Practical RST Tutor
Personalized Online Learning - Final Report
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12/14/18

Introduction

Our tutor aims to teach Practical Rhetorical Structure Theory to annotators. Rhetorical Structure

Theory (RST) is a method of annotation that focuses on identifying relations between

sentences. Annotation is commonly used to identify patterns and elements in computer

generated text which can then be converted into a format to feed Machine Learning algorithms.

Many annotators are unfamiliar with RST and learning the method is quite dry and laborious.

Typically, learning RST involves mulling over academic papers and websites, which is generally,

an unengaging process. Identified a need to enhance the RST learning process, we decided to

build an engaging online adaptive tutor to help annotators learn this method more efficiently.

Before detailing our Cognitive Task Analysis it is important to provide some terminology in

order to gain a clear understanding of our tutor.

Relation: Relations refer to the term that describes how one sentence is connected or

associated with the following sentence.

Nucleus: Nucleus refers to the sentence which contains the main claim or idea.

Satellite: Satellite refers to the sentence which provides either additional information or

evidence for the Nucleus sentence.

Cognitive Task Analysis

For our Cognitive Task Analysis we conducted a Think Aloud study on 5 subjects who have no

prior experience using or learning RST. For the study, the subjects were asked to read 4 sets of

3 relation definitions (ABCD) and to identify the relations for corresponding sets of sentences.

Each set of relation definitions contained a different difficulty factor that we identified.

Here are descriptions for our four conditions:

Condition for Section A: With examples and conjunction phrases

Condition for Section B: With examples but without conjunction phrases

Condition for Section C: With conjunction phrases but without example

Condition for Section D: With both examples and conjunction phrases, but all involve Nucleus-Nucleus relations.

The difficulty factors we identified through our theoretical task analysis were '**learning without examples**' and '**learning without conjunction phrases**'. Learning without examples refers to a condition when the subjects are to learn the relations with the definitions but without examples. Conjunction phrases refers to a phrase that can be insert into the two sentences to conjoin them without sounding unnatural. These phrases can often give strong hints to a student about how two sentences are related to each other. Learning without conjunction phrases refers to a condition when the subjects are to learn the relations with the definitions but without the conjunction phrases.

Through this design we wanted to gain insight on:

1. Whether providing learners with example help them in identifying relations.

2. Whether providing learners with conjunction phrases help them in identifying relations.

3. Whether learners find identifying Nucleus/ Nucleus relations are easier than the other.

Results of the CTA

From this CTA we gain insights on the several common strategies our subjects use and which aspects of our initial design are *actually* helpful. We observed that the subjects of this CTA regularly referred back to the relation definitions, compared their given task sentences with the examples provided and used insertion techniques with the conjunction phrases by inserting the phrase between both sentences to see if it logically made sense. We also observed that our

subjects did not pay much attention to or rely on the Nucleus/Satellite aspect of RST, nor did they find that particularly helpful for them to identify relations. Some of the surprising strategies that subjects used are described in details in the appendix,

Based off of these observations we decided to make a several changes to our original tutor design. We decided to implement an "insertion test" method to mimic the learning strategy observed by adding a step where students have to identify the best conjunction phrase that connects both sentences. . We also decided to add an additional step in which the student must identify the general group or category that the sentences fall into. Based on our assumption, this would help the student narrow down their relation options to just a few relations rather than having them select from all possible relations. Since we observed that students did not pay much attention the connection between Nucleus/Satellite and identifying the correct relation, we decided to de-emphasize it in our original tutor design and condensed it into a multiple choice question. This way the user would be able to focus more on the conjunction hints and examples which provided much more assistance in their learning process.

Tutor Implementation

Knowledge Components
We have 4 Knowledge Components, which translates to 4 Production Rules, in our rule based tutor.

Identify Group: This knowledge component focuses on getting the user to understand the general group or category which the correct type of relations are in. This KC is problem general.

<u>Identify Conjunction Phrase:</u> This knowledge component focuses on getting the user to understand the type of conjunction phrase that best joins the 2 sentences given. This KC is problem general

<u>Nucleus-Nucleus or Nucleus-Satellite:</u> This knowledge component focuses on getting the user to understand whether the pair of sentences is a Nucleus-Nucleus type or a Nucleus-Satellite type. The question advises the user to look into which sentence seems more important. This KC is also problem general.

<u>Identify Relation:</u> This knowledge component focuses on getting the user to select the best fitting relation for the given pair of sentences. The question for this skill asks the user to, keeping all the prior information they've gathered in mind, choose the best fit among the given relations. In the Example Tracing Tutor, this skill is problem specific because there are only 3 relations for which there are problems so there is more specificity with this skill. For instance, there are 3 relations (Evaluation, Conjunction, Evidence) in one group of 9 problems (3 problems per relation). On the skill bar there are the skills, 'Identify Evaluation', 'Identify Conjunction' and 'Identify Evidence'.

Example Tracing Tutor
For our Example Tracing Tutor we created 9 problems for 3 relations. Each relation has 3 problems which specifically target that relation. Although the Example Tracing Tutor and the Rule Based Tutor have the exact same interface, the Example Tracing Tutor contains more targeted error messages. As shown in Figure 6 in the Appendix, the error messages provided are specific to the answer choice the student selected. The thought process behind the error messages was to provide the student with an actual systematic method to approach the problem. For example, if the student identified the

wrong conjunction phrase, the error message advises them to actually insert the phrase between both sentences and read it aloud to see if it fits logically.

Cognitive Model
For the Rule Based Tutor we have implemented 4 production rules, one for each Knowledge Component, as stated earlier. The working memory for our tutor is relatively nonexistent. Since all the student answers are predetermined and there is not any variability in them, all the answers are pre-loaded through the bootstrap rule. The Rule Based tutor differs from the Example Tracing Tutor is 2 ways, variability in problems and error/buggy messages. For the Example Tracing Tutor we've created 9 problems in total dealing with 3 relations. For the Rule Based Tutor we've created 45 problems for 15 relations (3 problems per relation). The relations have been grouped according to difficulty level, which was identified by our resident RST expert, Kexin. By grouping problems by difficulty level, we allow for the user to move from easy to difficult as they move through the tutor. For the error/buggy messages, we opted to provide more general task type feedback in this Rule Based tutor. Our error messages are particular to the specific task question but are not relation or error specific. For example, if a student incorrectly identifies the Group, the error message will provide a hint for how the student should generally go about identifying the group correctly, but the message is not specific to the student's answer, a feature that is implemented in the Example Tracing tutor..

Observations from the pilot
Unlike the previous think aloud CTA, our pilot study involved our target users of this tutor. They are either in NLP or linguistics background. Among three of our participants, two have experience either learning or annotating in RST, therefore the domain is relatively familiar to

them, which make it easier for them to give us more insightful suggestions. The third

participant does not have previous exposure to RST, but she is familiar with CTAT tutors and

her major is in Natural Language Processing, and this structure is of interest to her for future

study.

Our pilot is divided into three parts: pre-test, tutor practicing and post-test. In the pre-test and

post-test, the participants are asked to do 11 questions of RST. Similar to the previous CTA,

they are given sentence pairs and asked to identify relation for them. We use the same

questions for both pre-test and post-test to ensure the validity and measure learning gains. The

centerpiece of the pilot involved participants to practice on our tutor, using the tutorshop

platform.

	Participant 1	Participant 2	Participant 3
Background	Literacy and linguistics	Computer Science and Natural Language Processing	Computer Science and Natural Language Processing
Experience with RST	Have learnt basic RST and annotated a few articles using it	None	NLP expert, with lots of knowledge about this
Pre-test accuracy	54.5% (6/11)	63.6% (7/11)	Nearly 100%
Post-test accuracy	36.3% (4/11)	54.5% (6/11)	Nearly 100%

The participants have reported many insightful suggestions and challenges faced while using

our tutor, which helped us in later iteration. Firstly, participant 1 suggested that we make less

salient the "relation1, relation2, relation3" and make the whole interface less yellow. Participant

1 and 2 both experienced difficulty in understanding what the "group" in step 1 mean, and they

also encounter the problem of not always being able to find the conjunction words in options.

Another salient problem was they sometimes are not notified with whether or not they are

going down the right path. Participant 3 by himself has plenty of experience in this domain before the tutor even start, so he did not complete the whole process. However, from a pointview of domain expert, he told us our design is really meaningful, especially for he usually cannot come up with any effable regulation to do the RST job, but our design addressed to this problem for him to a certain extent.

Judging from the pre-test and post-test, the learners did not seem to improve in this domain. One possible reason is the users still experienced too few problem tasks to make significant improvement in this relatively complicated domain. Another reason is our tutor still needs improvement in design loop, inner loop and outer loop.

Changes we made to the design loop:

1. Changed the interface to a more harmonious color, and stress some interface elements that need their attention, for example "Your task".

2. To reduce user's confusion about "group", we added which group this relation belong to in the relation information components

3. To reduce user's confusion about "group"we also added a separate interface element that contains all the definition for groups

Changes we made to the inner loop:

1. We enriched the conjunction phrases' variety, which can make it easier for users to find proper one to insert.

2. We inserted pop out hints/ error messages to ensure the user stays on the right track.

3. We reviewed and made changes to the problem files for the content of RST.

Changes we made to outer loop

1. We added done button to make use of the function of automatically select next question

in Tutorshop, which also pave way for our adaptive problem selection.

2. We grouped the questions according to difficulty, and expose users with easy questions first, to increase their self-efficacy.

Participant Feelings/ Struggles/ Suggestions	Changes We Made	Iteration Loop
The interface is too yellow, and stress unimportant components.	Changed the interface to a more harmonious color, and stress some interface elements that need their attention, for example "Your task".	Design loop
Definition of groups is not self-explanatory.	1. Added which group this relation belong to in the relation information components 2. Add a separate interface element that contains all the definition for groups	Design loop
When finished with one questions, learners need to click/ select their next problems, which violate our adaptive problem selection principle.	Added done button to make use of the function of automatically select next question in Tutorshop	Outer loop
Should go from easy to hard	Grouped the questions according to difficulty, and expose users with easy questions first.	Outer loop
Sometimes feels none of the conjunction phrases fit.	Enrich the conjunction phrases' variety.	Inner loop
Does not know whether or not he/she is in the right path because not notified of wrong answer when using Safari.	Insert pop out hint/ error message	Inner loop
Misplacement and grammar mistakes	Review the problem files for the content of RST.	Inner loop

Advice for CTAT
One thing we hope CTAT can be improved upon is the Safari "incorrect action" function. In

Safari, it seems that when a student incorrectly answers a question, the CTAT incorrect

functionality doesn't work, that is, the red halo does not appear around the incorrect answer. To account for this, we implemented error messages so that students actually knew when they answered incorrectly. But, we hope that in the future, this is not necessary.

Another thing we think CTAT might improve is to make success or buggy message window style editable to users. So we can use CTAT do decide how long do we want that window last, and what is the proper size of the window.

Finally, we think maybe CTAT can add some functions make the art style of every interface element available to customize. So we can use a interface more elegant and more relevant to the topic of our tutor.

Reflections / Future Iterations

Due to the time constraint, our current tutor still has some limitation, and can benefit from four possible improvement.

Firstly, we still need more data on whether our tutor is able to help learners learn these relations. Specifically, do they need the first step of the inner-loop, which asked them to choose group? From our qualitative analysis in think aloud, it supports that having conjunction phrases and insert test (step 2 in our tutor) should be able to help learners. But in that case, the step 1 which ask users to choose groups of relation may not hold true for its effectiveness, especially if the definition of the groups are loosely-defined by our empirical experience. So in future iteration, we might consider deleting this step to compare the relative outcome of the two designs.

Secondly, our tutor would benefit from more detailed, error-specific hint and buggy message. Right now the hint and buggy messages are still relatively general, and focus on directive

instruction that scaffold you what to do next. But in the future, it may be useful to add in buggy message that are specific to the type of errors learners made, for example, to compare and resolve confusion between two specific relation, by pointing out to them why this is wrong answer.

Thirdly, now the buggy message and hint exist in the form of a pop out window, while this may be alarming enough to ensure the users change their strategies, this error message seems a little detached from the original interface. Thus in future iteration, it might be helpful to incorporate the error message in the same interface, and make it appear right besides the error made for a short period of time (say 5 seconds), everytime the user make an error. This way the users will not only notice the buggy message, but can also refer to the task where they go wrong at the same time.

Appendix

Figure 1.

Practical RST Tutor

Relation 1

Evaluation

Defintion:

S assesses N based on what is presented in N or logical deduction from N.

Example:

S: They are going to be very warm in winter.

N: These sweaters have supreme wool inside.

Conjunction Phrases:

"People have reason to say...", "It is logical to say..."

Group:

Supplementary

Relation 2

Conjunction

Defintion:

The two sentences are conjoined to form an entirety that serve a common purpose.

Example:

N: This didn't make me like the story any less,

N: nor did I find it hard to follow.

Conjunction Phrases:

"Another thing about this is..."

Group:

Conjunct

Relation 3

Evidence

Defintion:

Readers' comprehending S increases their belief in N.

Example:

S: According to statistics, the average time that Chinese kids doing housework is only 0.2 hr/ week, while American kids spend 0.8 hr/week on housework.

N: Chinese students may be more spoiled with doing less housework in the childhood.

Conjunction Phrases:

"One evidence for this is..." ,"What can effectively support this is...","This is backed up by the fact that..."

Group:

Supplementary

Figure 2.

Your Task

Identify the relation for the sentence pair:

A: It is important to speak out about your own opinion.

B: Napoleon was just an ordinary soldier in 1973, yet in the important battle, he put forward his strategies and got promoted from then on.

Identify Relation
Nucleus-Satellite vs. Nucleus-N
Identifying Group
Identify Conjunction Phrase

Additional Information

Group Definition

Progressive:

Sentence A builds on Sentence B, and moves the idea forward.

Supplementary:

The Satellite (one sentence) is

Step by Step

Lets try to solve this problem step by step!

Step 1: Which class/group do you think the relation will likely fall into? (In other words, what best describe the nature of this relation?)
Please select from the drop down menu.
[--- ⏷]

Step 2: What conjunction phrase can best connect the two parts?
Please select from the drop down menu.
[--- ⏷]

Step 3: Is this a Nucleus-Nucleus relation (two parts equally important) or a Nucleus-Satellite one?
○ Nucleus-Nucleus   ○ Nucleus-Satellite

Step 4: Now, what is the relation between these two sentences?

[--- ⏷]

Figure 3.

Group Definition

Progressive:

Sentence A builds on Sentence B, and moves the idea forward.

Supplementary:

The Satellite (one sentence) is supplementing information to the Nucleus(the other sentence).

Conjunct:

Two sentences are joined to form a unit and serve a common purpose.

Repeating:

The two sentences contain similar information.

Contrast:

Two sentences are in contrast or in comparison.

No relation:

Two sentences have no explicit relation.

Figure 4.

Step 4: Now, what is the relation between these two sentences?

| --- ⬍ |

A: It is important to speak out about your own opinion.

B: Napoleon was just an ordinary soldier in 1973, yet in the important battle, he put forward his strategies and got promoted from then on.
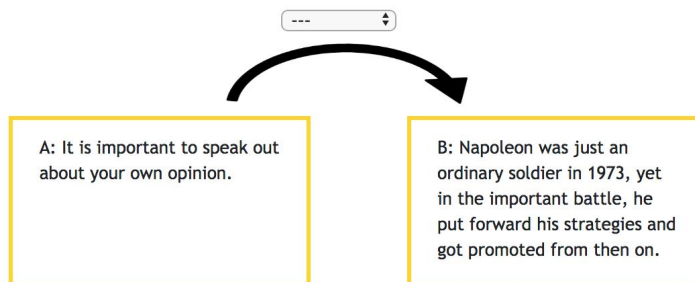
Figure 5.

Lets try to solve this problem step by step!

Step 1: Which class/group do you think the relation will likely fall into? (In other words, what best describe the nature of this relation?)
Please select from the drop down menu.

✓ Progressive
Supplementary
Contrast
Repeating
Conjunct

Step 2: What conjunction phrases can best connect the two parts?

Figure 6.

Group:
Supplementary

Group:
Conjunct

Group:
Supplementary

Your Task

Step by Step

Lets try to solve this problem step by step!

Identify the relation for the sentence pair:

A. The wood house by the lake is nicely-built and has a great view.

B. The wood house is more favored by the tourists.

Nucleus-Satellite vs. Nucleus-N
Identify Evaluation
Identifying Group
Identify Conjunction Phrase

Additional Information

Group Definition
Progressive:

CTAT Info Panel ch class/group do you think the relation will likely fall into? (In other words,

Repeating is defined as : The two sentences contain similar or same information.Does this apply to this sentence pair?

Repeating

Step 2: What conjunction phrase can best connect the two parts?
Please select from the drop down menu.

Step 3: Is this a Nucleus-Nucleus relation (two parts equally important) or a Nucleus-Satellite one?
○Nucleus-Nucleus   ○Nucleus-Satellite

Practical RST Tutor- Cognitive Task Analysis

In this study, you are going to read some information about relations in Rhetorical Structure Theory, and use them to identify what are the relation between sentence pairs. You will do four groups of tasks in total, each group involve 3 relations and will ask you three questions. Try to "THINK ALOUD" while you are doing the tasks!

Some background knowledge: In RST, there are two types of relations:

Nucleus/Nucleus(N/N) and Nucleus/Satellite(N/S).

S(satellite) is usually less important than N(nucleus). If the two sentences are equally important, they are in N/N relations, otherwise, they are in N/S relations.

A

First, please read some information about three relations.

1.Background:
Definition: S helps readers better understand N.

S: Until 1984, Burkina Faso was called Obervolta.
N: According to an EMNID poll, many Europeans today believe that they are two different countries.

Phrases best connect two parts: "What you need to know about this is…"

2. Condition:
Definition: Realization of N depends on realization of S.

S: If you are over 21,
N: You can drink alcohol in America.

Phrases best connect two parts: "Condition to achieve this is…", "if…"

3. Evaluation

Definition: S assesses N based on what is presented in N or logical deduction from N.

N: These sweaters have supreme wool inside.
S: They are going to be very warm in winter.

Phrases best connect two parts:"People have reason to say...", "It is logical to say..."

Now it is your turn to identify the relation of the following sentence pair:

Choose from [condition,evaluation, background]

Question1:
A: In 2001, the Patriot Act was issued.
B: People have mixed feelings towards it.

Relation:

Question2:
A: If it is snowing and the road is slippery
B: You probably need snow tire to drive safely.

Relation:

Question3:
A: It is snowing and 30 degree outside.
B: Pittsburgh is experiencing a really cold winter now.

Relation:

_____

B

First, please read some information about three relations.

4.Preparation

Definition: S precedes N and S make readers more ready, interested in reading N.

Example:
S: He was laughing and seemed unusually happy today.
N: Later he told me he had an A in an exam today.

5.Elaboration

Definition: S provides N with additional details.

Example:

N: Today is really cold.

S: It is less than 30 degrees.

6. Motivation

Definition: Because of S, readers' desire to perform the action in N increases.

Example:

S: That red dress seems your style.

N: It would make sense that you buy it.

Now it is your turn to identify the relation of the following sentence pair:

Choose from [Preparation, motivation, elaboration]

Question1:

A: The milk here seem very fresh and healthy, they are also good for your bones.

B: Make sure you drink enough milk every day.

Relation:

Question2:

A: The economics was going down in America during the depression.

B: President Roosevelt was handed this challenging task to invigorate the economy.

Relation:

Question3:

A: The economics was going down in America during the depression.

B: The depression affects people's job opportunity a lot.

Relation:

_____

C

First, please read some information about three relations.

7. Restatement:

Definition: S contains the same information as N.

Phrases best connect two parts: "This is basically saying…", "In other words…"

8. Cause

Definition: S is the cause of N.

Phrases best connect two parts: "Because…", "Reason for this is…"

9. Interpretation

Definition: S contains the writer's personal opinion on N, which involves content outside N and cannot be deducted from N.

Phrases best connect two parts: "[Somebody]'s personal opinion is…", "[Somebody] feels that…"

Now it is your turn to identify the relation of the following sentence pair:

Choose from [cause, interpretation, restatement]

Question1:
A: The blue car is my type of car.
B: I really like the blue car.

Relation:

Question2:
A: It is snowing outside.
B: It is a rare case to be snowing in April.

Relation:

Question3:
A: He ate too much cheese and fell in love with drinking soda after coming here.
B: He gain 10 pounds in 1 month.

Relation:
_____

D

First, please read some information about three relations.

10. Contrast

Definition: Two sentences are put into comparison, they are both nucleus.

Example:
N: Animals can heal,
N: but trees cannot recover from destruction made to it.
Phrases best connect two parts: "But..."""On the other hand.."

11. Sequence

Definition: There is a succession relationship in time for the nuclei.
Example:
N: I would first peel the orange.
N: Then put them in the blender.
Phrases best connect two parts: "After that...","before that..."

12. Conjunction

Definition: The two sentences are conjoined to form a unit.
Example:
N: This didn't make me like the story any less
N: nor did I find it hard to follow.
Phrases best connect two parts: "Another thing about this is..."

Now it is your turn to identify the relation of the following sentence pair:

Choose from [contrast, sequence, conjunction]

Question1:
A: We are meeting at 12:30.
B: Half an hour later we will be able to finish this task.

Relation:

Question2:
A: He feels sad to leave this city.
B: He also feels very lonely.

Relation:

Question3:
A: Sometimes it may be beneficial to drink some wine.
B: Yet, drinking too much wine could harm your health.

Relation:

Transcription from Think Aloud CTA.

| User 1 (KY) | Section A | Question 1:
"Yeah this is the same as in the example. If you only say N, it will be hard to understand what the two countries are, and S explained what these two countries are."
Question 2(INCORRECT):
Jumped to the wrong answer "This must be evaluation, this is kind of easy."
But then doubt his own answer and changed it "Oh it has an if, then it should be condition."
Then went back to wrong answer after doing the insertion test "People have reason to say... then I think maybe it is still evaluation"
Question 3:
"Evaluation and condition are kind of hard to distinguish. The difference is, is it a deduction or a thing that will happen? In the examples.. It said blablabla..." |
| | Section B | Question 1:
"Reader will perform an action after listening S in motivation."

Question 2 (INCORRECT):
"This must be an elaboration (wrong), it provides more details about this. A must be before B, because A said economy is going down, without A you don't know what 'the challenge task' is, so B is dependent on A, A is the main part".

Question 3
"This is not motivation, .. this is still elaboration, it is not getting me more interested in reading (the second part)" |

	Section C	Question 1: "Restatement, hard to say which is S which is N." Question 2: "This must be interpretation. B is S because it provide writer's personal opinion." Question 3: "This will be cause. What is the NS for cause again (looking back), oh, S is the cause of N."
	Section D	Question 1: "This is easy, I can do it immediately." "This must be sequence." Question 2: "This must be conjunction" Question 3: "This is comparison (wrong wordings)".

Additional interview/ analysis of user 1:

User 1 (KY)	Interesting thing noticed:	He did not notice the difference in different version of ABCD!
	Surprising strategy used:	1. He used more about definition, sometimes example. 2. He also tried to apply conjunction(insertion test) to see whether it fit for 2 times (when deciding the hard condition/evaluation one.) "It make sense to say this…"(conjunction inserting test of "evaluation"), "realization of S and N" (referring to definition of "condition") 1. Method of exclusion. "So it is definitely not condition, what else could it be…"
	General experience:	"Quite easy." "Still have part C?" (complaining about length)
	Accuracy:	A:2/3 B:2/3 C:3/3 D:3/3 Total: 10/12

	Which is most helpful?	definition	" Yeah, definition is definitely helpful to have, it is like the most fundamental thing about this relation. "(Very useful 10/10)
		example	" Concrete example is quite useful, I can compare it with the actual questions." (7/10)
		N/S	"Deciding N and S will not really help me in deciding relations. It is not easier than deciding relations itself. Probably because I am not that famiilar with N and S " (1/10)
		Conjunctions hint:	"It is a more generalizable information than concrete example, that I can use it in other situation " When asked whether adding a step of choosing conjunction will help with identifying relations: "Wouldn't that kind of decide what relation this is? But yeah, I think it will definitely help." (9/10)

User 2 (KY)	Section A	Question 1(skipped): "This is kind of like a causal relationship." "This is kind of like the 'Shuncheng' relation in Chinese." Question 2: "I think this is evaluation (wrong)" "I thought this is evaluation because I thought there are causal relationship, but after I read the question 3 I think question 2 is more like a condition, and question 3 more like a deduction." Question 3: "I think this is evaluation then the former one is condition then I guess."

	Section B	**Question 1:** "I think this is a motivation, because B is an action whose subject is 'you', and A provide a motivation statement for it." **Question 2:** "I think this is the 'interest' one, which is A has a sentence that make you more interested in reading later part." **Question 3** "Elaboration I guess, but I guess it is because you offered me the situation to choose from 3, that I think it is similar to elaboration. But if all relations are present, I might say this is more like condition. "
	Section C	**Question 1:** "I think this is pretty subjective.. Then interpretation.. No wait a minute, it should be restatement, because they are basically the same. Reason why it is not interpretation is because B can be deducted from A". **Question 2:** "This is kind of like interpretation, because the second part cannot be deducted from A. It sounds like this person has been living here for a long time." **Question 3:** "A seem like the cause of B."
	Section D	**Question 1:** "This should be sequence because it is related to the time and sequential " **Question 2:** "I think this is conjunction, two are conjoined together" **Question 3:** "This is a contrast relationship. (jumped to the answer)"

Additional interview/ analysis of user 2:

User 2 (KY)	Interesting thing noticed:	1. She was very prompt and accurate in learning and identifying relations. 2. She got all the questions right. 3. She is very conscious in not to game the system and guess, but carefully evaluate and try to write down the best match of relation. 4. She noticed every typo, format, and grammar error in the protocol and tried to correct them. "Because I used to be an editor" 5. She was very surprised to see the relation "Cause". I asked her why in the later interview, "Because I saw many relations before that I think has the causal relations, but they are more fine-grained I guess".
	Surprising strategy used:	1. She would first thoroughly grasp the relation related information. 2. She sometimes use her own words to re-explain her understanding of some relations. "I think this relation has causal relation" 3. She would come up with her own definition of the relations: "I will think of motivation is used when the subject is 'you'" 4. Because of her prior knowledge in Chinese linguistics, she would make analogy. "(Background) In Chinese linguistics structure, this is similar to 'Shuncheng' relation." "(Conjunction) I will think of it as 'Binglie(conjoined)' (Chinese linguistics)" 5. She make generalization, using the example or definition given. "(Elaboration) So this is offering more details." 6. She would compare between different similar relations. "Motivation seems very similar to preparation. I guess the only difference is that motivation focus on the action. I will think of it best used when the subject is 'you'"
	Main difficulty run into:	1. She did not run into too many difficulty. Though she was a bit struck in the A part. In Q1 (background) "This left me no choice but to choose background. I am not sure, I will leave it blank" 2. For Q2: "This is evaluation. (later) no this seems more like condition, because 3 has more emphasis on the causal relationship"

	General experience:	1. She was very efficient and accurate. 2. "This leave me some chance to game the system. Since you are only showing three relations that I am to choose from at each time. I think if at the end there is a session with all the relations to choose from, I may still have difficulty, because many of them are actually quite similar."	
	Accuracy:	A:2.5/3 B:3/3 C:3/3 D:3/3 Total: 11.5/12	
	Which is most helpful?	definition	"Useful"(Very useful 7/10) "I will sometimes refer back to definition, after I saw the example and conjunction."
		example	"Useful, but in some cases such as easy relation as Cause, the phrases to connect each parts is enough. That is why I didn't notice in C there are no example. (But I notice in B there are no conjunctions.) In some cases, such as motivation relation, only giving conjunction may still be vague, which is when we need example." (9/10)
		N/S	It seem she did not pay too much attention to N/S. "No much help." (1/10)
		Conjunctions hint:	"Very helpful, because this is making it explicit." (9/10)

| User 3 (PC) | Section A | Question 1:
"So… This I don't think it's condition, because it's not like an 'if' type thing…Evaluation…ummmmm…."
"It seems like the first example so I'm going to go say that that is background"

Question 2:
"That sounds like an 'if' statement so that is condition"

Question 3:
"That kind of seems like that's background information"
"Yeah actually that seems more like evaluation because it kind of seems like a deduction from the first statement." |
| | Section B | Question 1:
"Kinda seems preparationish"
"Elaboration…uhhh….It's not really elaborating on that same sentence-err-fact. I think, cause its kinda telling you to do something"
"Motivation…. I mean yeah….I guess it could kind of be motivation because it's telling you why you should drink milk everyday"

Question 2 (INCORRECT):
"Elaboration..Preparation…Motivation"
"I guess…President Roosevelt was handed the task..soo…Its not necessarily motivation for the reader."
"Elaboration…it's kind of telling who I guess….was tasked with fixing it…So I'll go with Elaboration"

Question 3
"That also kind of seems like Elaboration to me…..Because…umm…the..its similarly giving more information about the Depression'

"I don't think its preparation….because it's kind of concerning the same issue a little bit more which doesn't seem to be the case from the example for preparation and…..motivation…again it doesn't really give much motivation because it doesn't match the example. " |

	Section C	**Question 1:** "That is a restatement because it's basically saying the same thing. My type of car is similar to saying I really like this car" **Question 2:** "Well I think...hmm....It's not necessarily a cause, but I also don't know. I mean I guess it could kind of be a personal opinion. It definitely involves content outside N and cannot be deducted from N so I'm just going to go with interpretation because I don't think its cause or restatement" **Question 3:** "That seems to be the cause because he gained 10 pounds because he ate all this cheese and drank soda."
	Section D	**Question 1:** "I think that is sequence because there is some sort of time relationship between the two things" **Question 2 (INCORRECT):** "Uhh....that seems to be conjunction..ummm... I don't know if he feels very lonely because... like in the city...but...so it could be a 'but' or an 'and'...But I guess 'Another thing about this'[referring to Phrase hint] doesn't make sense because he...I dont know..They don't seem as related...So I think putting 'but' between it would make more sense. So that is a contrast " **Question 3:** That's definitely a contrast because it's two kind of opposite statements.

User 4 (PC)	Section A	**Question 1 (DIDN'T ANSWER):** "I would probably say….its background….uh…because….well….the first..the part A is um…it helps readers to better understand….well…I say its background cause…you need to know that the Patriot Act was issued to better understand…well actually I don't know… Question 2!" **Question 2:** "Its evaluation…condition I mean. Because it says 'if' in the sentence" **Question 3:** "This is evaluation because…uh…its a logical deduction"
	Section B	**Question 1:** "It is an elaboration, because its elaborating on milk." "Actually this should be motivation…because the benefits of milk should motivate you to drink milk everyday" **Question 2:** "I would say its preparation, cause you need to know the first sentence to get the second sentence" **Question 3:** "Elaboration because..uh…the second sentence provides additional details about the first sentence"
	Section C	**Question 1:** "Uhhhh…..I…I guess it is…umm…. A restatement because you're saying the exact same thing…Well?..yeah…Well?…yeah its saying the exact same thing." **Question 2 (DIDN'T ANSWER):** "Well..I guess..its 'Cause'?…It's not really 'Cause'…" [Asking experimenter] What if it's none of them?' 'I think it's none of them…Because it's not a restatement. B is not a restatement of A. Its not 'Cause' because… because one of the sentences does not cause the other one…and it's not interpretation because it doesn't contain the writer's opinion." **Question 3:** 'That would be cause because..uh..he gained weight because of

		the first sentence”
User 5 (MT)	Section A	**Question 1** “ I guess...umm...the patriot act, I think A is a background of B, because...I cannot say any reasoning process of this, it is too instinct, I simply jumped to the answer...” (MT: you may take advantage of the N/S to help your reasoning............) “It may help, it is super easy to figure out the relation, but the thing is just like..obvious...” **Question 2(Incorrect)** (jump to the answer and give only example-specific analysis of his reasoning once again) “I think, hmm it is again, background, for I can say, what you need to know about sentence 2 is sentence 1, right?” **Question 3** Not taken
	Section B	**Question 1** “It is a little bit hard for me to distinguish...hmm...(take long time read examples over and over again, just read, repeat, no think aloud)” “Ok! I think it is preperation...hmmm” (some case-specific analysis) **Question 2,3** Not taken
	Section C	**Question 1** “ OK, I think it is a..cause...? No! It is restatement, cause the 2 sentences are just the same thing!” (asked do you think this time. Lack of example makes it harder) “It depends, examples do help, especially when the definition is kind of blurred, but this time, by definition itself, restatement is too clear, so it may not help this time” **Question 2,3** Not taken

	Section D	**Question 1** **"This is kind of simple, just..sequence, cuz there is a conjunction** **marker for the 2 sentences, it suggests the relation."** **(asked do you noticed this time there is no N/S)** **"No, I usually tend not to use the idea"** **Question 2,3** **Not taken**