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# Public preferences for different practices in large carnivore management – a multidimensional approach

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# Sammendrag

En nasjonalt representativ spørreundersøkelse av Norges voksne befolkning viser at allmennhetens *preferanser for ulike forvaltningspraksiser* er påvirket av mange ulike variable. Resultatene samsvarer i hovedsak med det som er kjent som *påvirkninger på allmennhetens aksept* av store rovdyr.

Også ønsker om forvatningspraksis avhenger derfor av mange ulike forhold. Slike komplekse sammenhenger blir kanskje mer forståelige dersom man ser de mange variablene som innbyrdes relaterte deler av et sammenhengende system. Denne analysen støtter en flerdimensjonal modell, hvor prediktorene er:

1. To hovedsynspunkter på rovdyrene (*trussel* og *ikke-trussel*),

2. to grupper av dyr (*mindre* and *større* rovdyr),

3. respondentenes *grad av aksept for rovdyr i fem ulike situasjoner*, og

4. en rekke *egenskaper ved respondentene*.

Rovdyr som forstås som en trussel og "Store rovdyr" (ulv og bjørn), fører til ønsker om en streng forvaltningspraksis. Men også respondentenes generelle aksept av rovdyr er en viktig prediktor for hva man ser som passende tiltak. I tillegg henger mange egenskaper ved respondentene sammen med ønsker og preferanser om forvaltningstiltak. En del av denne påvirkningen kan være indirekte, slik at den virker gjennom sin innflytelse på aksepten av rovdyr.

Denne flerdimensjonale modellen er såvidt kompleks at den nok antyder at enklere synspunkter kan begrense vår evne til å forstå viktige sider ved dette forskningsfeltet.

I den offentlige debatten om store rovdyr finnes det deltakere som helt enkelt argumenterer enten *for* eller *mot* store rovdyr i Norge. Våre resultater antyder at mer nyanserte synspunkter er vanlige i den allmenne befolkningen. Det samsvarer kanskje bedre med en rovdyrpolitikk hvor man *både* godtar bestander av store rovdyr *og* dessuten bruker strenge virkemidler i forvaltningen når dyrene utgjør en trussel.

## Abstract

In a representative national survey of the adult population of Norway, public *preferences for different management practices* were influenced by a large number of different variables. Results are largely consistent with known *influences on public acceptance* of the large carnivores.

Management preferences are subject to a number of different influences. The interpretation of this complexity may be facilitated by viewing the variables as interrelated parts of a coherent system. The present analysis supports a multidimensional model, involving the predictors:

5. Two main perspectives on the carnivores (*threat* and *non-threat*),

6. two groups of species (*minor* and *major* carnivores),

7. respondents' degree of *carnivore acceptance* in five situations, and

8. a set of *respondent characteristics*.

Carnivores posing a threat and "Major carnivores" (wolf and bear) are associated with preferences for more severe management than others. Respondents' acceptance of carnivores also is a major predictor. In addition, a number of respondent characteristics are significantly related to the management preferences. Part of this influence may be *indirect*, mediated through carnivore acceptance.

The complexity of the multidimensional model implies that simpler perspectives may limit our comprehension in this field of research.

In popular debate on large carnivores, some participants argue simply *for* or *against* maintaining carnivore populations. The present results suggest that the general population hold more complex views, possibly more consistent with a policy of *both* accepting the carnivore populations *and* taking severe management measures when animals prove threatening.

# Contents

# 1. Introduction

Expanding into territory that has traditionally been used for other purposes, the increasing population of wolves *Canis lupus* in Scandinavia has sparked a public debate about the general management of large carnivores. Potential influences on people's perceptions of the large carnivores have been studied in several surveys, focusing on, e.g., wildlife-related values, attitudes, and motives. In representative samples, a majority accepts the existence at large carnivores. Similarly, the majority agrees that wolves are a symbol of nature, and would find it exciting to observe large carnivores (Bjerke, Reitan and Kellert, 1998; Karlsson, Bjärvall and Lundvall, 1999; Bjerke, Skogen and Kaltenborn, 2002; Ericsson and Heberlein, 2003).

## 1.1 Attitudes are dependent on situation

Knowing peoples' *general* feeling or attitudes towards carnivores may be of limited value, however. Several previous studies (e.g., Decker and Purdy, 1988; Decker, Jacobson and Brown, 2006; Whittaker, Vaske and Manfredo, 2006; Thornton and Quinn, 2009) indicate that in wildlife management research, general or abstract values may be different from more specific attitudes toward wildlife. Peoples' views on carnivores and management actions seem to depend on the circumstances implied.

In the U.S.A., Zinn, Manfredo, Vaske and Wittman (1998) showed that attitudes toward management actions directed at mountain lions *Puma concolor*, beavers *Castor fiber*, and coyotes *Canis latrans* depended upon the behaviour and location of the species. In a study among Colorado (USA) metropolitan residents, Zinn and Pierce (2002) found that more women than men expressed concern about being attacked by mountain lions, but that men were more likely than women to accept destroying the animal. Respondents with children living at home expressed greater concern than others.

Scandinavian researchers have also looked at attitudes toward wolves among various stakeholder groups. For example, the importance of measuring situation-specific attitudes when considering acceptable management actions was shown by Ericsson, Heberlein, Karlsson, Bjärvall and Lundvall (2004). They found that a majority of Swedish respondents found wolf hunting acceptable if it reduced the risk of livestock depredation, and if wolves entered human dwelling areas. Most Swedish hunters found wolf hunting justified if wolves threatened dogs, but the majority of the general public did not agree to this. Similarly, Karlson and Sjøstrøm (2007) found that Swedish respondents' distance to a wolf territory correlated positively with their attitudes toward wolf conservation.

Scepticism towards threatening animals has been shown also in other cultures and in relation to various species (e.g., Hill, 1998; Gillingham and Lee, 1999). And in a survey in Tanzania, Kaltenborn, Bjerke, Nyahongo and Williams (2006) measured how well 21 different species were liked by the respondents. When asked about their preferences for various management actions, respondents revealed a higher degree of acceptance of problems caused by animals that were well liked. If human lives were threatened, however, peoples' liking of the species had no effect on their preferences for management actions.

In a nationally representative Norwegian survey (Bjerke et al. 2002), respondents were asked about the acceptability of large carnivores a) living in remote wilderness, b) close

to where humans live, c) killing livestock, d) killing pets, or e) threatening humans. There were clear differences between these four situations, with acceptance of carnivores gradually decreasing from the first to the last. While the existence of wolves and brown bears *Ursus arctos* in remote wilderness, e.g., was accepted by 80% of the respondents, only about 20% accepted having them close to human dwellings (Kleiven, Bjerke and Kaltenborn, 2004).

## 1.2 Attitudes are dependent on species

While much research has been on wolves, also attitudes to the brown bear have been studied (e.g., Swenson et al., 1999; Kaczensky, Blazic and Gossow, 2004). And in Slovakia, 70% of respondents supported the existence of lynx *Lynx lynx*, compared with only 58% support for the wolf (Wechselberger, Rigg and Bet'kova, 2005). As stated by Bath, Olszanska and Okarama (2008), however, the Eurasian lynx is the unknown large carnivore if viewed from a human dimension perspective. Similarly, research on attitudes toward the wolverine *Gulo gulo* is almost totally lacking.

But all four species were included in the comprehensive Norwegian survey (Bjerke et al. 2002). Here, 80% of the Norwegian public was shown to accept the existence of wolves and bears in the country, while close to 90% accepts the two smaller carnivore species. Clearly then, species is not a factor to be excluded in this field of research.

## 1.3 Attitudes are dependent on several respondent characteristics

Several socio-demographic factors have been shown to influence general attitudes toward wolves. Women, the elderly, and people with limited education generally express relatively negative attitudes toward the species. Also, urban respondents accept a larger wolf population than do rural residents (Bjerke et al., 1998; Karlsson et al., 1999; Bjerke and Kaltenborn, 2000; Williams, Ericsson and Hdeberlein, 2002; Tangeland, Skogen and Krange, 2011). In addition, certain socio-cultural variables may seem important. Skogen and Thrane (2008) found that a measure of cultural capital (number of books in the home), as well as traditional rural values, should be included when attitudes toward wolves are analysed.

Further, *disempowerment* (a lack of personal control and influence) has been shown to be positively correlated with negative attitudes toward large carnivores among sheep farmers in Norway (Bjerke et al., 2000). Similarly, distrust in formal or informal information sources has been shown to be associated with negative attitudes toward wolves (Skogen and Haaland, 2001; Skogen and Thrane, 2008). Lastly, economic loss due to large carnivores (Røskaft, Händel, Bjerke and Kaltenborn, 2007) and environmental value orientation (Kaltenborn, Bjerke and Strumse, 1998; Bjerke and Kaltenborn, 1999) have been shown to affect attitudes toward large carnivores among the general public of Norway.

## 1.4 Influences combined

The existence of so many diverse influences on attitudes towards carnivores is a challenge. A comprehensive covariance analysis of carnivore acceptance data from the Norwegian survey (Kleiven & al. 2004) clearly showed that a multidimensional perspective was needed to properly assess the combination of influential variables. The

differences between situations constitute a major impact on the acceptability scores, as do the differences between the four species. But also a number of respondent characteristics are significantly related to the acceptability of carnivores. All types of variables simultaneously play a part – and interaction effects may be observed. Hence simpler notions including more limited sets of influences may lead to incomplete and possibly even misleading interpretations of the data.

## 1.5 Factors influencing the preferences for management actions

Ideally, decisions at all levels of government would be guided by correct assessments of public preferences for carnivore-related measures and initiatives. Politics and legislation, as well as wildlife management, need to be informed about peoples' attitudes toward various management actions – as well as the factors underlying or influencing such attitudes. Previous research and experience may suggest several candidate factors.

If people express very positive and accepting attitudes towards carnivores, they are likely to favor rather low level, non-intervening management actions. And conversely, a negative and rejecting stance toward the carnivores will probably coincide with a preference for more direct and restrictive measures, perhaps including the killing  of the animals. Common sense as well as simple balance theory (Heider 1958; Festinger 1957) would predict some correspondence between peoples' acceptance of carnivores and their preferences for carnivore-related management actions. However, as we have seen, attitudes and acceptance of carnivores is a  complex matter. It is to be expected, therefore, that also understanding peoples' preferences for management actions will require a multi-dimensional approach. Most likely, the influences on management preferences will have much in common with the factors determining what is viewed as acceptable carnivore behavior.

Firstly, the *situation* factor is likely to be relevant. After all, the need for wildlife management actions often arises from carnivore behavior that is unacceptable to the general public. *Animal species* should also be considered, since some carnivores are more disliked than others. But also respondents' *personal characteristics* should be considered; given that numerous individual differences are related to carnivore acceptance. In addition, *carnivore acceptance* should also be viewed as a separate variable. By this inclusion, it may be possible to separate other variables' *direct* influence on management preferences from their *indirect* influence through carnivore acceptance.

The present study, then, addresses the influence of *situation*, *species*, *respondent characteristics*, and *carnivore acceptance* on the Norwegian public's attitudes toward wildlife management actions. The study uses unpublished data from the Norwegian survey (Bjerke & al. 2002).

## 2. Methods and material

### 2.1 Sampling and data collection

The respondents were recruited by telephone (Telenor's directory) on the basis of a mathematically correct sample of the population (15 years and older) in each of the 19 Norwegian counties. The family member who had his/her birthday most recently was asked to participate. Initially, 7953 persons were contacted, and 3500 respondents were recruited to fill in the questionnaire. The questionnaire with pre-stamped return envelopes was sent by post to the recruited persons in November 2000. Ten days later a reminder was sent to all respondents, and a second reminder (including the questionnaire) was posted in December. Seventy-three percent of the recruited persons completed and returned the questionnaire. After removal of respondents yielding incomplete data, 2449 respondents remained in the final sample.

### 2.2 The questionnaire and analysis

A questionnaire covering a diverse set of items was used, most of which will not be discussed here. Directly relevant to our purposes was information related to Norway's four large carnivores (bear, lynx, wolf, and wolverine). This included the respondent's preferences among different management actions towards the carnivores – as well as the respondent's degree of acceptance of a variety of carnivore behaviors. Also elicited was information about the respondent's environmental and cultural value orientations, basic values in life, political preferences, and simple socio-demographics.

*Management alternatives*

Respondents were asked to indicate their preferred choice between five alternatives for management actions in the face of carnivores. The options were:
1. Do nothing
2. Scare the animal off
3. Catch and move the animal
4. Tag the animal for (satellite) surveillance
5. Kill the animal

*Behavior alternatives*

Subjects' preferences were elicited for five different animal *behavior situations*:
1. Far away: *The animal lives in the wilderness, far from people*
2. Close: *The animal is observed not very far from inhabited areas*
3. Livestock: *The animal kills domestic animals*
4. Pets: *The animal kills pets (cats or dogs)*
5. Human threat: *The animal threatens a human*

For each of these five situations, preference data were obtained for four different *animals* (lynx , wolverine, timber wolf and brown bear). Each respondent, therefore, provided 20 counts of choice data (preferred management option for four different *animals* in five different *situations*).

As previously reported (Kleiven & al. 2004), also *acceptance* data were collected within the same four-by-five design. For all four animals, each of the five behaviors was judged on a scale ranging from *quite unacceptable* (=1) to *quite acceptable* (=5). The mean of the five behaviors was then computed, yielding a composite acceptance score across the four species.

*Values and socio-demographics*

As shown previously (Kleiven & al. 2004; Skogen & Thrane, 2008), a number of variables influence peoples' *acceptance* of carnivore behavior. The present study investigates whether or not the same variables also predict peoples' preferences for management actions.

The variables shown to be significant predictors of carnivore acceptance in our first study (Kleiven & al. 2004) were:
1. Situation/animal behavior (5 categories: Far away → Human threat)
2. Animal species (4 categories: Lynx, wolverine, timber wolf, brown bear)
3. Perceived lack of control (5-point scale: 1. Low control → 5. High control)
4. Community size (5-point scale: 1. Town >40 K → 5. Sparsely populated area)
5. Gender (Binary: 1. Female – 2. Male)
6. Age group (6-point scale: 1. 15-24 → 6. 65+years)
7. Education (5-point scale: 1. Primary → 5. Graduate College)
8. Economic loss from carnivores expected (Binary. Yes – no)

On the more specific problem of wolves, Skogen and Thrane (2008) view *"…respondents' opinions of the desirable population size.."* (op. cit., p. 22), as *"… a measure of attitudes toward wolves"*. They then go on to show that several "cultural" variables of a fairly general nature may predict peoples' attitude toward wolves. Variables from that study also included in the present study were:

9. Father's vocational group (6-point scale: 1. Adm. Leadership → 6. worker)
10. Number of books at home: (6-point scale: 1. None → 6. 1000+)
11. Norwegian New Environmental Paradigm Scale, shortened version (Scale 1 → 5)
12. Accept of traditional rural values (Scale 1 → 5)
13. Trust in local authorities (Scale 1 → 3)
14. Trust in national institutions (Scale 1 → 3)
15. Perceived lack of control (Scale 1 → 5)

# 3. Analyses and results

The five management options may be arranged in a definite order, ranging from the *least severe* (Do nothing) to the *most severe* (Kill the animal) management actions. In the analyses, therefore, they were treated as an *ordinal* scale.

If the preference data had been on a higher level of measurement, the responses to management alternatives could have been viewed as a nested repeated-measure design. Then, a three-way variance analysis (similar to that used by Kleiven et al. (2004)) could have been employed. Since our preference data are ordinal, however, common analysis of variance or covariance will not be appropriate. Instead, the ordinal preference data were analyzed according to a fairly complex measurement model with means included. In this model, the preference data on the four different animals were the manifest variables.

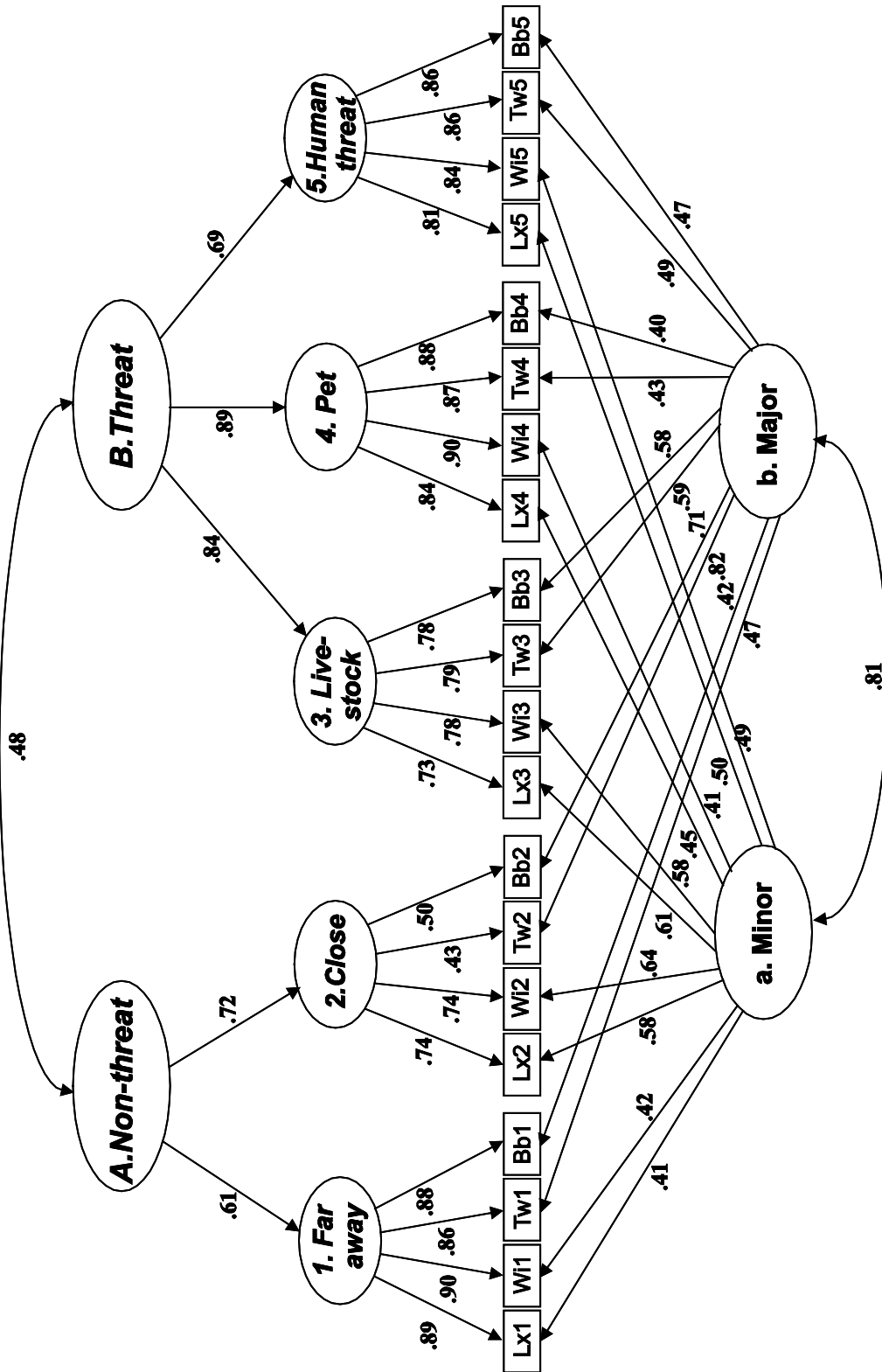## 3.1 Situations and species: The measurement model

The five *situations* were first modeled as five single and simple latent variables: *1. Far away, 2. Close*, *3. Livestock*, *4. Pet*, and *5. Human threat,* using Mplus 5.1 with WLSMV estimation for ordinal data (Muthén and Muthén 2007). In independent models, CFA does not yield good model fit for these five factors.

However, the five latent variables may be viewed as forming two distinct classes of situations. One class implies that the animal is a *menace* or a *threat* of some kind, while the other does not. The two latents *1.Far* and *2.Close*, then, contribute towards the second-order latent variable (*A. Non-threat*). The three remaining latent variables (*3.Animal*; *4.Pet;* and *5.Human threat*) contribute to the second-order latent variable of *B. Threat*.

Also, Kleiven et al.'s (2004) analyses of acceptance data indicate that the wolverine and the lynx are in general more tolerable to most people than the timber wolf and the brown bear. It seemed reasonable to expect, therefore, that this difference also would impact the preferences for management actions. To handle this potential source of variance, two additional latent variables were added. The lynx and the wolverine were dubbed *minor* large carnivores, while the timber wolf and the brown bear were designated as the *major* ones. Data on *lynx* and *wolverine*, accordingly, were assumed to relate to factor *a. Minor*, and the data on *timber wolf* and *brown bear* to factor *b. Major*.

The resulting complex measurement model is displayed in figure 1. The performance of the model was examined by Mplus 5.1, using the default WLSMV estimator for categorical data. All paths drawn are statistically significant. The Chi-square test does not support the model (Chi-square = 126.906; df = 18; p < .0001). Other indices, however, suggest that the model is rather consistent with the observed data (CFI = .999; RMSEA = .050; WRMR = .975). Apparently, the structure of the measurement model is not very different from that in our data.

**Figure 1: The basic measurement model**

Neither classifying the five situations into *"Non-threat"* and *"Threat"* nor sorting the four carnivores into the *"Minor"* and *"Major"* categories violates the correlations actually present in the material. Our complex measurement model, therefore, appears to correctly reflect relations between the variables – manifest and latent – that are needed to assess peoples' preferences for management actions to large carnivores.

This type of CFA model, however, only reflects the *correlations* between the different variables. But we also need to know if the *level* of the responses to the five situations (and to the *Non-threat* and *Threat* conditions) were similar or not. In addition, *Minor* and *Major* carnivores may or may not elicit the same responses. But the level (or mean) of the variables does not appear in the diagram.

With ordinal variables, however, 'normal' arithmetic means may not be computed. In that case, therefore, the Mplus procedure uses *threshold levels* as a proxy to means. For four of the five possible responses (preference for one of the five alternatives given for management action), a threshold is computed. Thresholds may be viewed as the ordinal "counterpart" of the intercept term in common regression equations. A threshold is computed for each response category, and may be used to predict the probability of that response.[1]

As an example, consider the thresholds of responses to lynx, shown in figure 2. Clearly, all thresholds are at their maximum in the "Far away" situation, descending to a minimum under "Human threat". This tendency is also found with the responses to the three other species in question.

**Figure 2: Threshold values for responses to lynx in the five situations**



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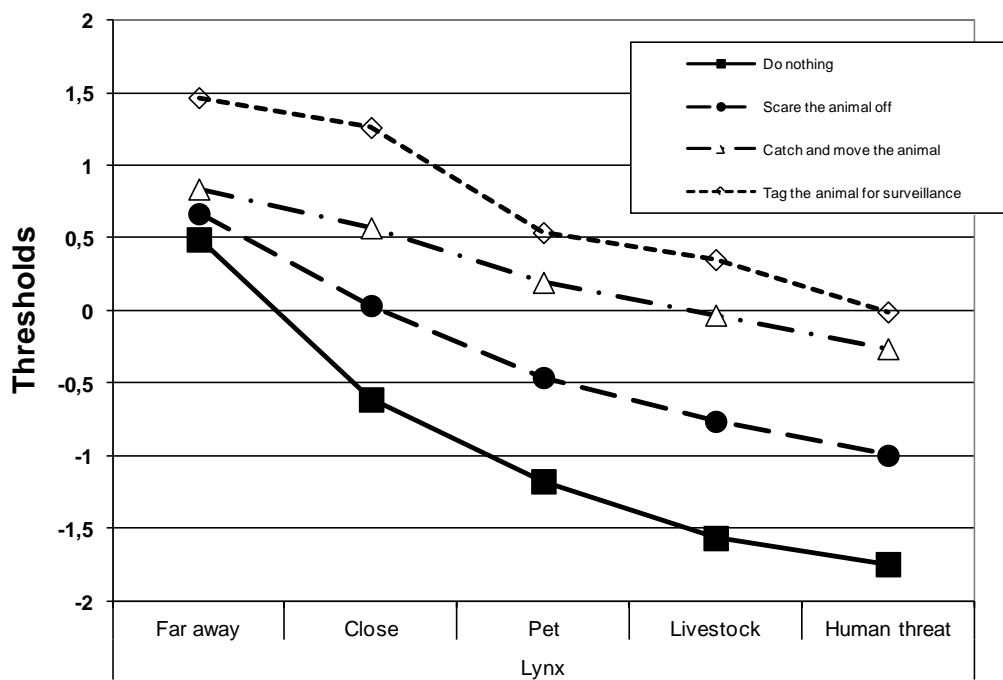
[1] Assigned no threshold value, the fifth response has its probability determined as the residual: The probability of "*killing the animal*" simply is the probability of going beyond response 4 (*Tag the animal for surveillance*).

The question is, then, whether or not the threshold differences between the five situations constitute a statistically significant tendency. Testing this involves an alternative model, specifying that thresholds for corresponding items in all five situations be equal.

However, the common test for significant Chi-square differences cannot be performed on the values derived with WLSMV estimations, according to Muthén and Muthén (2007). Using a special Mplus procedure (op. cit.: pp 367-368), however, an adjusted chi-square value for the difference may be obtained. It shows that the difference is highly significant (Chi-square = 9078.233; df = 13; p < .0001). This difference indicates that in our data, the distribution of preferences for management actions varies across the five situations.

The same logic may be applied to the question of different thresholds in the *Minor* and *Major* pair of carnivore species. A model specifying equal thresholds *for all species* in each of the five situations also does not fare well. Again employing the Mplus special procedure to test the statistical significance of the difference, it turns out to be highly significant (Chi-square = 2517.517; df = 18; p < .0001). This difference indicates that the responses to the four species are also not equal. It may be noted, however, that specifying the *species* to have equal thresholds apparently comes closer to the "true" model than did the model with equal thresholds for all *situations*.

Understanding these differences in terms of the 80 thresholds implied and their odds ratios is hardly convenient, however. The distribution of original preference responses, therefore, may give a more accessible picture of the matter. Figure 3 shows the response proportions in the "Non-threat" and "Threat" situations.

**Figure 3: Distribution of responses to two classes of situations. Per cent**
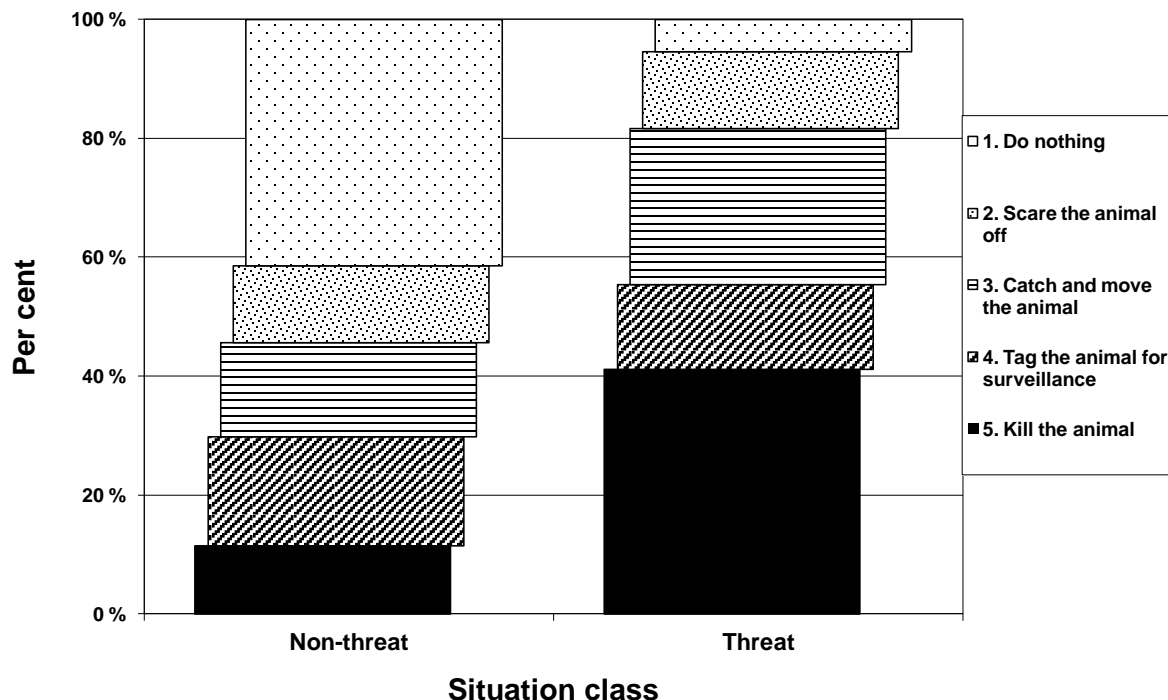
In the "Non-threat" situations, the dominant (modal) response is to *do nothing*, and *killing the animal* is a relatively rare response. In the "Threat" condition, however, *killing the animal* is the modal response. Here, only a small minority prefers to *do nothing*. It may also be noted that also *catch and move the animal* is a fairly common response. The difference in response distributions between the two situation classes is highly significant (Chi-square = 11228.45; df = 4; p < .0001).

The *Minor* and the *Major* carnivores also elicit different responses. As figure 4 indicates, responses to the Major category are the most severe. It is quite clear, however, that the differences are smaller that the differences between situations. Nonetheless, the differences are clearly significant (Chi-square = 574.59; df = 4; p < .0001).

**Figure 4: Distribution of responses to "Minor" and "Minor" large carnivores. Per cent.**
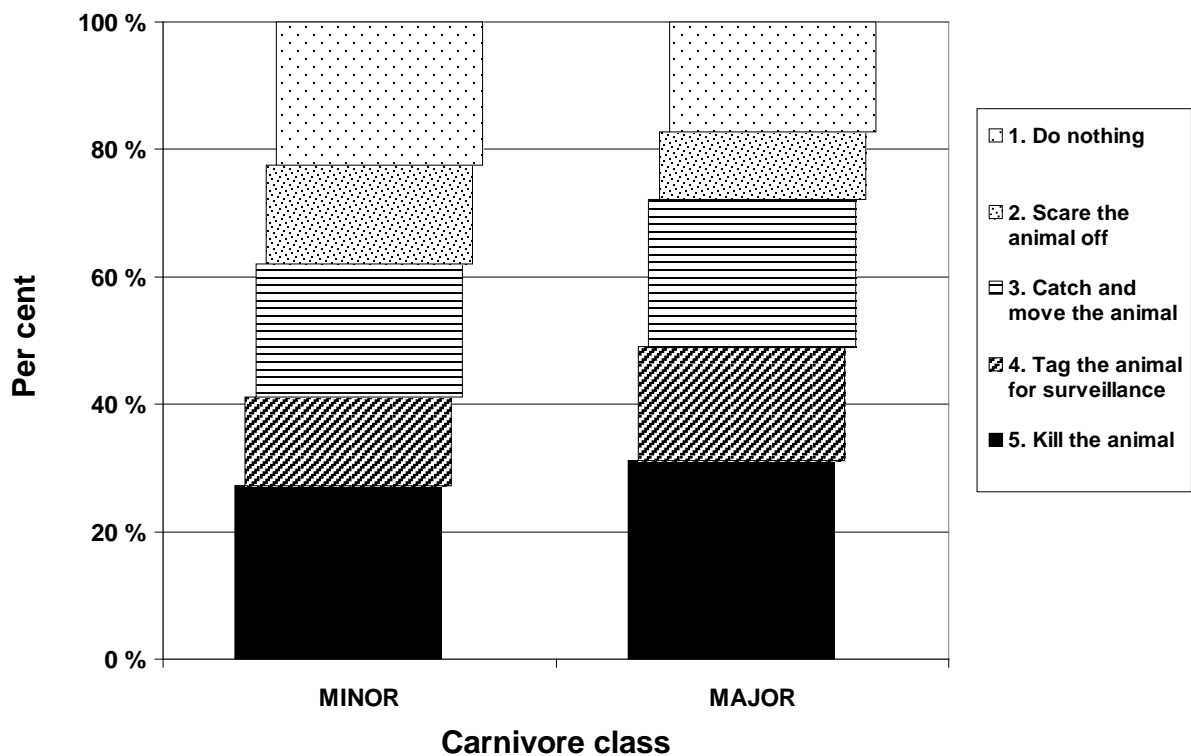


### 3.2 Acceptance scores and individual characteristics: The effect model

In figure 5 the final MIMIC model is shown. It fits the data rather well. While chi-square does not support the model (Chi-square = 294.612; df = 66; p <0.001), all other indices do (CFI = 0.996; RMSEA = 0.040; WRMR = 1.368).

The model includes the *acceptance* scores for the five situations, modeled as (significant) paths to the *preference* scores related to these situations. The model also includes all exogenous variables that are significantly correlated with the two second-order factors *Non-threat* and *Threat*.

**Figure 5: MIMIC model of influences on preferences for carnivore management actions**
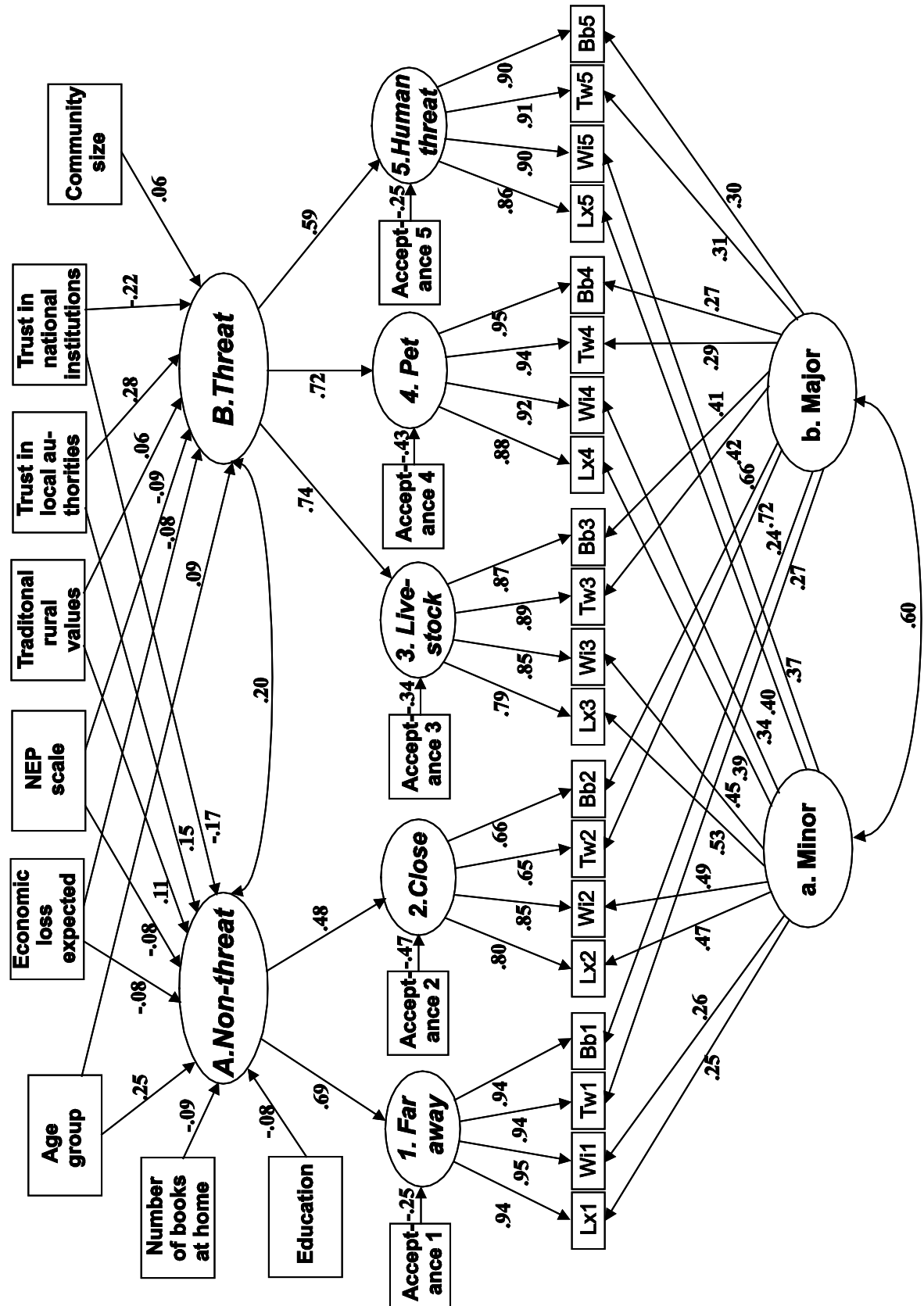
Three variables (*Gender, Father's occupation, Perceived lack of control*) are not included in the model, being significantly related neither to *Non-threat* nor to *Threat*. This part of the results was not expected, since previous studies present all variables as important influences on management preferences.

Seeing an explanation for this apparent incongruence, a similar model was run, but *leaving out* the acceptance scores. The chi-square test still appears not to support the model (Chi-square = 259.326; d.f. = 59; p < .0001), while other indices obviously do (CFI = .998; RMSEA =.04; WRMR = 1.152).

As shown in table 1, loadings of most exogenous predictor variables then were slightly higher. And the importance of Gender, shown by previous studies to be a significant influence on management preferences, is reaffirmed. Apparently, the inclusion of the acceptance scores serves to attenuate the influence of most exogenous factors. This may suggest that these factors, known to be strong predictors also of peoples' *acceptance* of carnivores, exert an *indirect* influence through the acceptance scores.

In principle, this idea could have been checked in a "double" model, including both acceptance scores and management preferences. Unfortunately, the complexity involved in this proved impractical. It is nevertheless quite likely, however, that the influence of these exogenous variables are somewhat stronger than suggested in figure 5, due to indirect effects through the acceptance scores.

**Table 1: Exogenous variable loadings (doubly standardized) on Non-threat and Threat conditions in models including and excluding acceptance scores**

| Variables | Non-threat | | Threat | |
|---|---|---|---|---|
| | Model without acceptance scores | Model including acceptance scores | Model without acceptance scores | Model including acceptance scores |
| Gender | -.11*** | n.s. | -.10*** | n.s. |
| Age | .31*** | .25*** | .12*** | .09** |
| Education | -.09** | -.08* | n.s. | n.s. |
| Books | -.15*** | -.09** | -.06* | n.s. |
| Community size | n.s. | n.s. | .09*** | .06* |
| Economic loss expected | -.11*** | -.08* | -.08*** | -.08** |
| NEP scale | -.13*** | -.08* | -.11*** | -.09*** |
| Traditional rural values | .14*** | .11** | .14*** | .06* |
| Trust in local authorities | .27*** | .15*** | .37*** | .28*** |
| Trust in national authorities | -.21*** | -.17*** | -.21*** | -.22*** |

\* p < .05    \*\* p < .01    \*\*\* p < .001

It may also be noted that the variables *Father's occupation* and *Perceived lack of control* did not come out as significant in any of the two models. In the present analyses, they were shown to predict neither *Non-threat* nor *Threat*, regardless of the presence of acceptance scores.

## 4. Discussion

Results are largely consistent with the hypotheses implicit in the complex design of the survey; respondents' preferences for different management practices are indeed subject to a large number of influences. The five behavioral situations do make a difference, as do the four carnivore species implied. Respondents' degree of carnivore acceptance also is important. A large number of Socio-demographic and value-related variables also do matter, largely consistent with results of previous research that was referred in the introduction.

Viewed together, the large set of influences forms a picture that may not be easily comprehensible. A simple regression model, involving all the variables as independent predictors, is not tenable in the repeated-measures design of this study. To take a first step towards a more ambitious interpretation of the given facts, therefore, a complex MIMIC model is proposed.

The model's main merit is placing a large number of different relations into a common and unifying picture, recognizing the coexistence of a large number of influences on management practice preferences. In spite of its complexity, it is clearly supported by the results of the study. The predictive variables are:

1. *The threat dichotomy,* distinguishing between carnivore behavior that implies threat and behavior that does not. Although it greatly simplifies matters, this classification appears adequate. Significantly different management preferences are found with the two perspectives, and the correlation between two is modest (.20).

2. *The grouping into "major" and "major"* carnivores also appears meaningful. There is a significant difference in management preferences between these two classes. This difference is clearly smaller, however, and the correlation between the two is substantial (.60).

3. *The respondents' degree of acceptance* of each behavior type of behavior is also strongly predictive of their preferences for management actions. The observed relations also run in the expected direction; largely acceptable behavior calls for less severe management measures – and vice versa. Loadings run from -.25 to -.47, all highly significant.

4. Socio-*demographic and value-related variables* also show some relevance to management preferences. This is consistent with expectations, but apparently carries less weight than the three first predictors. In the present study, *degree of trust* in *local* and *national authorities* seem to be the most important, with substantial loadings (.28 and -.22, respectively) in the *threat* condition. Also respondents' *age* is a variable worth noting, loading .25 on "non-threat" and .09 on "threat" condition management preferences.

   Generally, however, the factor loadings of the socio-demographic and value-related variables may be viewed as fairly low, however statistically significant. And a few variables, like gender, apparently do not influence management preferences directly at all. It is likely, however, that some indirect influence is exerted through the five (mediating) acceptance variables.

Also, a few variables are related to only one of the two behavior classes (Threat or non-threat). While *Community size* only matters to management preferences in the *threat* condition, *Number of books at home* and *Education* relate only to the *non-threat* condition.

Among the many influences on management preferences, two clearly stand out as important. The threat/non-threat distinction makes a lot of difference, as does the respondents' acceptance of carnivores. The classification of four carnivore species into the "minor" and "major" classes also appears meaningful, but carries less weight. This also applies to most socio-demographic and value variables. They do matter, but most person differences appear as less important than the variables already mentioned.

Given that the model sums up the relations in our data in a reasonable manner, it has some implications for future research.

*General* questions about carnivores and preferred management actions should be avoided. Since responses do not generalize well across threat and non-threat conditions, researchers should be *specific* about whether or not the carnivore in question poses a threat or not. If not, respondents may be liable to form rather different "self-instructions" that will impact their responses. When several surveys show urban/rural differences, a partial explanation may be that the "threat" perspective is more easily available to rural residents than to urbanites.

Also species differences should be taken into account. Questions about carnivores *in general* may be decoded in different ways, leading some respondents to think of wolves while others consider wolverines or even smaller vermin. Thinking of different animals is likely to produce quite dissimilar responses. These conclusions are in harmony with the previous investigations of Zinn et al. (1998), Bjerke et al. (2002), Ericsson et al. (2004), and Whittaker et al. (2006).

Given the complexity of our resulting model, an even more general caution against simple research designs may be justified in this field of research. Peoples' attitude and tolerance towards carnivores clearly is a multidimensional phenomenon, also evidenced by the numerous variables shown to influence preferences for managerial actions. In the absence of major variables, minor ones may assume unwarranted importance. Hence, limiting the focus to a small number of variables – like gender, urbanity or age – is likely to yield somewhat misleading simplifications, no matter how correct their associated statistics may be.

Perhaps more importantly, our findings may have implications for national debates on large carnivores. In the Norwegian media, highly visible participants are often seen to argue simply *for* or *against* maintaining viable carnivore populations. Consequently, the public debate may leave an impression that the only two options for carnivore management are *encouraging* or *eradicating* the populations. This dichotomy may perhaps also be recognized in discussions elsewhere.

However, our results do not appear to support such a simple approach to carnivore management. The general population is shown to hold more complex views, largely out of step with the simple dichotomy. This is also supported by a recent survey of the publics' attitudes toward large carnivores (Tangeland et al. 2011) where it is shown that

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people in rural areas are willing to accept higher levels of large carnivore populations. Rather, our results should probably be viewed as consistent with a policy of *both* accepting the existence of carnivores without intervening *and* taking severe management measures when animals prove threatening. Presently, there are some indications that also the Norwegian government may be cautiously approaching a similar kind of flexible policy. The current large carnivore management was originally based on a parliamentary policy report from 2003 (St.melding 15). This report set the basis for establishing eight carnivore regions, each with a politically appointed board and a regional mandate for establishing hunting quotas and management actions within the framework of national policy and carnivore population goals (Direktoratet for naturforvaltning, www.rovviltportalen.no). Among several measures, controlled licensed hunting of large carnivores appears to be a salient means of increasing acceptance and reducing conflicts.

Unfortunately, the question of whether such a combination of management practices will prove viable or not in actual practice is quite another matter. That question is not addressed by the present study.

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