	1	12
Total	31	15	17	37	10	8	27

Tables 4-6: Interactive and play behaviour of “Fairholme wolves” and the two ravens “Greyfeather”(Grey) & “Black” in May/June 2000-2002 within their traditional homesite.

Table 4: Frequency of all interactions of “Fairholme”- wolf pups and adults with the two ravens “Greyfeather” (Grey) & “Black” in May/June 2000 (n = 112)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & “Grey”	8	5	4	7	2	2	1
Wolf pup & “Black”	3	5	5	11	2	2	4
Adult wolf & “Grey”	9	3	1	5	-	-	10
Adult wolf & “Black”	5	1	-	8	-	3	6
Total	25	14	10	31	4	7	21

Table 5: Frequency of all interactions of “Fairholme”- wolf pups and adults with the two ravens “Greyfeather” (Grey) & “Black” in May/June 2001 (n = 214)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & “Grey”	18	7	6	16	6	4	4
Wolf pups & “Black”	13	10	9	12	5	5	5
Adult wolf & “Grey”	15	5	5	8	3	4	11
Adult wolf & “Black”	10	4	2	14	-	2	9
Total	56	26	22	42	14	15	29

Table 6: Frequency of all interactions of “Fairholme”- wolf pups and adults with the two ravens “Greyfeather” (Grey) & “Black” in May/June 2002 (n = 81)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & “Grey”	4	1	3	8	1	2	2
Wolf pupa & “Black”	4	2	4	8	1	1	4
Adult wolf + 1 raven	6	1	-	5	-	1	6
Adult wolf + 2 ravens	5	-	2	2	-	-	8
Total	19	4	9	23	2	4	20

Table 7-9: Interactive and play behaviour of “Bow wolves” and two individually not identified ravens in May/June 2004-2006 within their traditional homesite.

Table 7: Frequency of all interactions of “Bow”- wolf pups and adults with one or two ravens in May/June 2004 (n = 153)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & 1 raven	9	8	5	17	3	1	5
Wolf pups & 2 ravens	12	13	8	13	4	2	1
Adult wolf & 1 raven	6	2	5	10	1	1	8
Adult wolf & 2 ravens	2	4	5	-	2	-	6
Total	29	27	23	40	10	4	20

Table 8: Frequency of all interactions of “Bow”- wolf pups and adults with one or two ravens in May/June 2005 (n = 194)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & 1 raven	32	12	9	18	1	2	6
Wolf pups & 2 ravens	20	10	13	11	-	2	3
Adult wolf & 1 raven	9	1	-	3	-	-	16
Adult wolf & 2 ravens	10	-	1	3	-	-	12
Total	71	23	23	35	1	4	37

Table 9: Frequency of all interactions of “Bow”- wolf pups and adults with one or two ravens in May/June 2006 (n = 140)							
Interaction:	“App”	“Tp”	“Cp”	“Og”	“Pr”	“Cr”	“Ch”
Wolf pups & 1 raven	5	6	2	16	2	2	5
Wolf pups & 2 ravens	8	7	2	12	2	1	3
Adult wolf & 1 raven	10	3	1	8	1	-	12
Adult wolf & 2 ravens	12	4	2	4	1	-	9
Total	35	20	7	40	6	3	29

Tables 10-12: Mutual excursion behaviour of the “Faireholme wolves” when approaching/ leaving their traditional homesite (“R-A”) or travelling through their core territory (“C-T”) in winter 2000/2001-2002/2003, accompanied by the ravens “Greyfeather” (Grey) & “Black” or a flock of ravens (“F-R”).

Table 10: Frequency of mutual excursions of “Fairholme wolves” in winter 2000/2001, accompanied by the two ravens “Greyfeather” & “Black” or a flock of ravens. (n = 107)

Excursions:	Approaching “R-A”	Leaving „R-A“	Excursion in “C-T”
Wolf group & “Grey”	20	18	5
Wolf group & “Black”	16	21	5
Wolf group & “F-R”	2	1	19
Total	38	40	29

Table 11: Frequency of mutual excursions of “Fairholme wolves” in winter 2001/2002, accompanied by the ravens “Greyfeather” & “Black” or a flock of ravens. (n = 108)

Excursions:	Approaching “R-A”	Leaving „R-A“	Excursion in “C-T”
Wolf group & “Grey”	18	15	8
Wolf group & “Black”	12	19	6
Wolf group & “F-R”	1	3	26
Total	31	37	40

Table 12: Frequency of mutual excursions of “Fairholme wolves” in winter 2001/2002, accompanied by the ravens “Greyfeather” & “Black” or a flock of ravens. (n = 59)

Excursions:	Approaching “R-A”	Leaving „R-A“	Excursion in “C-T”
Wolf group & “Grey”	10	8	4
Wolf group & “Black”	7	10	2
Wolf group & “F-R”	2	3	13
Total	19	21	19

Tables: 13-17: Mutual excursion behavior of the “Bow wolves ”when approaching/ leaving their traditional homesite (“R-A”) or travelling through their core territory (“C-T”) in winter 2004/2005-2008/2009, accompanied by one or two ravens or a flock of ravens (“F-R”).

Table 13: Frequency of mutual excursions of “Bow wolves” in winter 2004/2005, accompanied by one or two ravens or a flock of ravens. (n = 60)

Excursions:	Approaching “R-A”	Leaving “R-A”	Excursion in “C-T”
Wolf group & 1 raven	12	11	6
Wolf group & 2 ravens	10	8	8
Wolf group & “F-R”	2	1	2
Total	24	20	16

Table 14: Frequency of mutual excursions of “Bow wolves” in winter 2005/2006, accompanied by one or two ravens or a flock of ravens. (n = 29)

Excursions:	Approaching “R-A”	Leaving “R-A”	Excursion in “C-T”
Wolf group & 1 raven	3	5	2
Wolf group & 2 ravens	5	2	2
Wolf group & “F-R”	2	1	7
Total	10	8	11

Table 15: Frequency of mutual excursions of “Bow wolves” in winter 2006/2007, accompanied by one or two ravens or a flock of ravens. (n = 107)

Excursion behavior	Approaching rendezvous area	Leaving rendezvous area	Excursion in core territory
Wolf group + 1 raven	19	11	8
Wolf group + 2 ravens	21	10	10
Wolf group + flock of ravens	7	3	18
Total	47	24	36

Table 16: Frequency of mutual excursions of “Bow wolves” in winter 2007/2008, accompanied by one or two ravens or a flock of ravens. (n = 118)

Excursions:	Approaching “R-A”	Leaving “R-A”	Excursion in “C-T”
Wolf group & 1 raven	18	15	12
Wolf group & 2 ravens	12	16	14
Wolf group & “F-R”	1	2	28
Total	31	33	54

Table 17: Frequency of mutual excursions of “Bow wolves” in winter 2008/2009, accompanied by one or two ravens or a flock of ravens. (n = 36)

Excursions:	Approaching “R-A”	Leaving “R-A”	Excursion in “C-T”
Wolf group & 1 raven	5	4	3
Wolf group & 2 ravens	4	4	2
Wolf group & “F-R”	-	-	14
Total	9	8	19

Comparison data (number & percent): Wolves travelling with or without ravens.

Table 18-20: Comparison (in %) of all mutual excursions of “Faireholme wolves”, when approaching/leaving their traditional homesite (“RA”) from winter 2000/2001 to 2002/2003, with or without the company of the ravens “Greyfeather” (Grey) & “Black” or a flock of ravens (“F-R”).

Table 18: Comparison (in %): Excursions of “Fairholme wolves” in winter 2000/2001, with or without the company of the ravens “Greyfeather” & “Black” or “F-R”. (n = 95)

Number/ Percent:	Appr. “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & “Grey”	20 x	4 x	83	18 x	4 x	82
Wolf group & “Black”	16 x	4 x	80	21 x	3 x	86
Wolf group & “F-R”	2 x	1 x	66	1 x	1 x	10 0
Total	38 x	9 x	81	40 x	8 x	83

Table 19: Comparison (in %): Excursions of “Faireholme wolves” in winter 2001/2002, with or without the company of the ravens “Greyfeather” & “Black” or “F-R”. (n = 87)

Number/ Percent:	Appr. “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & “Grey”	18 x	5 x	78	15 x	3 x	83
Wolf group & “Black”	12 x	4 x	75	19 x	6 x	76
Wolf group & “F-R”	1 x	-	100	3 x	1 x	75
Total	31 x	9 x	77	37 x	10 x	79

Table 20: Comparison (in %): Excursions of “Faireholme wolves” in winter 2002/2003, with or without the company of the ravens “Greyfeather” & “Black” or “F-R”. (n = 55)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & “Grey”	10 x	4 x	71	8 x	3 x	73
Wolf group & “Black”	7 x	3 x	70	10 x	3 x	77
Wolf group & “F-R”	2 x	1 x	66	3 x	1 x	75
Total	19 x	8 x	70	21 x	7 x	75

Tables 21-25: Comparison in % of all mutual excursions of “Bow wolves”, when approaching/leaving their traditional homesite (“RA”) from winter 2004/2005 to 2008/2009, with or without the company of one or two ravens or a flock of ravens (“F-R”).

Table 21: Comparison (%): Excursions of “Bow wolves” in winter 2004/2005, with or without the company of one or two ravens or “F-R”. (n = 58)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & 1 raven	12 x	3 x	80	11 x	3 x	79
Wolf group & 2 ravens	10 x	3 x	77	8 x	3 x	73
Wolf group & “F-R”	2 x	1 x	66	1 x	1 x	50
Total	24 x	7 x	77	20 x	7 x	74

Table 22: Comparison (%): Excursions of “Bow wolves” in winter 2005/2006, with or without the company of one or two ravens or “F-R”. (n = 29)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & 1 raven	3 x	2 x	60	5 x	3 x	63
Wolf group & 2 ravens	5 x	3 x	63	2 x	1 x	66
Wolf group & “F-R” ^f	2 x	1 x	66	1 x	1 x	50
Total	10 x	6 x	63	8 x	5 x	62

Table 23: Comparison (%): Excursions of “Bow wolves” in winter 2006/2007, with or without the company of one or two ravens or “F-R”.(n = 98)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & 1 raven	19 x	6 x	76	11 x	4 x	73
Wolf group & 2 ravens	21 x	8 x	72	10 x	3 x	77
Wolf group & “F-R”	7 x	4 x	64	3 x	2 x	60
Total	47 x	18 x	72	24 x	9 x	73

Table 24: Comparison (%): Excursions of “Bow wolves” in winter 2007/2008, with or without the company of one or two ravens or “F-R” (n = 88)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	in %
Wolf group & 1 raven	18 x	6 x	75	15 x	5 x	75
Wolf & 2 ravens	12 x	5 x	71	16 x	5 x	77
Wolf group + “F-R”	1 x	1 x	50	2 x	2 x	50
Total	31 x	12 x	72	33 x	12 x	73

Table 25: Comparison (%): Excursions of “Bow wolves in winter 2008/2009, with or without the company of one or two ravens or “F-R”. (n = 22)

Number/ Percent:	Appr “RA” with raven	Appr. “RA” without raven	%	Leaving “RA” with raven	Leaving “RA” without raven	%
Wolf group & 1 raven	5 x	2 x	71	4 x	1 x	80
Wolf group & 2 ravens	4 x	1 x	80	4 x	1 x	80
Wolf group & “F-R”	-	-	-	-	-	-
Total	9 x	3 x	75	8 x	2 x	80