A Supplemental Material

A.1 Example dialogs with different reward functions

Dialogs	Category	Reward
USR: *I am at* `<uncovered_departure>`.		
SYS: what time do you want to travel?	proceeding turn	-1
USR: *At* `<time>`.		
SYS: what time do you want to travel?	proceeding turn	-1
USR: *You already knew that!*		
SYS: Where do you want to go?	proceeding turn	-1
USR: *I want to go to* `<uncovered_arrival>`.		
SYS: Let me look that up for you. Sorry, there is no result that matches your request.	success	20
	Total reward	17

Table 8: An example of the simulated dialog using the baseline reward.

Dialogs	Category	Reward
USR: *I am at* `<uncovered_departure>`		
SYS: Where do you want to go?	no match	-1
USR: `<arrival>`.		
SYS: where do you want to go?	matched	-4.01
USR: *You already knew that!*		
SYS: where are you leaving from?	repetition	-2.5
USR: *You already knew that!*		
SYS: what time do you want to travel?	no match	-1
USR: *At* `<time>`.		
SYS: Let me look that up for you. Sorry, there is no result that matches your request.	success	20
	Total reward	11.49

Table 9: An example of the simulated dialog using the sentiment reward with repetition penalty (SRRP).

A.2 Annotation scheme

Label	Definition	Description
-1	negative	Shows impatience, disappointment, anger or other negative feelings in voice.
0	neutral	Shows neither positive nor negative feelings in voice.
1	positive	Shows excitement, happiness or other positive feelings in voice.

Table 10: Sentiment annotation scheme.

A.3 Context features used in supervised learning

Model	Context features
baseline HCN	Presence of each entity in dialog state
HCN + dialogic features	Presence of each entity + dialogic features in Table 3
HCN + predicted sentiment label	Presence of each entity + predicted sentiment label in one-hot vector

Table 11: Context features in different SL models.

A.4 Selected acoustic features in Section 5.1

Selected acoustic features after feature selection
pcm_loudness_sma_iqr1-3
pcm_fftMag_mfcc_sma[0]_pctlrange0-1
pcm_fftMag_mfcc_sma[0]_upleveltime90
pcm_fftMag_mfcc_sma[7]_upleveltime75
logMelFreqBand_sma[1]_quartile3
logMelFreqBand_sma[1]_upleveltime75
logMelFreqBand_sma[2]_kurtosis
logMelFreqBand_sma[3]_amean
logMelFreqBand_sma[3]_linregc2
logMelFreqBand_sma[5]_upleveltime90
lspFreq_sma[7]_minPos
lspFreq_sma[7]_skewness
pcm_loudness_sma_de_kurtosis
pcm_fftMag_mfcc_sma_de[5]_amean
pcm_fftMag_mfcc_sma_de[6]_linregerrQ
pcm_fftMag_mfcc_sma_de[9]_kurtosis
pcm_fftMag_mfcc_sma_de[10]_iqr1-2
logMelFreqBand_sma_de[5]_quartile2
lspFreq_sma_de[4]_percentile99.0
jitterLocal_sma_de_iqr1-2

Table 12: Selected acoustic features in Section 5.1