## Supplementary material

**The power of discourse: associations between trainers' speech and behavioral and physiological responses of socialized wolves (*Canis lupus*) and dogs (*Canis familiaris*) to training.**

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**Figure S1:** Illustrative spectrogram of trainer's speeches. Red boxes represent the marking of the fundamental frequency (F0) of distinct speech events in the three categories studied: nice (A), neuter (B) and reprehensive (C). Arrows indicate the maximum (max.) and minimum (min.) frequencies of these speeches. X axis: time interval of 200 milliseconds; y axis: frequency in kHz.
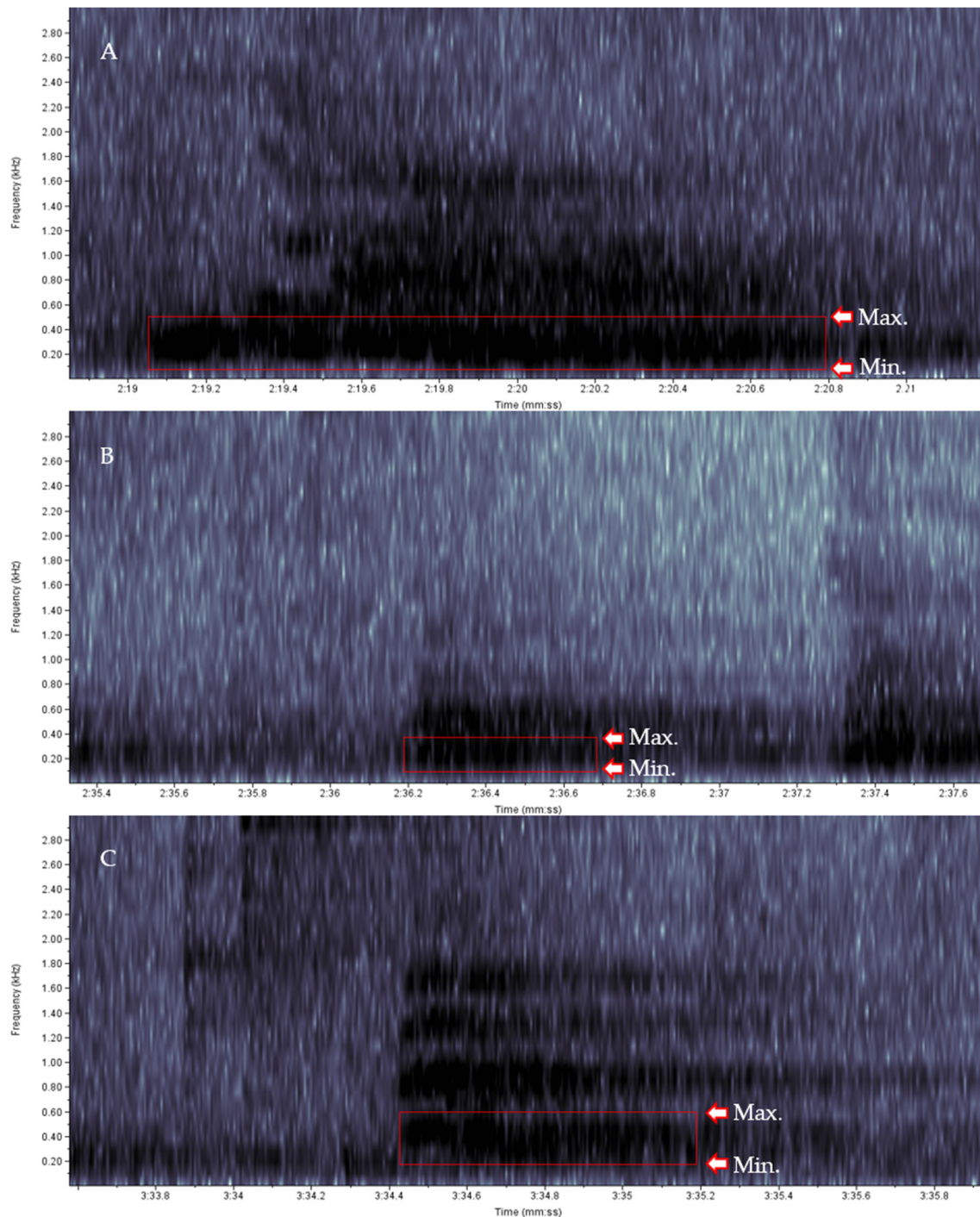
**Table S1.** Full (initial) Generalized Linear Mixed Models* run for dogs (*Canis familiaris*) and wolves (*Canis lupus*), considering the effects of the explanatory variables (subspecies; nice names – NiN; neutral names – NeN; reprehensive names – ReN; nice speeches – NiS; neutral speeches – NeS; reprehensive speeches – ReS; and laugh – L) on the response variables (visual orientation to trainer – vot; exploring – exp; jumping – jump; time at less than 1 meter – less; correct responses – correct; and tail wagging – waggp).

| Model | Intercept | Subspecies** | NiS | NeS | NiN | NeN | ReS | ReN | L | Subspecies: NiS | Subspecies: NeS | Subspecies: NiN | Subspecies: NeN | Subspecies: ReS | Subspecies: L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mod_exp voice_art | 5.72E-18 | 2.80E-13 | 8.02E-11 | 5.56E-02 | 1.18E-06 | 2.91E-42 | 7.85E-01 | 1.41E-01 | 2.86E-01 | 9.01E-02 | 1.10E-02 | 6.82E-07 | 6.53E-01 | 9.83E-01 | 6.04E-02 |
| mod_correct_voice_art | 0.00E+00 | 2.90E-03 | 1.82E-01 | 1.22E-05 | 2.61E-01 | 1.48E-01 | 1.36E-01 | 8.92E-01 | 4.20E-02 | 3.26E-01 | 1.33E-01 | 5.20E-01 | 3.40E-01 | 5.87E-03 | 2.55E-02 |
| mod_jump_voice_art | 7.37E-01 | 4.43E-02 | 1.49E-01 | 1.20E-02 | 4.52E-02 | 6.36E-02 | 5.34E-07 | 9.97E-01 | 1.49E-02 | 9.19E-01 | 5.35E-03 | 8.60E-02 | 6.71E-02 | 9.88E-01 | 9.19E-02 |
| mod_less _voice_art | 1.84E-63 | 8.62E-01 | 1.27E-06 | 9.04E-01 | 3.43E-06 | 8.98E-14 | 1.76E-01 | 2.27E-02 | 9.98E-01 | 3.52E-04 | 8.15E-01 | 1.19E-03 | 5.49E-04 | 6.78E-01 | 5.90E-01 |
| mod_vot_voice_art | 8.99E-63 | 8.13E-01 | 1.73E-02 | 6.59E-02 | 1.05E-09 | 3.57E-27 | 9.82E-02 | 1.78E-03 | 2.61E-01 | 8.55E-02 | 2.94E-01 | 3.61E-05 | 5.23E-07 | 9.51E-02 | 2.21E-01 |
| mod_waggp_art_voice | 1.42E-02 | 9.40E-12 | 2.49E-05 | 9.54E-05 | 8.68E-01 | 5.88E-03 | 4.91E-01 | 4.29E-05 | 3.11E-03 | 7.37E-03 | 1.86E-06 | 3.56E-01 | 3.46E-04 | 3.15E-11 | 7.51E-03 |

* Model assumptions were tested through graphical evaluation, and correlations between pairs of variables were previously checked to avoid collinearity. No pairs of variables presented correlations equal or greater than 0.7.
** Wolves or dogs; wolves is the reference group.

**Table S2.** Full (initial) Generalized Linear Mixed Models* run for dogs (*Canis familiaris*) and wolves (*Canis lupus*), considering the effects of the explanatory variables (subspecies; minimum frequency (Min_Freq); maximum frequency (Max_Freq); average power (Avg_Pow); delta time (delta_time); peak frequency (Peak_Freq); and number of speeches (num_speeches) on the response variables (visual orientation to trainer – vot; exploring – exp; jumping – jump; time at less than 1 meter – less; correct responses – correct; and tail wagging – waggp).

| Model | Intercept | Subspecies* | all_mean Min_Freq | all_mean Max_Freq | all_mean Avg_Pow | all_mean delta_time | all_mean Peak_Freq | all num_speeches | Subspecies: all_mean Min_Freq | Subspecies: all_mean Max_Freq | Subspecies: all_mean Avg_Pow | Subspecies: all_mean delta_time | Subspecies: all_mean Peak_Freq | Subspecies: all_num speeches |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mod_exp_acoustic | 6.88E-05 | 2.60E-01 | 1.13E-15 | 1.16E-04 | 5.17E-01 | 3.02E-02 | 2.12E-10 | 1.59E-02 | 4.95E-01 | 5.79E-02 | 4.29E-01 | 4.17E-01 | 9.74E-01 | 1.29E-05 |
| mod_correct_acoustic | 6.67E-20 | 1.19E-01 | 5.98E-04 | 3.49E-02 | 6.92E-02 | 4.66E-07 | 1.30E-01 | 8.94E-03 | 1.07E-05 | 3.45E-01 | 7.98E-01 | 1.36E-04 | 1.76E-02 | 6.57E-03 |
| mod_jump_acoustic | 2.95E-01 | 4.58E-01 | 2.16E-03 | 1.21E-02 | 3.34E-02 | 8.81E-03 | 2.17E-01 | 1.49E-01 | 1.76E-01 | 1.53E-03 | 4.02E-02 | 4.90E-05 | 1.54E-01 | 4.67E-01 |
| mod_less_acoustic | 1.58E-67 | 3.13E-01 | 2.92E-05 | 2.58E-02 | 1.77E-03 | 3.99E-02 | 3.43E-04 | 1.50E-01 | 9.44E-05 | 2.83E-02 | 6.18E-02 | 2.04E-02 | 3.65E-04 | 1.69E-01 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mod_vot_acoustic | 1.22E-73 | 1.13E-01 | 4.96E-09 | 3.83E-01 | 1.62E-08 | 1.91E-04 | 4.92E-04 | 2.46E-01 | 3.11E-08 | 3.23E-01 | 5.74E-04 | 4.48E-04 | 7.16E-04 | 1.81E-01 |
| mod_waggp_acoustic | 4.98E-04 | 5.41E-01 | 1.78E-02 | 2.47E-14 | 3.14E-09 | 1.16E-14 | 1.58E-16 | 4.32E-01 | 8.71E-02 | 1.40E-11 | 2.70E-07 | 9.97E-12 | 5.82E-13 | 9.95E-02 |

* Model assumptions were tested through graphical evaluation, and correlations between pairs of variables were previously checked to avoid collinearity. No pairs of variables presented correlations equal or greater than 0.7.

** Wolves or dogs; wolves is the reference group.

**Table S3.** Final Generalized Linear Mixed Models* run for dogs (*Canis familiaris*) and wolves (*Canis lupus*), considering the effects of the explanatory variables (subspecies; nice names – NiN; neutral names – NeN; reprehensive names – ReN; nice speeches – NiS; neutral speeches – NeS; reprehensive speeches – ReS and laugh – L) on the response variables (visual orientation to trainer; exploring; jumping; time at less than 1 meter; correct responses and tail wagging).

| Response variables | Explanatory variables | Estimate ± sd | z-value | *p* |
|---|---|---|---|---|
| Visual orientation to trainer | (intercept) | 5.58 ± 0.746 | 7.48 | <0.001 |
| | Subspecies** | 0.06 ± 0.472 | 0.12 | 0.903 |
| | NiN | -0.04 ± 0.009 | -4.87 | <0.001 |
| | NeN | -0.03 ± 0.004 | -7.65 | <0.001 |
| | ReN | -0.03 ± 0.009 | -3.64 | <0.001 |
| | Subspecies X NiN | 0.02 ± 0.005 | 3.84 | <0.001 |
| | Subspecies X NeN | 0.01 ± 0.003 | 4.81 | <0.001 |
| Exploring | (intercept) | 6.22 ± 0.771 | 8.07 | <0.001 |
| | Subspecies | -3.65 ± 0.508 | -7.18 | <0.001 |
| | NiN | -0.19 ± 0.043 | -4.37 | <0.001 |
| | NeN | 0.06 ± 0.004 | 14.04 | <0.001 |
| | Subspecies X NiN | 0.22 ± 0.039 | 5.64 | <0.001 |
| Jumping | (intercept) | 1.67 ± 0.882 | 1.89 | 0.059 |
| | Subspecies | -1.54 ± 0.572 | -2.70 | 0.007 |
| | NeS | -0.06 ± 0.024 | -2.55 | 0.011 |
| | L | 0.09 ± 0.033 | 2.58 | 0.010 |
| | Subspecies X NeS | 0.05 ± 0.017 | 2.99 | 0.003 |
| Time at less 1 meter | (intercept) | 5.53 ± 0.746 | 7.42 | <0.001 |
| | Subspecies | 0.08 ± 0.472 | 0.17 | 0.865 |
| | NiS | 0.004 ± 0.001 | 4.74 | <0.001 |
| | NiN | -0.04 ± 0.008 | -4.27 | <0.001 |
| | NeN | -0.02 ± 0.004 | -5.68 | <0.001 |
| | ReN | -0.02 ± 0.009 | -2.23 | 0.026 |
| | Subspecies X NiS | -0.002 ± 0.001 | -4.15 | <0.001 |
| | Subspecies X NiN | 0.02 ± 0.005 | 3.39 | 0.001 |
| | Subspecies X NeN | 0.01 ± 0.003 | 3.72 | <0.001 |
| Correct responses | (intercept) | 3.21 ± 0.123 | 26.09 | <0.001 |
| | Subspecies | 0.34 ± 0.076 | 4.48 | <0.001 |
| | NeS | -0.01 ± 0.001 | -4.42 | <0.001 |
| | ReS | 0.95 ± 0.341 | 2.78 | 0.005 |
| | L | -0.04 ± 0.022 | -1.95 | 0.052 |
| | Subspecies X ReS | -0.94 ± 0.34 | -2.75 | 0.006 |
| | Subspecies X L | 0.03 ± 0.013 | 2.04 | 0.042 |
| Tail wagging | (intercept) | -2.45 ± 0.787 | -3.12 | 0.002 |
| | Subspecies | 3.33 ± 0.49 | 6.80 | <0.001 |
| | NiS | 0.02 ± 0.005 | 3.57 | <0.001 |
| | NeS | -0.05 ± 0.01 | -4.66 | <0.001 |
| | ReS | 1.57 ± 0.279 | 5.64 | <0.001 |
| | NeN | 0.07 ± 0.02 | 3.43 | 0.001 |
| | ReN | -0.56 ± 0.137 | -4.09 | <0.001 |
| | L | 0.09 ± 0.034 | 2.76 | 0.006 |
| | Subspecies X NiS | -0.01 ± 0.003 | -2.92 | 0.004 |
| | Subspecies X NeS | 0.03 ± 0.005 | 5.15 | <0.001 |
| | Subspecies X ReS | -1.62 ± 0.25 | -6.48 | <0.001 |
| | Subspecies X NeN | -0.04 ± 0.01 | -3.97 | <0.001 |
| | Subspecies X L | -0.04 ± 0.017 | -2.54 | 0.011 |

*Explanatory variables without effect on the response variables were removed from the models during the model-selection process.
**Wolves or dogs; wolves is the reference group.

**Table S4.** Results of Dunn and Tukey *post hoc* tests comparing the acoustic parameters (minimum frequency, maximum frequency, delta time, peak frequency, number of speeches, average power) of nice, neutral and reprehensive speeches emitted by trainers in Positive Reinforcement Training sessions with dogs (*Canis familiaris*) and wolves (*Canis lupus*).

| Post hoc | Bioacoustics variables | | Values |
|---|---|---|---|
| Dunn | *Minimum frequency* | Neutral x Reprehensive | Mean difference = 4.98 $p = 0.88$ |
| | | Nice x Neutral * | Mean difference = 77.34 $p < 0.001$ |
| | | Reprehensive x Nice * | Mean difference = 82.32 $p = 0.03$ |
| Dunn | *Maximum frequency* | Neutral x Reprehensive* | Mean difference = - 151.89 $p < 0.001$ |
| | | Nice x Neutral* | Mean difference = 78.04 $p < 0.001$ |
| | | Reprehensive x Nice * | Mean difference = - 73.85 $p = 0.03$ |
| Tukey | *Average power* | Neutral x Reprehensive* | Mean difference = - 6.45 $p = 0.00$ |
| | | Nice x Neutral | Mean difference = - 0.54 $p = 0.45$ |
| | | Reprehensive x Nice * | Mean difference = - 6.70 $p = 0.00$ |
| Dunn | *Delta time* | Neutral x Reprehensive* | Mean difference = -210.08 $p < 0.001$ |
| | | Nice x Neutral * | Mean difference = 95.47 $p < 0.001$ |
| | | Reprehensive x Nice * | Mean difference = -114.61 $p < 0.001$ |
| Dunn | *Peak Frequency* | Neutral x Reprehensive* | Mean difference = -98.78 $p = 0.01$ |
| | | Nice x Neutral * | Mean difference = 112.47 $p < 0.001$ |
| | | Reprehensive x Nice | Mean difference = 13.70 $p = 0.69$ |
| Dunn | *Number of Speeches* | Neutral x Reprehensive* | Mean difference = 235.89 $p < 0.001$ |
| | | Nice x Neutral * | Mean difference = 93.22 $p < 0.001$ |
| | | Reprehensive x Nice* | Mean difference = 329.11 $p < 0.001$ |

* Statistically significant results

**Table S5.** Final Generalized Linear Mixed Models* run for dogs (*Canis familiaris*) and wolves (*Canis lupus*), considering the effects of the explanatory variables (subspecies; minimum frequency – MinF; maximum frequency – MaxF; peak frequency – PF; average power – AP; delta time – DT and number of speeches – NS) on the response variables (visual orientation to trainer; exploring; jumping; time at less than 1 meter; correct responses and tail wagging).

| Response variables | Explanatory variables | Estimate ± sd | z-value | *p* |
|---|---|---|---|---|
| Visual orientation to trainer | (intercept) | 7.29 ± 0.79 | 9.25 | <0.001 |
| | Subspecies** | -0.81 ± 0.50 | -1.63 | 0.104 |
| | MinF | -0.006 ± 0.001 | -5.93 | <0.001 |
| | AP | -0.03 ± 0.004 | -8.02 | <0.001 |
| | DT | -0.45 ± 0.13 | -3.52 | <0.001 |
| | PF | 0.004 ± 0.001 | 4.47 | <0.001 |
| | Subspecies X MinF | 0.003 ± 0.001 | 5.51 | <0.001 |
| | Subspecies X AP | 0.015 ± 0.002 | 6.52 | <0.001 |
| | Subspecies X DT | 0.24 ± 0.08 | 3.14 | 0.002 |
| | Subspecies X PF | -0.002 ± 0.001 | -4.13 | <0.001 |
| Exploring | (intercept) | 6.97 ± 0.79 | 8.77 | <0.001 |
| | Subspecies | -3.52 ± 0.50 | -6.98 | <0.001 |
| | MinF | 0.012 ± 0.001 | 8.34 | <0.001 |
| | MaxF | 0.005 ± 0.001 | 5.45 | <0.001 |
| | PF | -0.015 ± 0.002 | -8.27 | <0.001 |
| Jumping | (intercept) | 5.70 ± 3.95 | 1.44 | 0.15 |
| | Subspecies | -4.04 ± 2.84 | -1.42 | 0.154 |
| | MinF | -0.012 ± 0.004 | -2.95 | 0.003 |
| | MaxF | -0.038 ± 0.008 | -4.64 | <0.001 |
| | AP | 0.24 ± 0.07 | 3.45 | 0.001 |
| | DT | -7.12 ± 2.17 | -3.29 | 0.001 |
| | Subspecies X MaxF | 0.024 ± 0.004 | 5.93 | <0.001 |
| | Subspecies X AP | -0.14 ± 0.05 | -3.08 | 0.002 |
| | Subspecies X DT | 5.13 ± 1.40 | 3.67 | <0.001 |
| Time at less 1 meter | (intercept) | 6.21 ± 0.77 | 8.09 | <0.001 |
| | Subspecies | -0.17 ± 0.48 | -0.35 | 0.73 |
| | MinF | -0.004 ± 0.001 | -4.01 | <0.001 |
| | MaxF | -0.004 ± 0.001 | -4.64 | <0.001 |
| | AP | -0.004 ± 0.002 | -2.34 | 0.019 |
| | DT | -0.31 ± 0.12 | -2.56 | 0.011 |
| | PF | 0.006 ± 0.001 | 4.94 | <0.001 |
| | Subspecies X MinF | 0.002 ± 0.001 | 3.58 | <0.001 |
| | Subspecies X MaxF | 0.002 ± 0.0003 | 5.34 | <0.001 |
| | Subspecies X DT | 0.20 ± 0.07 | 2.7 | 0.007 |
| | Subspecies X PF | -0.003 ± 0.001 | -4.94 | <0.001 |
| Correct responses | (intercept) | 2.45 ± 0.51 | 4.79 | <0.001 |
| | Subspecies | 0.71 ± 0.28 | 2.55 | 0.011 |
| | MinF | -0.012 ± 0.003 | -4.82 | <0.001 |
| | DT | -2.09 ± 0.43 | -4.88 | <0.001 |
| | PF | 0.012 ± 0.002 | 4.92 | <0.001 |
| | NS | 0.005 ± 0.002 | 2.41 | 0.016 |
| | Subspecies X MinF | 0.008 ± 0.001 | 5.18 | <0.001 |
| | Subspecies X DT | 0.96 ± 0.24 | 4.01 | <0.001 |
| | Subspecies X PF | -0.006 ± 0.001 | -4.73 | <0.001 |
| | Subspecies X NS | -0.003 ± 0.001 | -2.44 | 0.015 |
| Tail wagging | (intercept) | 4.65 ± 1.66 | 2.8 | 0.005 |
| | Subspecies | -0.44 ± 0.90 | -0.48 | 0.629 |

| | | | |
|---|---|---|---|
| MinF | 0.003 ± 0.001 | 5.01 | <0.001 |
| MaxF | 0.056 ± 0.007 | 7.76 | <0.001 |
| AP | -0.23 ± 0.03 | -8.45 | <0.001 |
| DT | 6.28 ± 0.82 | 7.67 | <0.001 |
| PF | -0.063 ± 0.007 | -9.28 | <0.001 |
| Subspecies X MaxF | -0.026 ± 0.004 | -7.28 | <0.001 |
| Subspecies X AP | 0.11 ± 0.01 | 8.07 | <0.001 |
| Subspecies X DT | -2.93 ± 0.41 | -7.07 | <0.001 |
| Subspecies X PF | 0.030 ± 0.003 | 8.68 | <0.001 |

*Explanatory variables without effect on the response variables were removed from the models during the model-selection process.

**Wolves or dogs; wolves is the reference group.

**Figure S2.** Characterization of voice of the five trainers involved in Positive Reinforcement Training sessions with dogs (*Canis familiaris*) and wolves (*Canis lupus*). Left to right, bottom margin: trainers 1, 2, 3, 4 and 5. Acoustic parameters of trainers' voices: minimum frequency, maximum frequency, peak frequency, average power, delta time and number of speeches. Number of nice, neutral, and reprehensive speeches: 10.391, 7.500, 47 respectively.