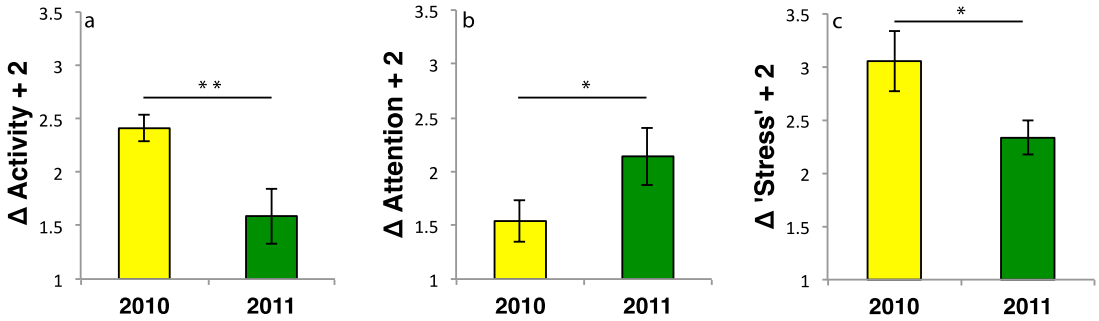
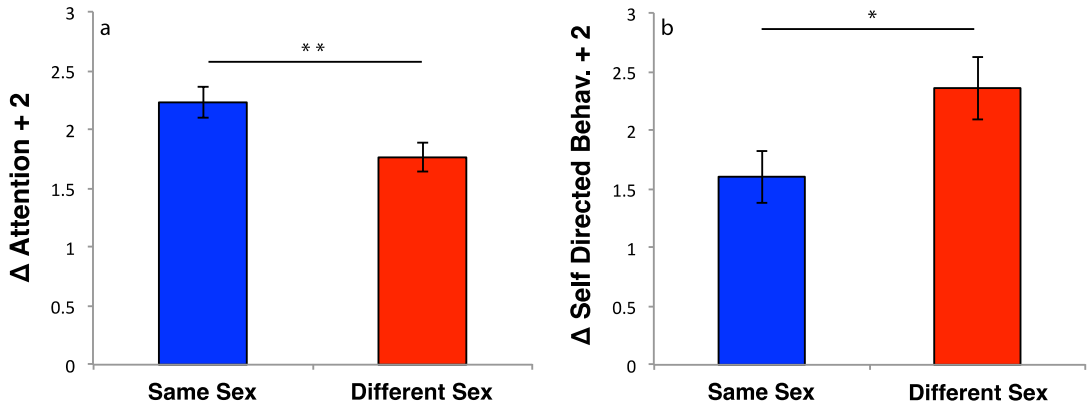
Supplementary figures:



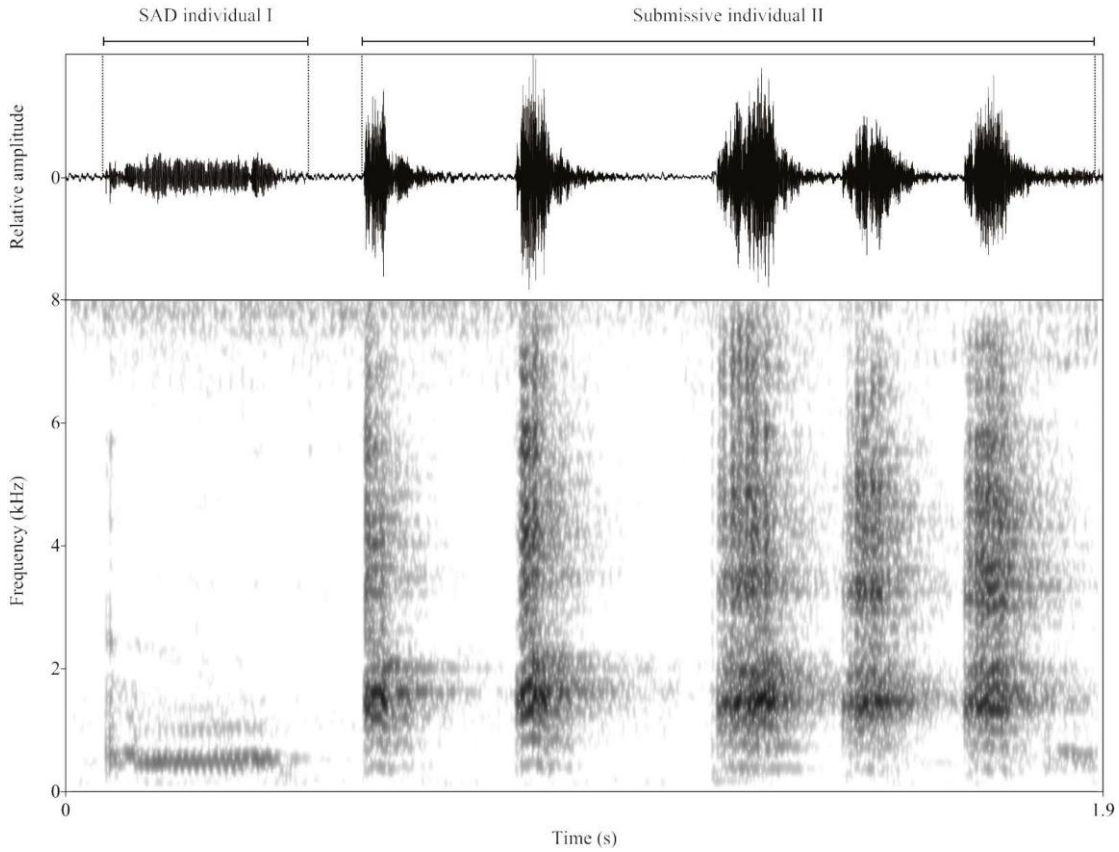
Supplementary Figure 1: Activity, Attention and 'Stress' behaviors of 2010 and 2011 ravens in response to in-group stimuli.

Mean ± SEM difference between play-back and baseline (**Δ**) of **a.** Activity, **b.** Attention, and **c.** 'Stress', for individuals born in 2010 (n = 10; yellow bars) for individuals born in 2011 (n = 6; green bars). GLMM: * P<0.05; ** P<0.01.



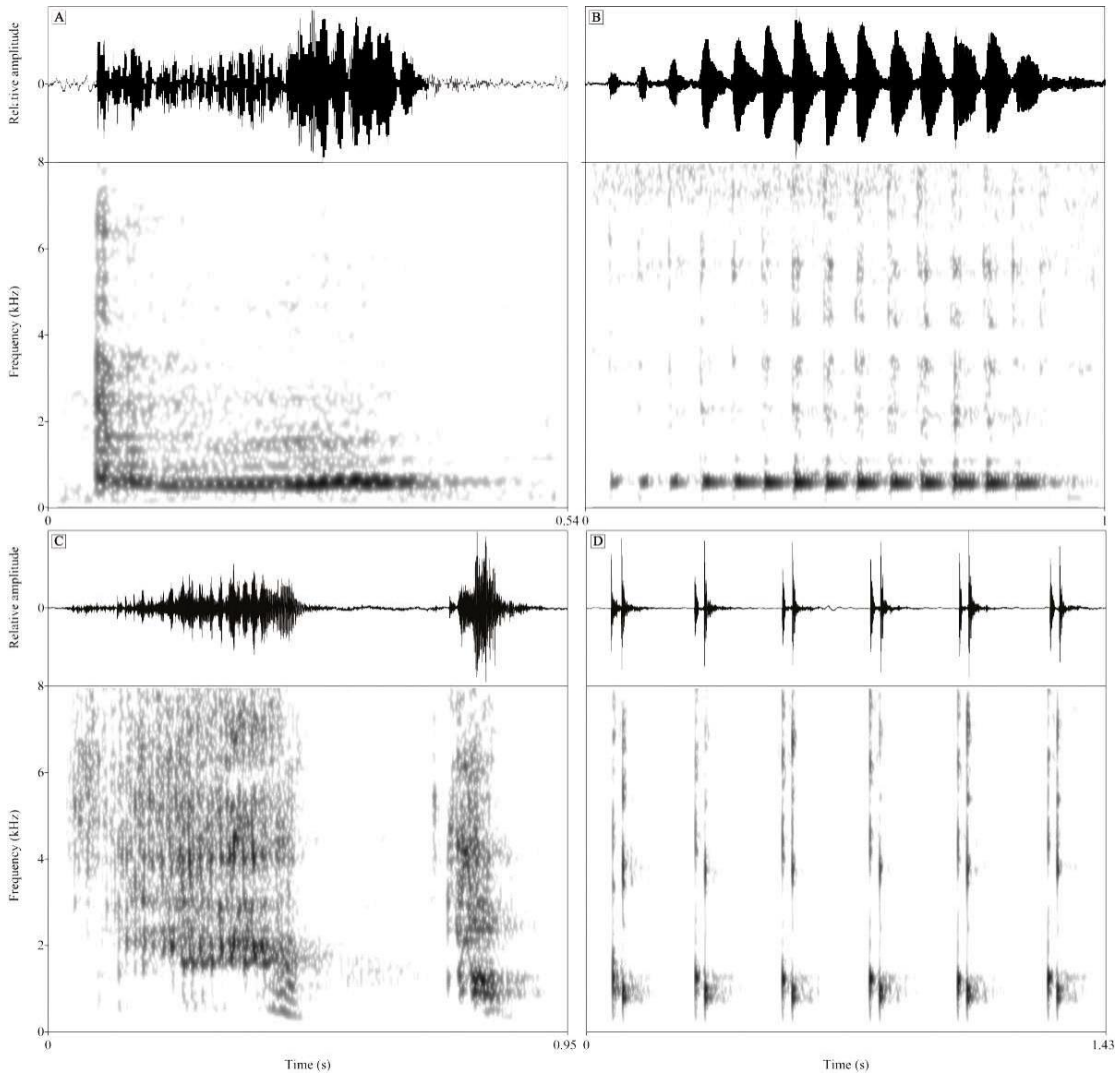
Supplementary Figure 2: Attention and Self-directed behaviors of out-group stimuli of same and different sexed ravens.

Mean ± SEM difference between play-back and baseline (**Δ**) of **a.** Activity, and **b.** Self Directed Behavior, for playbacks of individuals of the same sex (blue bars) and of individuals of the different sex (red bars). * $P<0.05$; ** $P<0.01$.



Supplementary Figure 3: Example of a vocal interaction between a dominant bird (individual I) giving a SAD and a subordinate bird (individual II) responding with a bout of submissive vocalizations.

Vocalizations represented with a corresponding waveform and a spectrogram. (Spectrogram settings: fast Fourier transform, Gaussian window shape, window length 0.001 s, dynamic range 50 dB)



Supplementary Figure 4: Example of the four acoustically distinct SAD types used in the playback stimuli.

Each vocalization represented with their corresponding waveform and a spectrogram. A) Was the predominant call of one male and three females from group 1, B) was the predominant call of two males from group 1, C) was the predominant call of three males and one female from group 2, D) was the predominant call of two females from group 2. Time axis is adjusted for each call individually for better presentation. (Spectrogram settings: fast Fourier transform, Gaussian window shape, window length 0.001 s, dynamic range 40 dB)

Supplementary tables:

Supplementary table 1: Information on each subject and its models.

	a. Individual Information					b. Models for playback			
Group	Name (abb.)	Sex	Year	Upbr.	Rank	FaSs	FaDs	UfSs	UfDs
1	Anton (An)	♂	2010	PR	1	Jk-Js	So-Kl	Ry-Mt	As-Jo
	Jakob (Jk)	♂	2010	PR	2	An-Js*	Le-Kl	Or-Mt	As-Jo
	Jonas (Js)	♂	2010	PR	3	An-Jk	Le-Kl	Ry-Mt	As-Ln
	Heidi (He)	♀	2010	PR	4	Le-Kl	Jk-Js	As-Jo	Or-Mt
	Lena (Le)	♀	2010	PR	5	So-Kl	An-Js	Ln-Jo	Ry-Mt
	Sophie (So)	♀	2010	PR	6	Le-Kl*	An-Js	As-Ln	Ry-Mt
	Klara (Kl)	♀	2010	PR	7	Le-So	An-Js	As-Jo	Ry-Or
	Elen (El)	♀	2010	PR	8	Le-So	An-Jk	As-Ln	Ry-Or
2	Thor (Th)	♂	2011	PR	1	Ry-Mt	As-Ln	An-Js	So-Kl
	Ray (Ry)	♂	2011	HR	2	Or-Mt	Ln-Jo	Jk-Js	Le-Kl
	Orm (Or)	♂	2011	HR	3	Ry-Mt*	As-Jo	An-Jk	Le-Kl
	Matte (Mt)	♂	2011	HR	4	Ry-Or	As-Jo	An-Js	Le-So
	Astrid (As)	♀	2010	HR	5	Ln-Jo	Ry-Mt	Le-So	An-Js
	Lellan (Ln)	♀	2011	HR	6	As-Jo*	Ry-Or	So-Kl	An-Js
	Joey (Jo)	♀	2010	HR	7	As-Ln	Ry-Mt	Le-Kl	Jk-Js
	Skadi (Sk)	♀	2011	PR	8	As-Jo	Or-Mt	Le-Kl	An-Jk

a) Name (abb.), sex, year of birth, way of upbringing (PR: parent-raised; HR: hand-raised) and dominance rank of each individual and the group in which it resided; **b)** Abbreviations of the names of the Familiar- Same sex (FaxSs) models, Familiar-Different sex (FaDs) models, Unfamiliar- Same sex (UfSs) models, and Unfamiliar-Different sex (UfDs) models.* refers to dyads in which the focal subject was ranking in between the two played back individuals.

Supplementary table 2: Schematic representation of all conditions

	Same Sex	**Different Sex**
In-group	Expected	Expected
	Unexpected	Unexpected
Out-group	Expected	Expected
	Unexpected	Unexpected

Supplementary table 3: Individuals and their corresponding predominant SAD types that were used to construct the stimuli.

Group	ID	Sex	SAD type
1	An	M	A
1	Jk	M	B
1	Jn	M	B
1	Ln	F	A
1	Sf	F	A
1	Kl	F	A
2	Ry	M	C
2	Or	M	C
2	Mt	M	C
2	As	F	D
2	Ll	F	C
2	Jy	F	D

Supplementary table 4: Component Matrix					
	Component				
	1	**2**	**3**	**4**	**5**
Self Assurance Display		**0.427**	0.342	0.250	
Loud-call		**0.501**			
Soft-call		**0.472**			
Singing duration			-0.268	-0.226	
Beak wipe		0.210		0.303	**0.533**
Scratch	-0.275	-0.229	0.305	**0.599**	
Branch-hop	**0.498**	-0.209			**0.593**
Head turn		-0.201	**0.579**	-0.279	0.218
Stretch				**0.534**	
Wall/Structure peck		**0.405**		0.327	**0.411**
Body shake	-0.298	**-0.550**	-0.211	0.264	
Auto-preen duration	-0.384	**-0.519**		0.327	
Flying duration	0.236	-0.373		-0.325	**0.527**
Walking duration	**0.795**				
Resting duration	**-0.891**		-0.273		
Freeze duration			**0.806**		
Manipulation of objects/food duration	**0.813**			0.233	-0.356
Eigenvalue	2.810	1.881	1.521	1.447	1.386
% of variance explained	16.532	11.064	8.948	8.687	8.154
Loadings of the original variables on the different components are shown. Loadings below ± 0.2 are omitted, and loadings exceeding ± 0.4 are in bold font.					