DIPLOMARBEIT

Titel der Diplomarbeit

„Who's dangerous? Acquisition of anti-predator identification in Ravens (*Corvus corax*)“

verfasst von

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Content

Introduction

Avoiding predation is paramount to secure survival in almost every species (Lima & Dill 1990). Falling prey before having a chance for successful reproduction would represent the total loss of individual fitness which makes anti-predator adaptations one of the major driving forces of evolution. Therefore several mechanisms evolved, ranging from simple spatial or temporal predator avoidance (Daly et al. 1992) to different types of body armours (Edmunds 1974) to complex behavioural adaptations (Stanford 2002). Especially in avian species mobbing is widespread: A joint action by multiple individuals of a weaker species against one or multiple individuals of a more powerful species that is initiated by the weaker species and is not a reaction to an attack of the stronger species (Hartley 1950). These actions can consist of vocalisations, approaches and/or physical attacks (Altmann 1956; Shields 1984).

There are many different hypotheses trying to explain the evolution and motivational background of mobbing. A widely known hypothesis states that animals take part in mobs in order to scare off predators through a display of strength (Curio 1978). They might also achieve this by informing potential predators about their detection and therefore minimized chances of a successful predation attempt (Caro 2005). However, the information does not always have to be directed towards the predator, but may also serve intraspecific purposes such as raising the attention of group members and maybe even informing them about specific kinds of threats (Griffin 2004). Cognitively more complex hypotheses discuss the recruitment of conspecifics and even heterospecifics to join the mob in order to increase its efficiency (Suzuki 2012). Taking leading roles in mobs might also be used to showcase one's fitness to group members by asserting dominance through approaching or harassing predators (Hegner 1985; Slagsvold 1984), a hypothesis that is paralleled by the Handicap principle which states that honest signals must be costly. This is achieved by handicapping oneself through lowering one's own fitness, either through energetically expensive phenotypical traits or risky behaviours that individuals with lower fitness could not afford (Zahavi et al. 1999).

In addition, during mobs all group members, participating or not, are very likely to be in a highly attentive state. This may be exploited by some individuals to communicate underlying intersexual mate attraction signals to other individuals with a higher rate of success (Ellis 2009). However, apart from using mobbing behaviour to send information, it could also be a tool for acquiring information. Mobbing of novel or little known individuals or species, maybe even objects, might serve to check their reaction and ascertain whether they prove a threat or not (Graw & Manser 2007). Further, since mobbing is a cooperative task there might very well exist differences in the willingness or disposition to cooperate with specific partners. On the one hand partner choice might be influenced by nepotism, a strong observable effect in which individuals prefer related over non-related individuals (Griesser & Ekman 2005). On the other hand reciprocity might influence partner choice which is a mechanism taking memory and individual recognition into account. Here, individuals only help other individuals if they previously got help from them or have reason to expect that they will get help in the future, but refuse to help individuals that failed to help them in the past (Krams et al. 2007).

These different hypotheses are not mutually exclusive, some of them are quite compatible and all of them need certain common requirements fulfilled by the species performing the mobbing behaviour. These requirements will be the focus of this study.

The evolution of mobbing requires regular contact with predators (Wallace J. Dominey 1983). It is also necessary that animals posses the cognitive abilities to coordinate actions and to cooperate with each other (Parker & Milinski 1997). In order to mob specific threats, animals must be able to learn about them. They have to remember what they have learned to use it for future confrontations and identification (Curio et al. 1978). And if there are effects of individual traits on mobbing behaviour, they should be expressed by different mobbing participation rates between group members.

Ravens (*Corvus corax*), which belong to the corvid family, fulfil all those requirements. Their scavenging lifestyle puts them in confrontation with predators, such as wolves (*Canis lupus*), on a regular basis (Wilmers et al. 2003). There are anecdotes of specific males taking a leading role in mobs (Heinrich 2007), indicating individual differences in mobbing participation. Ravens are a social species with high fission-fusion dynamics (Braun et al. 2012) in the non-breeder state. This social system potentially enables them to evolve complex cognitive abilities (Aureli et al. 2008) such as coordination in mobs. Corvids are also able to identify individual conspecifics (Wascher et al. 2012), which might allow them to identify other species or maybe even individuals of other species. Multiple studies already investigated and documented mobbing in corvids (Verbeek 1972; Marzluff & Balda 2010; Cornell et al. 2011) and some of them even focused on identifying specific threats, such as humans (Marzluff et al. 2010). Marzluff et al. (2010) investigated the abilities of American crows (*Corvus brachyrhynchos*) to learn about novel, artificial threats and use this information for prolonged periods of time. They introduced artificial threats by having human experimenters wear masks while catching and ringing the birds. After these stressful events the birds started to mob the masked presenters, even when they were not caught themselves, but only witnessed the catching of conspecifics. Marzluff et al. focused on the horizontal and vertical transmission of these traditions and used neutral masks, that were not worn during catching, as control. The whole study was conducted in the field and showed not only the crows' ability to learn to successfully differentiate between the masks, but also a spread of this behaviour to initially naive birds and new areas that indicates social learning (Marzluff et al. 2010; Cornell et al. 2011).

Using similar methods the focus of the current study was on underlying social aspects that influence mobbing participation. Human presenters with masks were used to elicit a mobbing response, but the birds were never handled or threatened by the presenters themselves. They learned of the outcome of a possible predation by witnessing an experimenter carrying a dead raven. In addition this study was conducted with captive birds instead of wild ones, which permitted knowledge of the birds' sex, age, raising, dominance, affiliation and kinship. Also it was possible to identify the mobbing participants on an individual basis and have complete control over the time, amount and manner of presentations. Furthermore time and design of exposure could be standardised for all birds, something that is hardly possible under field conditions.

The objectives of the present study were i) to investigate the ravens' speed of learning, ii) to determine the amount of time they are able to remember and use what they have learned to identify potential threats and iii) to investigate whether there are specific roles in mobs taken by specific individuals .

Our prediction was that individuals with higher dominance ranks will also have higher mobbing participation rates. An alternative strategy to scaring away the predator could be gathering additional information about the predator, which should show in the birds` behavioural response. We predict that the ravens will be fast in learning about new threats and already successful in distinguishing between dangerous and non-dangerous conditions after a few presentations. We further predict that the ravens will use this information for future encounters and significantly differ in their response between the conditions on a long-term basis.

Material and Methods

Subjects and Setting

Study subjects were 16 captive, subadult ravens that were kept in two equally large groups. All birds were housed at the Haidlhof Research Station, a collaboration between the University of Vienna and the University of Veterinary Medicine, Vienna, situated close to Bad Vöslau, Lower Austria (Fig. 1). Group A consisted of 5 females and 3 males, all parent-raised and hatched in 2010.

Fig. 1: Haidlhof research station

Group B consisted of 4 females (3 hand-raised, 1 parent-raised) and 4 males (3 hand-raised, 1 parent-raised). All but two females hatched in 2011 (the two females in 2010) (Tab. 1). All birds were marked with colored rings for individual identification. The birds were kept in two outdoor aviaries with walls of wire mesh and a roof netting. Each aviary had smaller experimental chambers attached, that were made entirely out of wood to separate the birds during the test condition but outside testing provided them with shelter and visually isolated retreating opportunities. Multiple branches were provided as enrichment and perching opportunities. The ground substrate consisted of sand, gravel and wood chips. The birds were fed twice a day with a diet of meat, fruits, vegetables and milk products and had access to water *ad libitum*.

Tab. 1: Overview of study subjects

Name	Group	Sex	Year Hatched	Raising
Astrid	B	Female	2010	Hand-raised
Joey	B	Female	2010	Hand-raised
Thor	B	Male	2011	Parent-raised
Skadi	B	Female	2011	Parent-raised
Lellan	B	Female	2011	Hand-raised
Matte	B	Male	2011	Hand-raised
Orm	B	Male	2011	Hand-raised
Ray	B	Male	2011	Hand-raised
Anton	A	Male	2010	Parent-raised
Heidi	A	Female	2010	Parent-raised
Jonas	A	Male	2010	Parent-raised
Jakob	A	Male	2010	Parent-raised
Klara	A	Female	2010	Parent-raised
Ellen	A	Female	2010	Parent-raised
Sophie	A	Female	2010	Parent-raised
Lena	A	Female	2010	Parent-raised

Testing procedure

The experiment was conducted from October 2011 to April 2012 and consisted of presentations of specifically accentuated persons. All presentations were performed between 2 and 4 pm. Every presentation consisted of two conditions and therefore two trials per day with a ten minute baseline before and after each trial. For the presentation a human presenter was clothed in standardised equipment and was wearing one of two masks depending on the condition of the trial (Fig. 2).

Fig. 2: Mask presenter in standardized clothing holding a dead raven. Clothing consists of black rubber boots, white rubber gloves and an olive plastic poncho. On the right are the two used masks: black on top and red on bottom.

The presenter walked along a fixed path where he/she started out of sight of the birds, approached the aviaries and took position at the respective locations (Fig. 3). At each location he/she paused for two minutes and then continued to the next location. After the final location the presenter returned to the starting point and went out of sight of the birds.

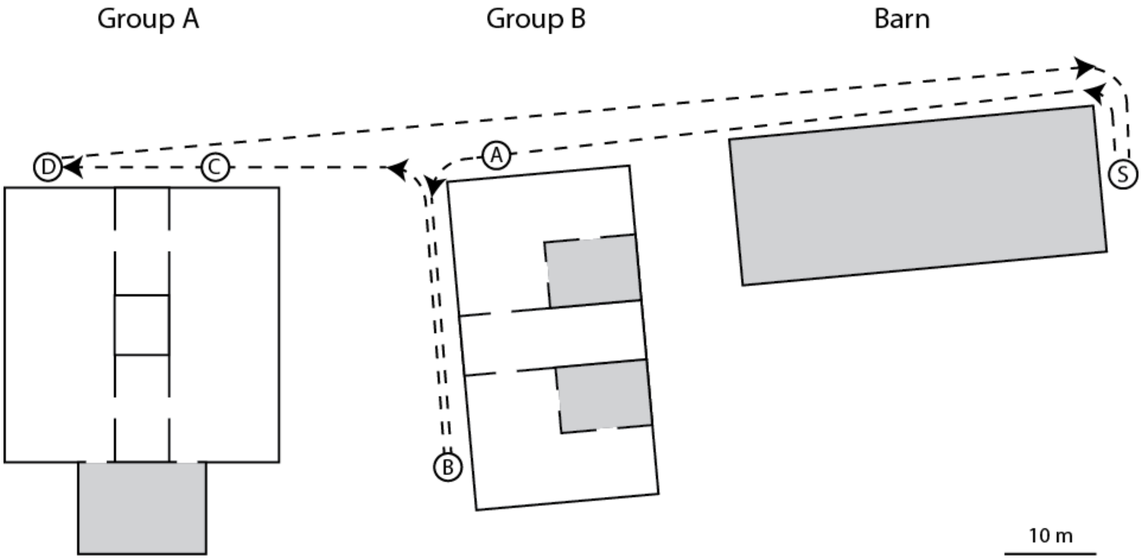

Fig. 3: Plan of the Haidlhof Research Station, raven aviaries and barn. (A), (B), (C), (D) show the mask presentation locations, (S) marks the starting point, visually isolated from the birds by the barn. The dashed line shows the path the presenter is walking along. Grey blocks mark inside areas, lines mark walls.

The experiment consisted of three phases; control, training and extinction. In the first phase, the control (October 2011), the birds were confronted with two neutral, novel masks. They were naive to both masks, the clothing and the presentation design. This phase consisted of four presentations, two times per week. In the second phase, the training (October 2011 to November 2011), the black mask was presented together with a dead raven. In this phase the association between the potential outcome of a predation (dead raven) and the "bad", black mask that it was presented with, was created. There were four presentations where a dead conspecific was presented with the black mask. These presentations took place once a week. In parallel presentations of the bad mask without a dead conspecific were performed, again once per week for the duration of the training phase. During every presentation both masks were presented in randomized orders, the neutral, red mask always without a dead raven. In the third and final phase, the extinction (November 2011 to December 2011), the precision and longevity of this association were tested by further presentations of both masks without the dead raven. Intervals were two times per month in the beginning, but were restricted to once per month (December 2011 to April 2012) to prevent habituation.

The behavioural response of the ravens was documented by video (Canon Legria HF S10, Canon Legria HF S30) and audio recording (Sennheiser ME 66). Recorded behavioural responses included the number of approaches, number and duration of vocalisations, both in and out of mobbing context, the time birds spent in close proximity to the mask (within a 3 meter radius to the presenter) and the time they spent on the ground. Video analysis was performed on PC with the use of Solomon Coder by András Péter. Statistics were done using SPSS Statistics 17.0 and SigmaPlot 11.0. Wilcoxon signed rank tests were used to compare between conditions, Friedman tests to compare between phases and Mann-Whitney U tests to compare between groups (always excluding presentations with a dead raven).

Results

Scolding

Comparison of the average time spent scolding as percentage to the total exposure time of the group shows significant differences in the performance rates between phases in group A (Fig. 4). Friedman tests show a statistically significant difference in group A in both neutral ($\chi^2(2)=11{,}200$; $p=0{,}004$) and bad mask condition

(χ^2(2)=13,040; p=0,001). Post-hoc analysis with Wilcoxon signed rank tests was conducted with a Bonferroni correction applied, resulting in a significance level set at p=0,025. In the neutral mask condition was no difference between control and training phase (Z=-1,34; p=0,180) but a trend showing higher scolding rate in the extinction phase than in the training phase (Z=-2,021; p=0,028). In the bad mask condition no difference between control and training was found (Z=-1,826; p=0,068) but a comparison of training and extinction did show a statistically significantly higher scolding participation in the extinction phase (Z=-2,366; p=0,018). In the bad mask condition the comparison of control and training phase showed no statistically significant difference (Z=-1,826, p=0,068) but the performance in the extinction phase was significantly stronger than in the training phase (Z=-2,366; p=0,018).

A comparison of the scolding performances of the neutral mask condition with those of the bad mask conditions within phases showed no significant differences in the control phase (Z=0,000; p=1,000), a trend in the training phase (Z=-1,826; p=0,068) and a significant difference in the extinction phase (Z=-2,366; p=0,018), both times with stronger participation rates in the bad mask condition.

In group B no statistically significant differences were found when comparing the control, training and extinction phases in both neutral (χ^2(2)=2,000; p=0,368) and bad mask condition (χ^2(2)=3,455; p=0,178). Comparison between the scolding rates of the neutral and bad mask condition showed no statistically significant differences in control (Z=-0,535; p=0,593), training (Z=-0,365; p=0,715) and extinction phase (Z=-1,069; p=0,285).

A Comparison between the two groups showed only a trend in their different scolding performances in the extinction of the bad mask condition (Mann Whitney U: Z=-1,864; p=0,062, all other p>0,1) (Fig. 4).

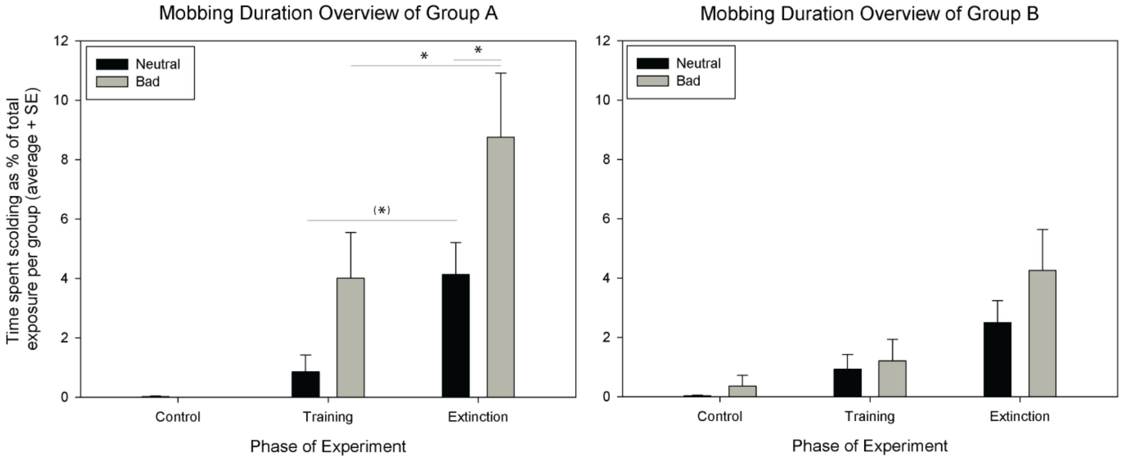

Fig. 4: Comparison of average group scolding performance over the three experimental phases (mean + SE). Significant differences in group A were observed between neutral and bad mask condition in extinction (p<0,05) and between extinction and training in bad mask condition (p<0,025; Bonferroni corrected) as well as a trend in neutral mask condition (p<0,05; Bonferroni corrected).

In group A a steady increase with high variation in scolding response was observed in parallel to the consecutive number of presentations in the bad mask condition of the training phase, both with and without a dead raven. But no statistically significant differences were found when comparing the trials within conditions and when comparing the conditions within trials (p>0,05) (Fig. 5). In group B the increase was less evident and individual variation was lower. Only the bad mask condition without dead raven and the neutral control condition from the dead raven presentations showed elevated scolding activity. No statistically significant differences were found (p>0,05) (Fig. 6). A Comparison between the performances of group A and group B in the training phase with the dead conspecific showed a trend with group A having higher participation rates (Mann Whitney U: Z=-1,660; p=0,097).

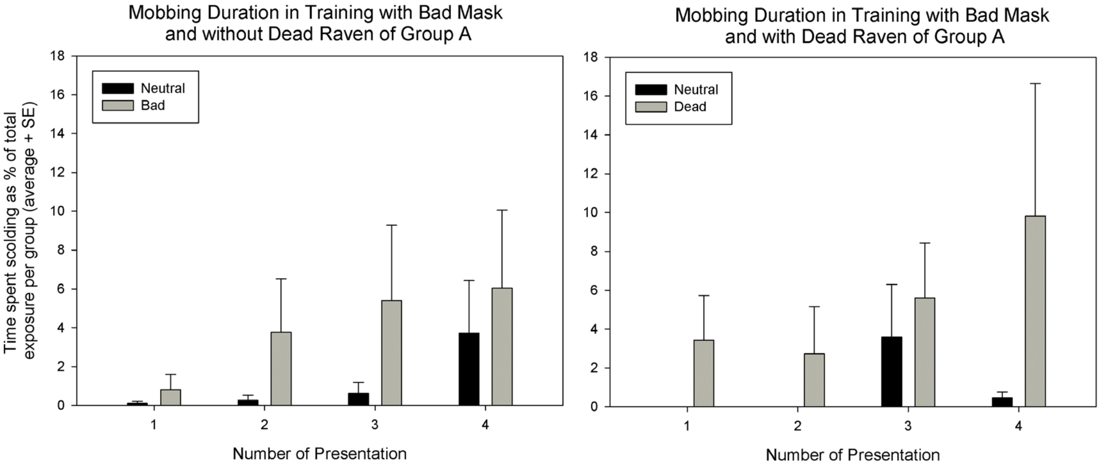

Fig. 5: Comparison of average group scolding performance over the four presentations of the training phase in Group A (mean + SE). The left part shows the scolding rates of the neutral mask and bad mask condition without dead raven. The right part shows the scolding rates of the neutral mask and bad mask condition with dead raven.

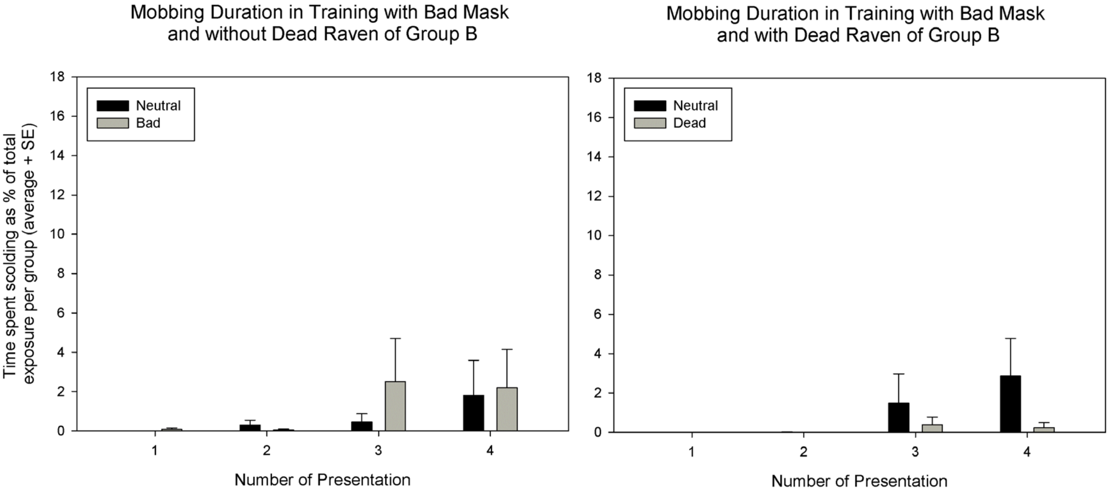

Fig. 6: Comparison of average group scolding performance over the four presentations of the training phase in Group B (mean + SE). The left part shows the scolding rates of the neutral mask and bad mask condition without dead raven. The right part shows the scolding rates of the neutral mask and bad mask condition with dead raven.

Individual performance levels of group A in the extinction phase show strong individual differences with two main contributors (Anton, Heidi) and a synchronisation between those two individuals (Fig. 7). In the bad mask condition seven out of eight individuals participated in scolding on at least one occasion, in the neutral mask condition six out of eight. The overall participation rate in the bad mask condition was higher than the participation rate in the neutral mask condition, but only in trial three of the presentation trials there was a significant difference (Wilcoxon: N=-2,201; p=0,028; all others p>0,05) (Fig. 7). In group B only two out of eight individuals scolded in the bad mask condition, and only three out of eight individuals scolded in the neutral mask condition (Fig. 8). There was no significant difference in any of the trials (p>0,05).

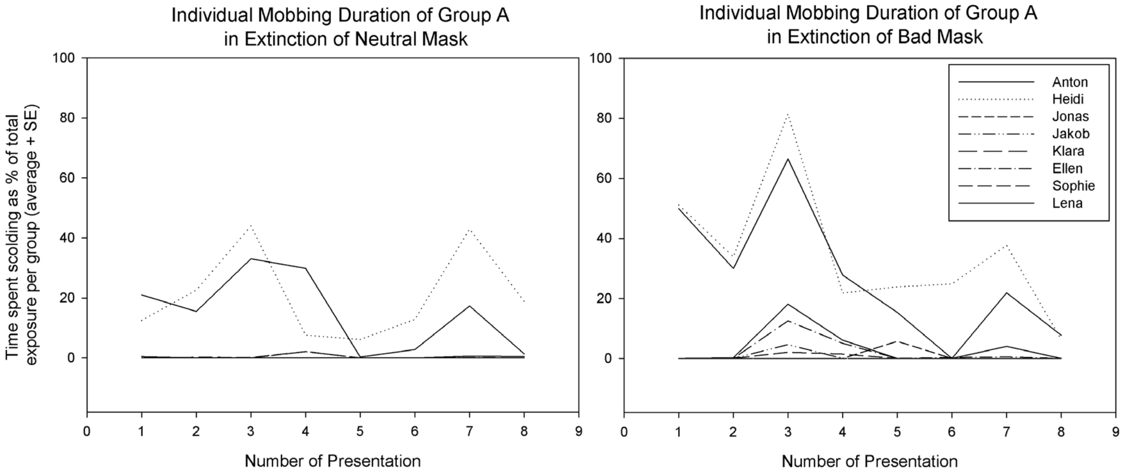

Fig. 7: Comparison of individual scolding performances over the eight presentations of the extinction phase in group A. Performance rates of the neutral mask condition are shown on the left, of the bad mask condition on the right.

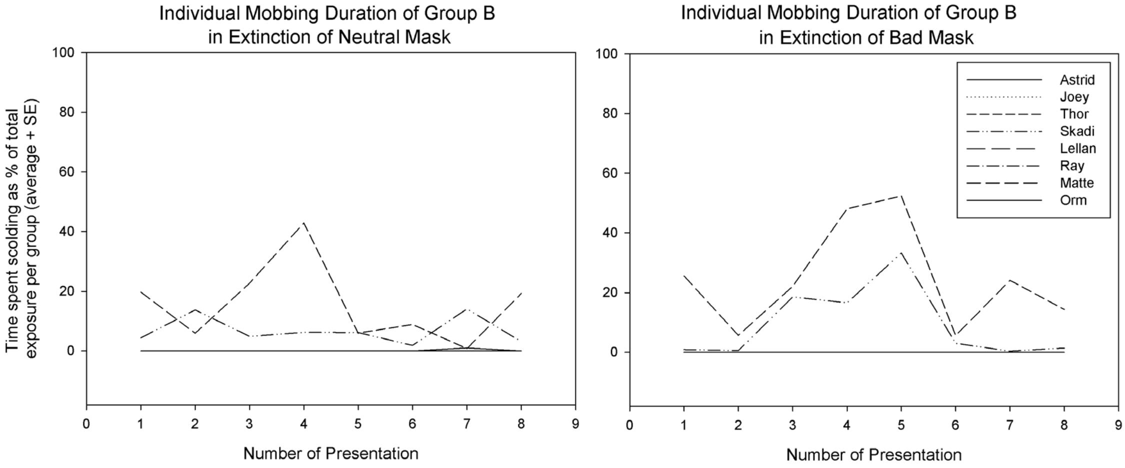

Fig. 8: Comparison of individual scolding performances over the eight presentations of the extinction phase in group B. Performance rates of the neutral mask condition are shown on the left, of the bad mask condition on the right.

Behaviour in addition to scolding

Friedman tests show significant differences when comparing the number of approaches by the birds towards the presenter over all three phases for both the neutral ($\chi^2(2)=12{,}968$; p=0,002) and the bad mask condition ($\chi^2(2)=15{,}000$; p=0,001) of group A, but not for group B (p>0,05) (Fig. 9). Post-hoc Wilcoxon signed rank tests with a Bonferroni corrected significance level of p=0,025 show significantly more approaches in the training phase than in the control phase (Z=-2,375; p=0,018) and more in the extinction phase than in the training phase (Z=-2,414; p=0,016). In the neutral mask condition no difference between control and training was found (p>0,05) but the extinction phase had significantly more approaches than the training phase (Z=-2,524; p=0,012). A comparison between the neutral and bad mask condition showed no difference in the control phase (Z=-1,342; p=0,180), a trend in the training phase with the bad mask condition having more approaches (Z=-1,89; p=0,059) and no difference in the extinction phase (Z=-1,025; p=0,305) (Fig. 9). During the presentation of the dead raven the birds of group A showed significantly less approaches to the bad mask than to the neutral mask that was presented without dead raven (Z=-2,379; p=0,17), while the birds of group B did not (Z=-1,414; p=0,157).

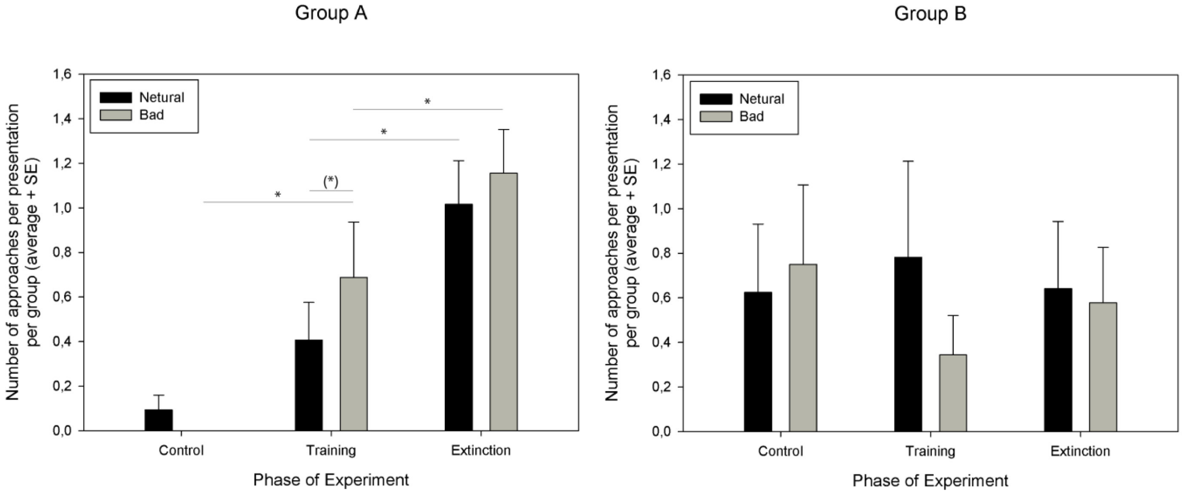

Fig. 9: Comparison of number of approaches over the three experimental phases (mean + SE). Significant differences in group A were found between control and training (p<0,025; Bonferroni corrected) and training and extinction (p=0,016; Bonferroni corrected) in the bad mask condition. In the neutral mask condition training and extinction varied significantly (p<0,025; Bonferroni corrected). A trend was found between the neutral and bad mask condition in the training phase (p<0,1).

Comparison of the time the birds spent on the ground over all three phases showed statistically significant differences in both neutral ($\chi^2(2)=12,286$; p=0,002) and bad mask condition ($\chi^2(2)=9,867$; p=0,007) of group A (Fig. 10). Post-hoc Wilcoxon signed rank tests with Bonferroni corrected significance level of p=0,025 show no significant differences in the neutral mask condition between control and training (Z=-1,826; p=0,068). In the extinction phase the birds spent significantly more time on the ground than in the training phase (Z=-2,38; p=0,017). In the bad mask condition there was significantly more time spent on ground in the training phase than in the control phase (Z=-2,555; p=0,011), but no difference between training and extinction (Z=-1,122; p=0,262). However, there was a trend between control and extinction, with extinction having more time spent on ground (Z=-2,201; p=0,028). The birds spent significantly more time on the ground in the bad mask condition than in the neutral mask condition in training (Z=-2,410; p=0,016) and the reverse in the extinction phase (Z=-1,960; p=0,050). No statistically significant difference was found in the control phase (Z=0,000; p=1,000). In group B Friedman tests showed no difference between the phases in the neutral mask condition ($\chi^2(2)=1,500$; p=0,472) but did so in the bad mask condition ($\chi^2(2)=6,000$; p=0,050). Post hoc Wilcoxon signed rank tests did not show any significant differences though (p>0,025). No statistically significant differences between the mask conditions were found in any of the three phases (p>0,05) (Fig. 10). However, a significant difference was observed showing less time spent on the ground when the bad mask was presented with a dead raven compared to the neutral condition in group A (Z=-2,207; p=0,027) but not in group B (Z=-1,461; p=0,144).

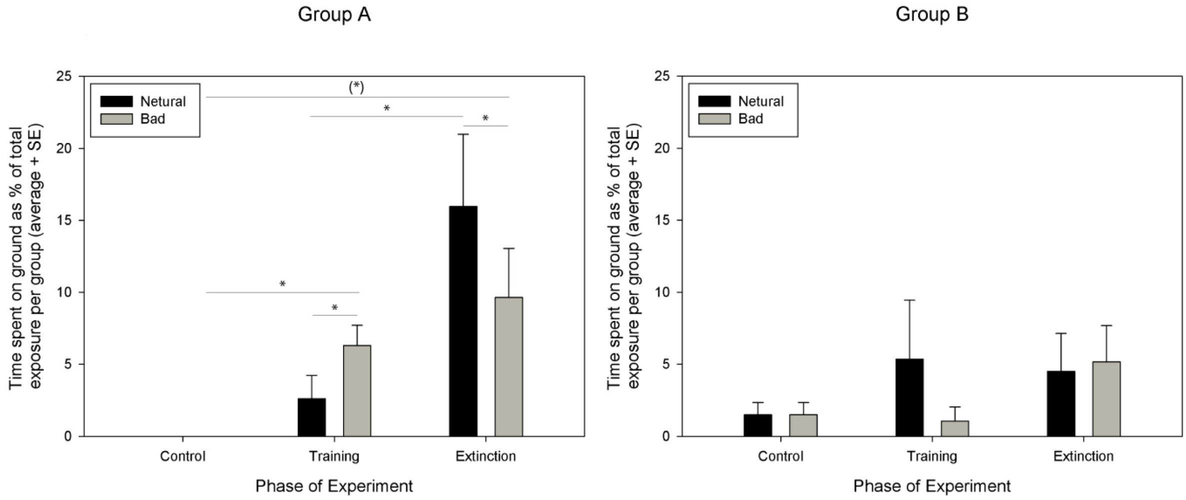

Fig. 10: Comparison of average time spent on ground per group over the three experimental phases (mean + SE). In group A significant differences between the control phase and the training phase of the bad mask condition (p<0,025; Bonferroni corrected) and between the training phase and the extinction phase of the neutral mask condition (p<0,025; Bonferroni corrected) were found. A trend between the control and the extinction phase of the bad mask condition was observed (p<0,025; Bonferroni corrected) as well as a significant difference between conditions in both training and extinction phase (p<0,05).

Discussion

The ravens in this study showed rapid learning capabilities, long-term memory and differentiation abilities in respect to facial masks, which has also been previously shown in wild crows (Marzluff et al. 2010). A steady increase in scolding rate over the conditions and a significant increase from training to extinction for both masks was documented in group A. Group B also showed a steady increase in scolding rate over the conditions. However, this increase was weaker than in group A and did not reach statistical significance. Group A showed a statistically significant difference between the neutral and the bad mask condition only in the extinction phase with the bad mask being scolded more frequently than the neutral one. No such difference was observed for group B. In group A seven out of eight individuals took part in scolding at least once during the extinction, in group B only two out of eight did. Overall scolding performance of group B was also lower than of group A. A synchronisation between sibling pairs was observed during the extinction phase in both groups. A similar pattern was found in both the number of approaches towards the presenter and the time the birds spent on the ground.

A rapid response in scolding rate in the training phase of group A shows a quick association of the dead raven with masked persons in general. The first presentation of the dead raven already elicited increased scolding behaviour, raising possibility of one trial learning about possible predators at least in some subjects, as was previously discovered in wild American crows (Marzluff et al. 2010). Differentiation between the masks took longer and only occurred in the extinction phase. Group A scolded the bad mask significantly more than the neutral mask while group B did not. This raises the possibility of social learning in combination with individual learning, which is further supported by the strong individual differences in participation. Flexible behaviour is beneficial when confronted with the choice to gather accurate but costly or less accurate but inexpensive information (Boyd & Richerson 1995), making a combination of the two even more likely (Hollén & Radford 2009).

Scolding response of both groups was strongest in the extinction, confirming that the birds responded to the dangerous presenter and not the dead raven. Lower scolding of group B indicates that birds in group B associated the masked presenters with a lower threat level than birds in group A. The fact that scolding performances did not drop in the extinction phase may indicate a perceived reward for the birds by seeing the presenter leave after scolding him/her and therefore potentially preventing another confrontation with a dead conspecific (Cornell et al. 2011).

In both groups it was the dominant male and its sister that were responsible for the main part of the scolding response. This might indicate that specific roles are taken by specific individuals during mobs. Kin or affiliation effects might also play an important role since other sibling groups showed similar responses to each other. Aside from kinship dominance may as well have affected the birds' response since both males and one sister were dominant in the group. The other sister was subordinate, but still had a high level of scolding, therefore not only dominance but also status could have an effect. Because of the low number of subjects we could not tease apart these potential effects.

The significant increase in number of approaches of group A for both masks from training to extinction and the lack of differentiation between the two conditions indicates a response alternative to scolding. This behaviour might not serve to scare away the threat, but get additional information about it, after the presenter was perceived as a threat in the training phase. The fact, that the birds showed significantly less approaches during the presentation of the dead raven supports this interpretation, since the presence of a dead conspecific increases the perceived threat level. The increase in number of approaches may indicate rising interest in the presenter. This hypothesis is supported by an increase in time spent on the ground in the training phase and even more so in the extinction phase, while they did not spend any time on the ground in the control phase. Furthermore, in the training phase they spent significantly less time on the ground when the bad mask was presented with a dead raven, but significantly more time when the bad mask was presented without a dead raven when compared to the neutral mask, indicating higher interest in the bad mask than in the neutral mask already in the training phase.

Group B showed no significant changes in their number of mask approaches or time spent on ground. This may show that the individuals of this group did not learn to differentiate between the masks or did not perceive the human presenters as a threat of the same extent as individuals of group A did. One possible explanation may be that individuals in group B were one year younger than the ones in group A, indicating an age effect. A second, and more likely explanation would be an effect of raising, since all individuals of group A were parent raised whereas only two individuals of group B were. These two parent raised individuals were also the ones that were responsible for most of the scolding response of group B, supporting a potential effect of raising. No effect of sex was found.

Since the only feature to allow discrimination was the face of the presenters the common trait of stiffness in both masks may have been confusing for the birds, as was hypothesised in Marzluff et al. (2010). The birds were still able to differentiate, indicating their focus on the face, which, in combination with their ability of gaze following (Bugnyar et al. 2004) might prove another problem of being able to identify the varying presenters by their eyes. However, scolding of the neutral mask could also be explained not as mistake or individual variability, but as risk averse behaviour with low costs and high benefits (Real & Caraco 1986). To disentangle these potential effects, follow up studies with human presenters of set roles would need to be done, where the human face is used as discrimination feature instead of an artificial mask.

Future approaches should look into individual performances to shed more light on individual differences and certain roles that are taken over. Also, single birds should be separated from the group to test whether isolation has an effect on their performance and check for social motivations. Further studies with other species, preferably closely related corvids, could show the ecological influence on mobbing behaviour.

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Abstracts

Avoiding Predation is essential for securing survival in many species. Mobbing is a viable strategy often found in animals that come in frequent contact with predators and have the cognitive abilities for identification and coordinated action. Previous studies investigated mobbing responses of corvids through artificially introduced predators in the wild. Here we applied this paradigm but precisely controlled the presentations and checked for social factors in a captive colony of subadult ravens (n=16) . We tested mobbing responses of birds to a masked human experimenter in a "neutral" and "dangerous" condition. During the first four tests the person with a “dangerous” mask carried a dead raven while passing the aviaries, whereas the person with a "neutral" mask did not; afterwards, tests were always performed without a dead raven. We were interested in i) how quickly ravens learned to mob the “dangerous” mask , ii) how long they showed a selective response and iii) which social factors influenced their participation in mobbing. Results showed that most birds quickly learned to differentiate between masks and continued to do so for a long period. Participation in mobbing was influenced by kin, dominance and type of raising (Blum & Bugnyar 2013).

Prädation zu vermeiden ist essentiell für das Überleben in vielen Spezies. Mobbing ist eine brauchbare Strategie welche oft in Tieren gefunden wird, die regelmäßigen Kontakt mit Prädatoren haben und über die kognitiven Fähigkeiten für Identifikation und koordinierte Aktion verfügen. Bisherige Studien untersuchten Mobbing Verhalten von Corviden durch künstlich eingeführte Prädatoren im Feld. Wir verwenden dieses Paradigma, aber kontrollieren die Präsentationen und testen auf soziale Faktoren in einer Kolonie von gefangenen, subadulten Raben (n=16). Wir testeten Mobbing Verhalten von Vögeln auf maskierte menschliche Experimentatoren in einer "neutralen" und einer "gefährlichen" Kondition. Während der ersten vier Tests trug die "gefährliche" Person einen toten Raben während sie an den Volieren vorbei ging. Die "neutrale" Person nicht; darauf folgende Tests wurden immer ohne toten Raben durchgeführt. Wir waren interessiert i) wie schnell Raben lernen die "gefährliche" Maske zu mobben, ii) wie lange sie eine selektive Reaktion zeigen und iii) welche sozialen Faktoren ihre Beteiligung am Mobbing beeinflussen. Ergebnisse zeigen, dass die meisten Vögel schnell lernen zwischen den Masken zu unterscheiden

und dies für eine lange Zeit weiterhin tun. Beteiligung am Mobbing wurde von Verwandtschaft, Dominanz und Art der Aufzucht beeinflusst.

Curriculum Vitae

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