Costs of coexistence: understanding the drivers of tolerance towards Asian elephants *Elephas maximus* in rural Bangladesh

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SUPPLEMENTARY MATERIAL 1 The wildlife tolerance model.

The wildlife tolerance model (Kansky et al., 2016) is a diagnostic tool comprising a set of universally comparable variables (Fig. 1). It comprises an outer model composed of exposure, meaningful events, benefits, costs and tolerance (Table 1) and an inner model composed of institutions, interest in wildlife, wildlife value orientations, empathy, anthropomorphism, values, social norms, personal norms, perceived behavioural control, habits and taxonomic bias.

Inner model
The following is extracted from Kansky et al. (2016) and lists the inner model variables with their associated hypotheses affecting costs, benefits and, subsequently, tolerance:

Institutions Individuals or communities who have negative perceptions of wildlife governance systems will perceive more costs than benefits of wildlife.

Interest in wildlife The more a person is interested in animals in general, and wildlife in particular, and the more experiential their interest in wildlife, the more benefits and fewer costs will be perceived to living with wildlife.

Wildlife value orientations Individuals and groups who prioritize mutualistic wildlife value orientations will perceive more benefits to living with wildlife compared to individuals and groups who prioritize utilitarian wildlife value orientations.

Empathy
People low on trait empathy will perceive more costs than benefits and therefore show less tolerant behaviour towards wildlife. Women will have higher empathy scores than men and therefore perceive more benefits than costs to living with wildlife.

Anthropomorphism
Taxonomic groups, species or individual animals that are attributed more mind will be seen as more beneficial than those with less mind attribution, and therefore will be tolerated more. People with low interest in animals will have fewer non-human representations than those with high interest in animals. Negative animal behaviour will be interpreted as being similar to human negative behaviour, resulting in low tolerance.

Values Individuals and groups prioritizing self-transcendence value orientations will perceive more benefits to living with damage-causing wildlife than individuals prioritizing self-enhancement values, who will perceive more costs to living with wildlife.

Social norms Individuals who belong to groups or communities in which wildlife is perceived to be more costly than beneficial and who have a high need to follow social norms will also perceive more costs than benefits. Individuals who belong to groups or communities

that implement unsustainable wildlife management interventions and that have a high need to follow social norms will implement unsustainable wildlife management interventions.

Personal norms Individuals or groups who have feelings of moral obligation towards a species will perceive more benefits than costs of living with wildlife and will be more tolerant.

Perceived behavioural control Low self-efficacy in ability to reduce costs of living with wildlife will increase perceptions of costs of living with wildlife and reduce tolerance.

Habits Individuals or groups who perform habitual activities that are difficult to change in response to living with wildlife will perceive more costs of living with wildlife. The greater the habit strength of these activities the greater the perceived costs.

Taxonomic bias Taxonomic groups, species or individual animals that are large, attractive, useful, rare, not dangerous, have positive cultural symbolism, or look and behave similarly to humans will be perceived as more beneficial than taxonomic groups, species or individual animals that are small, unattractive, not useful, common, dangerous, have negative cultural symbolism, and behave and look differently to humans.

In this study we tested the hypotheses emanating from the outer model:

H1: Exposure and meaningful events, both positive and negative, drive people's perceptions of costs and benefits.

H2: Costs (tangible & intangible) and benefits (intangible) drive tolerance.
For information on the wildlife tolerance model and in-depth explanations of all variables, see Kansky et al. (2016).

SUPPLEMENTARY TABLE 1 Rural livelihood survey: questions and indicators used in the questionnaire that informed the latent variables for testing the outer model of the wildlife tolerance model, with indicator calculations.

Latent variables		Indicators	Survey questions	Scale	Calculation of indicator
Exposure	1.	Visit_area_dry	How often did elephants visit your area in the last dry season (6 months)?	Number of times	Respondents gave the number of times they would see an elephant depending on the season. We then stratified answers 0–7.
	2.	Visit_area_wet	How often did elephants visit your area in the last wet season & winter (6 months)?	Number of times	As above
	3.	Visit_neigh_sum	How often did elephants visit your village in the last dry season (6 months)?	Number of times	As above
	4.	Visit_village_wet	How often did elephants visit your village in the last wet season & winter?	Number of times	As above
	5.	Visit_prop_dry	How many times did you see elephants on your farm/land in the last dry season?	Number of times	As above
	6.	Visit_prop_wet	How many times did you see elephants on your farm/land in the last wet season & winter?	Number of times	As above
Positive meaningful event	1.	Experience_pos	Have you had any particularly positive experiences with elephants? If yes, how many such incidents have you	Number of experiences	This is the mean of the total number of experiences respondents had during their lifetimes.

Latent variables		Indicators	Survey questions	Scale	Calculation of indicator
			experienced?		
Negative meaningful event	1.	Experience_neg	Have you had any particularly negative, traumatic or scary experiences with elephants? If yes, how many such incidents have you experienced? Please describe what happened.	Number of experiences	This is the mean of the total number of experiences respondents had during their lifetimes.
Tangible costs	1.	Mitigation_effort	Which of the following measures have you tried to prevent and reduce elephant damage? Please mark all those you have tried by ticking the ৺ in the first column.	Number of mitigation measures used (out of a list of 7)	Mean number of mitigation measures used (out of a list of 7).
	2.	Damage_dry	How much damage, in taka, did elephants cause to your property in the last dry season?	Taka	This is calculated from damage caused to crops and property, on average, during the season (6 months).
	3.	Damage_wet	How much damage, in taka, did elephants cause to your property in the last wet season and winter?	Taka	As above
	4.	Spent_mitigation*	How much money have you spent in total on mitigation measures to prevent elephant-caused damage on your property?	Taka	As above

Latent variables		Indicators	Survey questions	Scale	Calculation of indicator
	5.	Hours_lost_night	How much labour time is lost from your normal routine because of elephants?	Hours	This value is determined by the number of hours spent guarding against elephants, averaged for every respondent.
	1.	Avg_neg_emotion	What emotions do you feel living with elephants in your area? Please tick as many feelings as necessary and indicate the intensity of the feeling on a scale of 0–3. Frightened, Wary, Nervous, Furious, Frustrated, Animosity, Miserable, Unsettled.	0 = I do not feel this at all 1 = Weakly 2 = Average intensity 3 = Strongly	A score of 0–3 is given by each respondent for each of the eight emotions; this value is then divided by 8.
Intangible costs	2.	Cost_ele_avg	COSTELE1.Living with elephants in my area is difficult because I need to be vigilant at all times. COSTELE2.Living with elephants in my area is difficult because I become exhausted in guarding my crops. COSTELE3.Living with elephants in my area is difficult because I worry about the safety of my children.	1 = Strongly disagree 2 = Disagree; 3 = Neither 4 = Agree; 5 = Strongly agree As above	Total mean of responses. As above

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
		COSTELE4.Living with elephants in my area is difficult because it takes up a lot of my time to deal with them.	As above	As above
		COSTELE5.When I'm night-guarding against elephants who attack my crops my wife fears for my life.	As above	As above
			As above	As above
	3. Afraid_you	How afraid are you personally of elephants when they occur in the area in which you live?	1 = I am not afraid at all 2 = I am somewhat afraid 3 = I am moderately afraid 4 = I am quite afraid 5 = I am very afraid	As above
	4. Afraid_you_house	How afraid are other members of your household when elephants occur in the area in which you live?	1 = I am not afraid at all 2 = I am somewhat afraid 3 = I am moderately afraid 4 = I am quite afraid 5 = I am very afraid	As above
	5. Danger_humans	How dangerous do you think elephants are for	1 = Not dangerous at all 2 = Somewhat dangerous	As above

Latent variables		Indicators	Survey questions	Scale	Calculation of indicator
			humans when they occur in areas where humans live?	3 = Moderately dangerous 4 = Quite dangerous 5 = Very dangerous	
Tangible benefits*			Have you ever received any benefits from living with elephants (e.g. from development programmes, NGO compensation, subsidies for crops)?	Yes/No	n/a
Intangible benefits	2.	Benefit_you	Please list how beneficial or not you think elephants are for you. If you think there are any benefits, please list them.	1 = Not beneficial at all 5 = Very beneficial	Total mean of responses.
	3.	Benefit_community	Please list how beneficial or not you think elephants are for your community. If you think there are any benefits, please list them.	1 = Not beneficial at all 5 = Very beneficial	As above
	4.	Benefit_mankind	Please list how beneficial or not you think elephants are for humankind. If you think there are any benefits, please list them.	1 = Not beneficial at all 5 = Very beneficial	As above
	5.	Benefit_nature	Please list how beneficial or not you think elephants are for nature. If you think there are any benefits, please list them.	1 = Not beneficial at all 5 = Very beneficial	As above
		Avg_pos_emotion	What emotions do you feel living with elephants in your area? Please tick as many	0 = I do not feel this at all 1 = Weakly 2 = Average intensity	A score of 0–3 is given by each respondent for each of the eight emotions; this value is then divided by 8.

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
		feelings as necessary and indicate the intensity of the feeling on a scale of 0–3. Fascinated. Safe, Relaxed, Sympathetic, Amused, Grateful, Happy, Trusting	3 = Strongly	
Tolerance	1. Tol_kill_1	Many wild animals are known to cause damage to people and their property. Some are herbivores capable of eating agricultural crops and gardens or raiding urban households. Others are carnivores capable of killing domestic livestock as well as scaring, injuring or killing people. Under what conditions do you think it would be justified to kill a wild animal? Please ignore for now whether it is illegal or not, who would do the killing, how the animal would be killed, and what would be done with its body. Read the scenarios listed in the table below and tick the appropriate boxes.	1–7; 7 = completely opposed to an elephant being killed under any circumstances	Total mean of responses.

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
		If elephants are abundant do you think an elephant should be killed if…		
		…it is seen in the forest far away from any village, houses, livestock or agricultural crops?		
		…it is seen in the vicinity of where livestock are grazing or vegetable gardens or agricultural crops are growing, or close to where it could enter people's houses?		
		…it has injured or killed a domestic animal or has raided some houses or agricultural crops for the first time?		
		…it causes repeated problems for you and your community but has never harmed a person?		
		…it has threatened a child or adult?		
		…it has injured a child or		

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
		adult? …it has killed a child or adult?		
	2. Tol_kill_2	Same as above but…if elephants are rare do you think an elephant should be killed if…	1–7; 7 = completely opposed to an elephant being killed under any circumstances	As above
	3. Pop_area	Would you like the population of elephants in your area to decrease, stay the same or increase?	1 = Decrease a lot 2 = Decrease a little 3 = Stay the same 4 = Increase a little 5 = Increase a lot	Total mean of responses.
	4. Tol_village	Which village would you prefer/like to live in (if you had the choice and it was possible)? One where you saw elephants once every 3 months or never at all. One where you saw elephants once every 2 months or never at all. One where you saw elephants once per month or never at all. One where you saw elephants twice per month or never at all.	1–6; 6 = higher tolerance	Total mean of responses.

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
		One where you saw elephants 2–4 times per week or never at all. One where you saw elephants 5–7 days per week or never at all.		
	5. Tol_crop	If elephants came to my land and none of my crops were destroyed I would be… If elephants came to my land and 20% of my crops were destroyed I would be… If elephants came to my land and 40% of my crops were destroyed I would be… If elephants came to my land and 60% of my crops were destroyed I would be… If elephants came to my land and 80% of my crops were destroyed I would be… If elephants came to my land and 100% of my crops were destroyed I would be…	1 = Very sad 2 = A little sad 3 = I would not mind 4 = I would be happy 5 = I would be very happy 1–6; 6 = higher tolerance	For the six options, ranging from 0 to 100%, each respondent states on a scale of 1–5 how acceptable loss would be. These are then averaged.

Latent variables	Indicators	Survey questions	Scale	Calculation of indicator
	9. Spend_authorities†	How much taxpayers' money do you think should be spent by the authorities to manage elephants in Sherpur District?	1 = BDT 0 2 = BDT 100,000–1 million 3 = BDT 1–5 million 4 = BDT 5–20 million 5 = BDT 20–50 million 6 = BDT 50–100 million 7 = Whatever it takes 9 = I am not interested	n/a

*Tangible benefits not included in the analysis because of insufficient numbers of responses.
†Spend_authorities yielded an insufficient number of responses.

SUPPLEMENTARY MATERIAL 2

SUPPLEMENTARY TABLE 2 Evaluation criteria of the structural equation model, showing test results for indicator reliability (IR), composite reliability (CR) and convergent validity (AVE). Model 5 is the full set of indicators. We report model 3 in the main text (Fig.2).

Observed indicators from constructs	Latent variable description[1]	Model 1			Model 2			Model 3			Model 4			Model 5		
		IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE
Exposure			0.81	0.53		0.81	0.53		0.8	0.52		0.8	0.52		0.81	0.53
Visit_area_dry	Number of times elephants seen in area (dry season)	0.53			0.54			0.47			0.47			0.55		
Visit_area_wet	Number of times elephants seen in area (wet season)	0.56			0.56			0.49			0.49			0.57		
Visit_farm_dry	0	0.86			0.85			0.88			0.88			0.85		
Visit_farm_wet	0	0.89			0.89			0.91			0.91			0.89		
Positive meaningful events	Number of positive experiences with	1			1			1			1			1		

Observed indicators from constructs	Latent variable description[1]	Model 1			Model 2			Model 3			Model 4			Model 5		
		IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE
	elephants (no time frame)															
Negative meaningful events	0	1			1			1			1			1		
Tangible costs			0.57	0.25		0.57	0.25		0.55	0.51		0	0		0.57	0.25
Mitigation_effort	Number of mitigation measures used (from a list of 6)	0.48			0.48			0			0			0.48		
Damage_dry	Monetary costs (dry season)	0.16			0.16			0.1			0			0.16		
Damage_wet	0	0.84			0.84			1			1			0.84		
Spent_mitigation	Spent mitigating for elephants per annum	0.34			0.34									0.34		
Hour_lost_night	0	0.4			0.4			0			0			0.4		
Intangible costs			0.83	0.5		0.83	0.5		0.83	0.5		0.83	0.5		0.83	0.5
Avg_neg_emotion	0	0.68			0.68			0.68			0.68			0.67		
Danger_humans	Extent of	0.75			0.75			0.74			0.74			0.75		

Observed indicators from constructs	Latent variable description[1]	Model 1			Model 2			Model 3			Model 4			Model 5		
		IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE
	danger to humans posed by elephants															
Afraid_you	Extent of fear of respondent of elephants	0.74			0.74			0.74			0.74			0.74		
Afraid_other_ house	Extent of fear of elephants among other household members	0.84			0.84			0.84			0.84			0.84		
Opp_costs_ele_avg	0	0.46			0.46			0.46			0.46			0.47		
Intangible benefits			0.72	0.35		0.68	0.43		0.68	0.44		0.68	0.44		0.72	0.35
Avg_pos_emotion	Mean number of positive emotions (out of 6) as a result of living with elephants	0.81			0.87			0.86			0.86			0.82		
Benefit_community	0	0.54			0			0			0			0.53		
Benefit_humankind	Extent of	0.5			0.38			0.36			0.39			0.5		

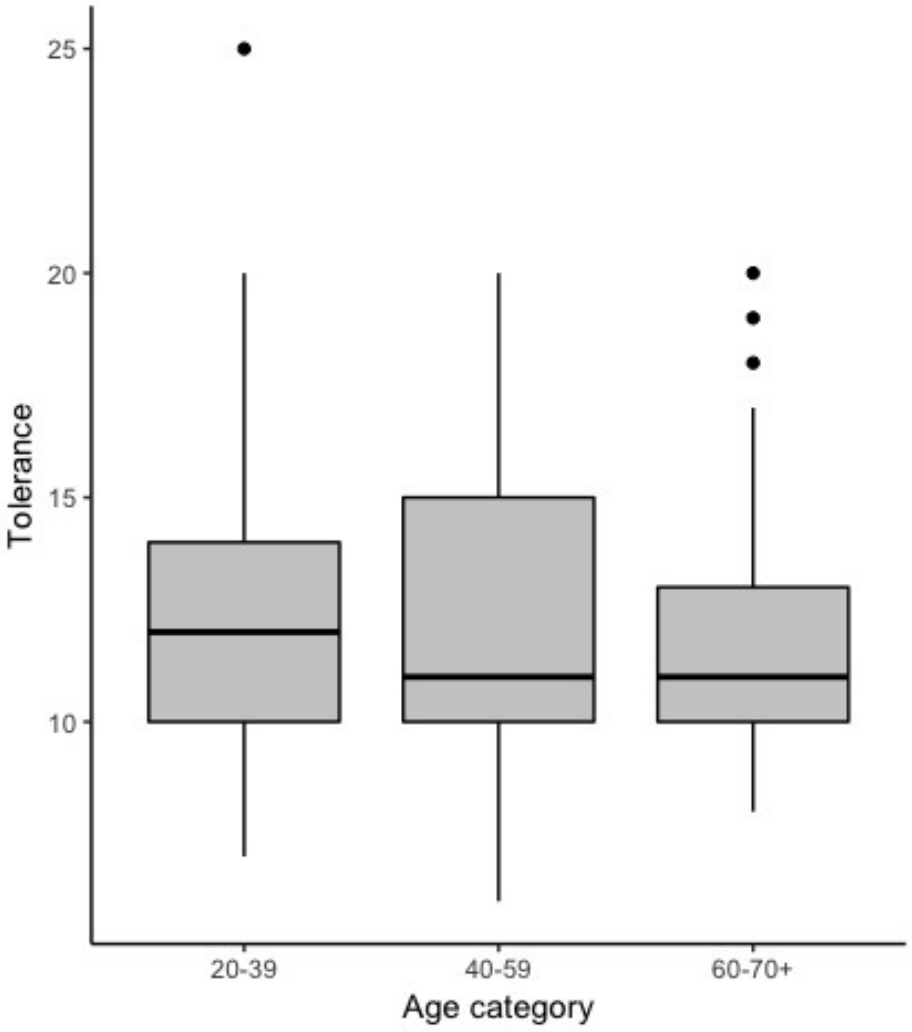
Observed indicators from constructs	Latent variable description[1]	Model 1			Model 2			Model 3			Model 4			Model 5		
		IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE
	benefits from elephants for humankind															
Benefit_nature	0	0.56			0.64			0.65			0.65			0.57		
Tolerance			0.78	0.55		0.78	0.55		0.78	0.55		0.78	0.55		0.73	0.43
Tol_crop	Would you be sad, accepting or happy to live in a village where elephants destroy 20, 40, 60, 80, 100% of your crops?	0.61			0.61			0.6			0.6			0.6		
Tol_village	Would you live in a village where elephants visited once every 3, 2, 1 month(s), twice per month, (2–4), (5–7) times per week, or never at all	0.81			0.81			0.81			0.81			0.79		

Observed indicators from constructs	Latent variable description[1]	Model 1			Model 2			Model 3			Model 4			Model 5		
		IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE	IR	CR	AVE
	for each choice?															
Pop_area	Would you like the elephant population in your area to increase, decrease or stay the same?	0.8			0.8			0.8			0.8			0.8		
Tol_Kill_1	When should elephants be killed when they are common in an area?													0.32		
Tol_Kill_2	0													0.32		

*indicates that AVE and CR are missing because the tangible costs construct contains only one indicator for cost (cost_dry), thus these measurements cannot be tested.
‡For models 1–4, various indicators were removed.
[1]Of the indicators measured forming the latent variables, the following were highly skewed: cost_dry, cost_wet, spent_mit, area_dry, area_wet, farm_dry, farm_wet and neg_exp_frq. Outliers were winsorized (trimmed) and negative loadings removed.

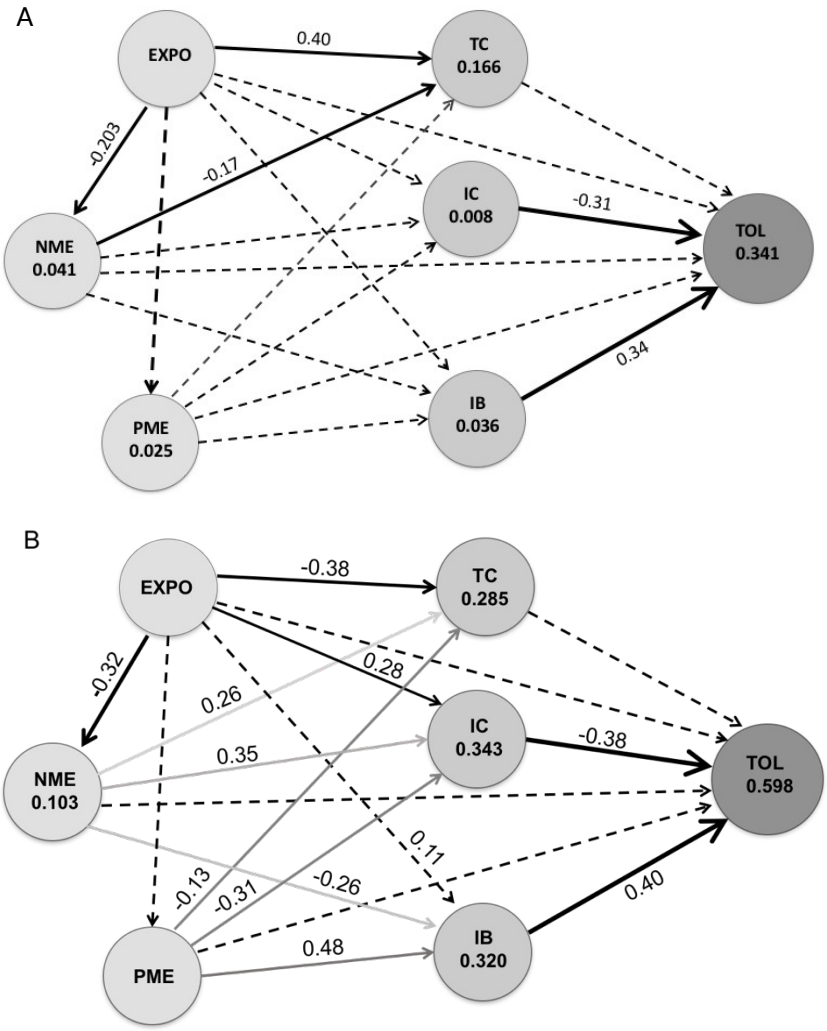
Testing for response bias for age and religion

We ran ANOVA tests across the complete set of tolerance indicators that were used in the structural equation model (Tol_crop, Tol_village, Pop_area, Tol_Kill_1, Tol_Kill_2) and the effect of age was found to be non-significant (Supplementary Fig. 2.0). The same test was applied to check for any differences across religions in the study area, and religion was also found to be non-significant.



SUPPLEMENTARY FIG. 2.0 Boxplot showing difference in tolerance of elephants across age categories. Horizontal lines represent local mean, whiskers 25th and 75th quantiles and dots represent outliers.

Supplementary Fig. 2.1 provides a visual representation of the wildlife tolerance model studies in Bangladesh and South Africa (Kansky et al., 2016), for comparison of the variables that significantly drive tolerance, and offers a perspective on how comparisons could be made after more studies are undertaken.



SUPPLEMENTARY FIG. 2.1 Partial least squares structural equation models of latent variables. Tangible costs (TC), intangible costs (IC), intangible benefits (IB), exposure (EXPO), negative meaningful events (NME), positive meaningful events (PME), and tolerance (TOL). Values within the circles are the coefficients of determination (R^2). Lines joining circles are the path coefficients linking the latent variables. Bold lines represent significant path coefficients and dashed lines non-significant path coefficients. Model A represents the study in Bangladesh and Model B the study in South Africa. Note that in Model B the pathway from exposure to tangible costs is negated for ease of comparison (in the South African study the scale of measurement for exposure was inverted, hence the negative pathway).