C Communication rules and Policy design

Table 1: Communicative Update Rules associated with Dialogue Acts

Dialogue Acts	Communication Rules
Restatement	Repeat the question/information either at the same speed or more slowly.
Feedback request	Option 1: Ask the participant whether they can follow what the agent has said.
	Option 2: Ask the participant whether it is difficult for them to answer this question.
	Option 3: Ask the participant whether they want to continue to answer this question by themselves.
Information extension	Provide more explanations to fix the issued questions or lost information.
Information supplement	Provide the full information / question in different ways to easily understand without confusion.
Confirmation	Get a help confirmation from the participant to overcome their confusion.
Affirm	Affirm that this information or question has issues or is difficult leading to the participant cannot answer.
Acknowledge	Acknowledge the participant's response correctly to remove the participant's source of confusion.
Subject change	Option 1: Raise a simple question that the participant can answer without confusion.
	Option 2: Bring up another interesting topic to arise the participant's engagement.

We can dive into the details of this approach by examining in Table 2 the specific updates associated with the confusion indicators. Specifically, we indicate the dialogue acts used to resolve the user's current confusion state. A key point here is that this policy makes policy choices based on (a) whether the participant is likely in a productive or unproductive confusion state; and (b) what is most likely to be the induction (cause) of confusion, *i.e.*, complex information, insufficient information, or others. Note that in our earlier work we highlighted contradictory information and inconsistent feedback as potential testable inductions for confusion states. However, the current model is focused only on what can be operationalised into a working system, and the reality is that it is difficult to estimate if a user's confusion might be due to contradictory information or false feedback, as by definition it is hard for a system to determine if it itself has made a mistake in its interactions with the user. Thus, we generalise the two induction categories Contradictory Information and False Feedback to a single - general induction category.

Table 2: Dialogue policy for mitigating different confusion states

Policy of productive confusion mitigation		
Confusion Inductions	**Dialogue Acts**	**Communicative Detail**
Complex infor*	Restatement	The agent will reintroduce the complex information step by step.
	Feedback request	The agent will ask whether the participant is clear on the issue or question.
	Confirmation	The agent will confirm whether the participant needs a help to answer this question or complete the task.
	Information supplement	The more and extra information will be told to the participant.
Insufficient infor	Affirm	The agent will affirm the question / information is insufficient.
	Confirmation	The agent will confirm whether the participant needs help to answer this question or complete the task.
	Information extension	The agent will provide the lost part of the question / information.
	Information supplement	The more and extra information for this question or task will be told to the participant.
Others	Acknowledge	The agent will show positive and correct feedback.
	Affirm	The agent will affirm the question / information has issues.
	Confirmation	The agent will confirm whether the participant needs help to answer this question or complete the task.
	Information extension	The agent will correct the question / information to be consistent.
	Information supplement	The more and extra information will be told to the participant.
	Feedback request	The agent will ask the participant whether they want to continue to answer this question or complete this task by themselves.
	Subject change	The agent will talk about a simple question or task with positive feedback.
Policy of unproductive confusion mitigation		
Confusion Inductions	**Dialogue Acts**	**Communicative Detail**
Complex infor* Insufficient infor Others	Affirm	The agent will confirm that the question / task is difficult which has led to the participant being confused.
	Information supplement	The more and extra information for this question or task will be told to the participant.
	Feedback request	The agent will ask whether participants want to continue to answer this question or task by themselves.
	Acknowledge	The agent will show a positive and correct response or feedback.
	Confirmation	The agent will confirm whether the participant needs help to answer this question or complete the task.
	Subject change	Option 1: The agent will ask a straightforward question or talk about a simple task to avoid confusion states.
		Option 2: The agent will talk about another interesting topic *e.g.* favourite food, movie, *etc.*

* Infor: Information