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IS517 Methods of Data Science

The Effects of Conversational Styles on the Dialogues among the Adults in the Later Adulthood

This study examines the impact of conversational agents' design on the dialogue generated by adults in their later years. The study focuses on how formal and informal conversational styles affect adults' communication with conversational agents in their later adulthood. An experiment was conducted with 50 participants, comprising 30 middle-aged individuals aged between 50 and 64 and 20 older adults aged between 65 and 80. The conversations were recorded and transcribed, and the resulting transcripts were analyzed using content analysis techniques.

The study explored how natural language processing could help validate and standardize the qualitative coding process among a research group. Using these measures, researchers can obtain reliable and accurate insights and trends from qualitative data. The study presents a procedure for using natural language processing to help ensure consistent categorization and WordCloud visualization. Despite the challenges of the subjective nature of qualitative research, researchers can use techniques, such as natural language processing and tools, to validate and ensure the research results.

Keywords: Conversational styles, Conversational Agents, Natural language processing, Sensitivity, Qualitative research

Background

The use of conversational agents to support human-computer interaction (HCI) in research settings has increased in recent years. Despite this trend, few studies have examined how age-related differences in the socio-emotional development of adults may interact with conversational agents to generate dialogue responses. The current study aims to explore this issue by focusing on how the design of conversational styles affects the dialogue generated by adults in their later adulthood.

To achieve this goal, Dr. Jessie Chin and Ph.D. candidate Smit Desai have been conducting an ongoing project at the ACTION lab in iSchool. I joined this project in August 2022 as one of the co-authors tasked with implementing quantitative research. Since joining, I have conducted a series of analyses to support this HCI study.

As part of this proposal, I suggest a new analysis we have not yet tried in our research. This analysis will provide new insights to the team and help advance our understanding of the topic. However, out of respect for the primary authors and to ensure I do not disclose any key findings before publication, I have obtained permission to use only a portion of the data I am handling for this course project.

Objective

This study aims to examine the impact of conversational agents' design on the dialogue generated by adults in their later years. As people age, various factors can influence how they interact with conversational agents, including changes in

cognitive abilities, personality, and conversational styles. By analyzing these factors, this study aims to identify how participants' conversational styles can shape their perceptions toward conversational agents in later adulthood.

To achieve this goal, the study will focus on two different conversational styles: formal and informal. These styles will be tested in a controlled experiment, in which participants will engage in conversations with conversational agents that use either formal or informal tone. The conversations will be recorded and transcribed, and the resulting transcripts will be analyzed using content analysis techniques for this part of the study.

To be more specific, the study explores how natural language processing could help validate the qualitative coding process in the current settings. Doing so will provide valuable insights into how qualitative analysis can be examined and standardized among a research group.

Dataset

For this study, we collected data from a total of 50 participants. The study involved a Wizard of Oz user study conducted in a simulated home environment. Although the number of participants may seem small, the analysis yielded almost 500 entries, as each participant engaged in long conversations with the conversational agent. These conversations were recorded as transcripts.

Application of Proposed Method

Although the author has yet to utilize natural language processing (NLP) analysis, it has been determined that NLP is an ideal methodology for conducting the proposed analysis. The data to be analyzed consists of dialogues generated by adults in their later adulthood, making NLP an effective tool for identifying patterns and themes in large amounts of text data.

A range of evaluation metrics will be used to ensure that all relevant information, thoughts, and feelings present in the dialogues are captured. These metrics include the frequency of certain words or phrases, the length of the dialogues, and the level of emotional intensity expressed in the text. Using various metrics, a comprehensive picture of the dialogues and the experiences of the adults who generated them can be painted.

Data Processing and Cleaning

Qualitative coding is a widely used method in user research for analyzing data obtained from interviews, focus groups, and other qualitative research methods. This method helps identify themes and patterns in the data, which can then be used to identify insights and trends. However, it can be challenging due to its subjective nature and potential for discrepancies in coding interpretation discrepancies. Researchers often use multiple coders and establish strict coding protocols to ensure the validity and reliability of qualitative data.

In addition to these measures, natural language processing techniques can also be utilized to help validate and verify the coding results. These techniques can help

ensure that the data is accurately categorized and the insights and trends identified are valid and reliable.

The data processing and cleaning stage involves several steps to ensure the quality of the data. Firstly, a content analysis is performed on the transcripts to identify relevant information. Next, three different coders independently categorize the transcripts into information, thoughts, and feelings. After this, each coder determines the levels based on the coding protocols. Finally, the coders meet to confirm the results and agree on the assigned categories and levels.

Participant No.	Coder	text	Disclosure Category (Information, Thoughts, Feelings)	Level
95	Gabby	I was probably irritated playing with friends and losing and not knowing that I could do better, and I just I, and I just didn't but otherwise I'm not usually a happy person, and so I just go with the flow.		
95	Gabby	I was probably irritated playing with friends and losing and not knowing that I could do better, and I just I, and I just didn't but otherwise I'm not usually a happy person, and so I just go with the flow.	Feelings	4
P20	Sheny Lin	Popping the balloons was like stomping on balloons, making rockets go up in the air and seeing how much the children laughed. Lots of fun, people thought it was dangerous I don't know why. The word search topic elements reminded me of college and I felt like I should have known more elements. Not a very good story.	Feelings	4
P20	Sheny Lin	I do remember I had a professor who believed that people could blow up, I always thought he was really funny. I'm Feelings a little irritated with myself because I don't know more elements on the top of my head. Just frustrated with the game, that's all. I play games a lot but sometimes they're more challenging than other times.	Thoughts	4
P20	Sheny Lin	I do remember I had a professor who believed that people could blow up, I always thought he was really funny. I'm Feelings a little irritated with myself because I don't know more elements on the top of my head. Just frustrated with the game, that's all. I play games a lot but sometimes they're more challenging than other times.	Feelings	4
P20	Sheny Lin	Well, I felt like I was at a traffic jam in the big city and I knew I could go, I could see where I could go, but I couldn't quite make it, just kind of stuck. Reminded me of work when there was a project and I couldn't get myself focused enough to finish it.	Thoughts	6
P24	MP	Driving over here, I had the directions in my mind, of how to get here and I had it planned out, and when I got here I couldn't find what I thought was there, so I was looking for particular words, and I think they would be there and they would not be there that's what it reminds me of is driving and not getting to your destination.	Thoughts	4
P24	MP	It actually reminded me of the kind of dream, you have where you can't ever end anything you keep going and going and going like a road that never ends. A bad situation that never ends.	Thoughts	2

Using these measures, researchers can obtain reliable and accurate insights and trends from qualitative data. This process can be time-consuming and laborious,

but it is crucial to ensure the accuracy and validity of qualitative data. Additionally, different interpretations of the same coding protocols can lead to discrepancies in qualitative coding, so the coding protocols must be established and followed strictly.

Categorizing Protocols

It is important to understand each category's different levels of statements to categorize information. For example, level one and two statements in the information category do not contain personal references. Levels three and four words typically include more general information about self or others. As we move up to higher levels, such as five and six, the statements tend to have more personal details about others and oneself, including physical appearance and behavior.

Information

Level 1: Statements that provide general or routine information only, without any personal reference to others

Level 2: Statements that provide general or routine information only, without any personal reference about self

e.g., "You need at least one month to travel to India.," "Brazil won the soccer game against Ecuador last night."

Level 3: Statements providing general information about others (including family, friends, and acquaintances)

Level 4: Statements providing general information about self

e.g., Age, occupation, description of family members/ self, interests, and hobbies

Level 5: Statements revealing personal information that exposes people close to the speaker, such as descriptions of physical appearance and behavior

Level 6: Statements revealing personal information that exposes self, such as descriptions of physical appearance and behavior

e.g.,Personal characteristics and traits, description of personal experiences, reporting of problematic behaviors of self or family members

Similarly, when it comes to thoughts, we can categorize them into different levels based on the degree of personal reflection. Levels one and two contain no indication of personal thoughts or ideas, while levels three and four reveal some

personal thoughts about others or oneself. Finally, at the higher levels of five and six, we see statements that reveal personal characteristics, physical appearance, health, intimate details, and wishful thinking about others and oneself.

Thoughts

Level 1: No indication of any thoughts or ideas on any subject that refer to others; expressing of general ideas only

Level 2: No indication of any thoughts or ideas on any subject that refer to the speaker personally; expressing of general ideas only

e.g., "I think feeding dogs with human food causes them damage." "I think that people may become dep endent on grass if it's used for medical reasons."

Level 3: Statements expressing the writer's personal thoughts about others on past events or future plans

Level 4: Statements expressing the writer's personal thoughts about self on past events or future plans

e.g., "I think I'd like to study biology when I go to college." "I remember the day my friend's mother died."

Level 5: Statements expressing thoughts relating to the speaker's personal characteristics, physical appearance, health, or intimate and wishful ideas about others

Level 6: Statements expressing thoughts relating to the speaker's personal characteristics, physical appearance, health, or intimate and wishful ideas about self

e.g., "I hate myself for insulting someone and apologizing immediately afterward." "I wish my husband had more courage." "I don't like myself when I hurt people and immediately apologize; it's pathetic."

Lastly, when it comes to feelings, we can categorize them into different levels based on the degree of expression. Levels one and two contain no expression of any feelings, while levels three and four typically express mild feelings. Moving up to levels five and six, we see more specific expressions of feelings about personal characteristics, physical appearance, health, intimate details, and wishful thinking about others and oneself. It is important to note that most statements fell into levels three and four. Examples were provided on the protocol to help us better understand how to categorize the text we analyzed.

Feelings

Level 1: No expressing of feelings at all when speaking about others

Level 2: No expressing of feelings at all when speaking about self

e.g., Writing may include a prosaic description of facts or personal ideas, without expressing any emotions or affective relevance

Level 3: Expressing some mild feelings, such as confusion or inconvenience; expressing ordinary concerns, frustrations, or minor deficiency about others

Level 4: Statements expressing the writer's personal thoughts about self on past events or future plans

e.g., "I think I'd like to study biology when I go to college." "I remember the day my friend's mother died."

Level 5: Statements expressing thoughts relating to the speaker's personal characteristics, physical appearance, health, or intimate and wishful ideas about others

Level 6: Statements expressing thoughts relating to the speaker's personal characteristics, physical appearance, health, or intimate and wishful ideas about self

e.g., "I hate myself for insulting someone and apologizing immediately afterward." "I wish my husband had more courage." "I don't like myself when I hurt people and immediately apologize; it's pathetic."

Challenges for Coders from a Coder's Perspective

Qualitative user research presents several challenges for ensuring the validity and reliability of results due to its subjective nature. One of the key challenges is that different interpretations of the same coding protocols can lead to discrepancies in qualitative coding. This can create confusion and inconsistencies in the results, which can impact the overall quality of the research.

Another challenge is that the coding process can be time-consuming and laborious. For example, in this project, two coders spent several hours reviewing the results of the project mentioned to reach an agreement. This consumes a lot of time and effort and can lead to errors and inaccuracies if the coders aren't careful.

To address these issues, natural language processing can be a helpful solution. It can automate the coding process, making it more efficient and reliable. In this case,

Word Cloud is used to visualize each category and validate the categorization results. This saves time and reduces the chances of errors and inconsistencies in the coding.

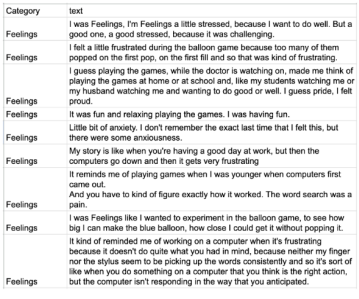
Using Natural Language Processing to Ensure Consistent Categorization

One effective way to improve categorization using Natural Language Processing is through WordCloud visualization. By visualizing each category, we can examine the categorization results and identify areas for improvement.

Despite the challenges, qualitative user research remains an important tool for understanding user needs and preferences. By using the proper techniques and tools, coders can overcome these challenges and produce high-quality research results.

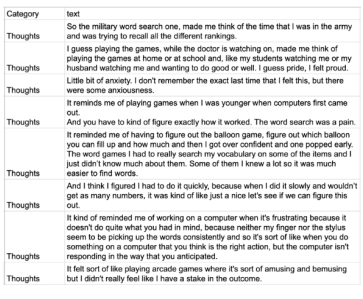
Procedure

To implement this method, we can start by separating the results into three different lists for WordCloud analysis.



Category	text
Feelings	I was Feelings, I'm Feelings a little stressed, because I want to do well. But a good one, a good stressed, because it was challenging.
Feelings	I felt a little frustrated during the balloon game because too many of them popped on the first pop, on the first fill and so that was kind of frustrating.
Feelings	I guess playing the games, while the doctor is watching on, made me think of playing the games at home or at school and, like my students watching me or my husband watching me and wanting to do good or well. I guess pride, I felt proud.
Feelings	It was fun and relaxing playing the games. I was having fun.
Feelings	Little bit of anxiety. I don't remember the exact last time that I felt this, but there were some anxiousness.
Feelings	My story is like when you're having a good day at work, but then the computers go down and then it gets very frustrating
Feelings	It reminds me of playing games when I was younger when computers first came out. And you have to kind of figure exactly how it worked. The word search was a pain.
Feelings	I was Feelings like I wanted to experiment in the balloon game, to see how big I can make the blue balloon, how close I could get it without popping it.
Feelings	It kind of reminded me of working on a computer when it's frustrating because it doesn't do quite what you had in mind, because neither my finger nor the stylus seem to be picking up the words consistently and so it's sort of like when you do something on a computer that you think is the right action, but the computer isn't responding in the way that you anticipated.

Category	text
Information	My story is like a first day on a job. I'm trying to learn all the new task. And to obtain all the knowledge that is needed to complete the task.
Information	My story is like the second day of school. You've talked to a few of your friends the first day and made a couple friends and you feel a little bit more comfortable but you're still not sure about anything yet.
Information	My story is, this is like your first day on a job and your boss is standing over you watching your task.
Information	I enjoyed the puzzle games a lot more, because it was one that was on military stuff and we have a bunch of family in the military so that brought nice memories of those various people, and then the colors was easy but I thought of different, you know, things where color was involved.
Information	I play wordle and spelling bee and yeah like that.
Information	I'm sorry but I think I've run out of stories that relate to these games. I'm not creative enough to come up with stories related to these games. There's not enough to them to really come up with a story.
Information	Well, it reminded me of the time I was randomly playing slot machines and just putting inwhatever amount randomly and then pushing the spin button. It wasn't working out very well so I decidedto change my strategy and put in so many coins at a time and see what happens with that same bet. So,that's what I did. I pushed the balloon five times and I pay out or it popped and I made about a quartereach time, and I came up with about six bucks. I think the first time I did it I came up with about sixbucks too in some sort of random way. So I really don't think it mattered a whole lot the approach that Igave. For the word search game, this time, I went ahead and just tried to find the easy words that I couldand then moved on to the next one. (I'm) pretty good at reading left to right and not bad up and down. It'sthe diagonal ones that really get me still. I kind of feel like my approach became less random and moresystematic as I went along these games. That's my story and I'm sticking to it.
Information	Well, a little while ago my daughter had to have her tonsils and adenoids removed and I wassitting in the waiting room and I was kind of anxious about the procedure. I was pretty relaxed, thought itwould go pretty well but still worried in that situation so I was sitting nervously, wondering howeverything was going, waiting for them to let us know



Category	text
Thoughts	So the military word search one, made me think of the time that I was in the army and was trying to recall all the different rankings.
Thoughts	I guess playing the games, while the doctor is watching on, made me think of playing the games at home or at school and, like my students watching me or my husband watching me and wanting to do good or well. I guess pride, I felt proud.
Thoughts	Little bit of anxiety. I don't remember the exact last time that I felt this, but there were some anxiousness.
Thoughts	It reminds me of playing games when I was younger when computers first came out. And you have to kind of figure exactly how it worked. The word search was a pain.
Thoughts	It reminded me of having to figure out the balloon game, figure out which balloon you can fill up and how much and then I got over confident and one popped early. The word games I had to really search my vocabulary on some of the items and I just didn't know much about them. Some of them I knew a lot so it was much easier to find words.
Thoughts	And I think I figured I had to do it quickly, because when I did it slowly and wouldn't get as many numbers, it was kind of like just a nice let's see if we can figure this out.
Thoughts	It kind of reminded me of working on a computer when it's frustrating because it doesn't do quite what you had in mind, because neither my finger nor the stylus seem to be picking up the words consistently and so it's sort of like when you do something on a computer that you think is the right action, but the computer isn't responding in the way that you anticipated.
Thoughts	It felt sort of like playing arcade games where it's sort of amusing and bemusing but I didn't really feel like I have a stake in the outcome.

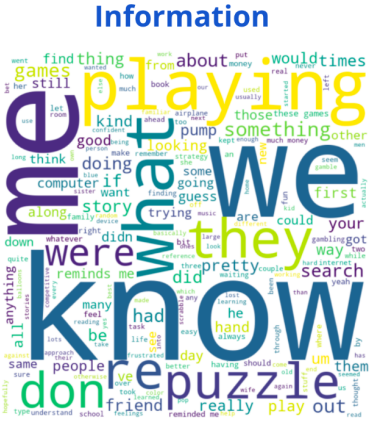
After this, we need to identify stop words based on our understanding of the research. For example, "game" and "balloon" are not typical stop words, but they are listed as stop words because experiment participants frequently talk about a game that includes balloons. These two words appear very often, so listing them as stop words can prevent them from being repeatedly seen in different categories. By taking these steps, we can obtain more detailed and comprehensive results that can be used to refine our categorization process.

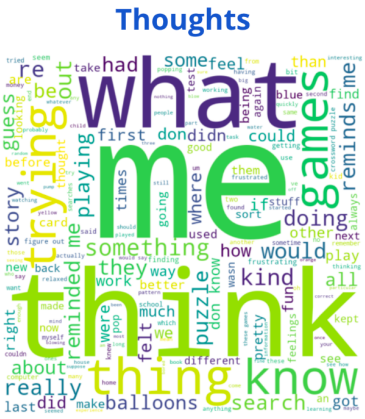
```
# Read the CSV file
csv_file = '/Users/chenghsuanlin/Downloads/Sensitivity Coding - Thoughts.csv'
df = pd.read_csv(csv_file)

# Preprocess the text data (optional)
def preprocess_text(text):
    text = text.lower()
    text = re.sub(r'\W+', ' ', text)
    text = re.sub(r'\s+', ' ', text).strip()
    words = text.split()
    words = [word for word in words if len(word) > 1]  # Filter out single-character words
    return ' '.join(words)

df['text'] = df['text'].apply(preprocess_text)

# Combine all the text into a single string
all_text = ' '.join(df['text'])

# Generate the word cloud
stopwords = set(['it', 'the', 'and', 'that', 'to', 'just', 'you', 'game', "was", "so",
                 "on", "but", "like", "word", "when", "of", "with", "not", "my", "in",
                 "this", "do", "get", "words", "because", "balloon", "have", "more",
                 "time", "is", "one", "or", "for", "there", "as", "at", "up", "go",
                 "well", "then", "little", "very", "can", "lot"])
wordcloud = WordCloud(width=800, height=800, background_color='white', stopwords=stopwords, min_font_size=10).generate(


# Display the word cloud using matplotlib
plt.figure(figsize=(8, 8), facecolor=None)
plt.imshow(wordcloud, interpolation='bilinear')
plt.axis('off')
plt.tight_layout(pad=0)
plt.show()
```

Results and Conclusion

After removing certain words, it became clear that each category has a different word cloud that aligns with the categorizing protocol. In the feelings category, there are words like "felt frustrated," "feelings," "feel frustrating," and "talking about their feelings in general." In the information category, people talk about what they know

and provide a statement or a piece of information. In the thoughts category, people think of something and provide their ideas and thoughts.





Limitations and Future Outlook

The subjective nature of qualitative research can make it challenging to ensure the validity and reliability of the results. The small sample sizes often used in qualitative research can limit the generalizability of the findings. Researchers may struggle to remain objective and avoid bias when analyzing qualitative data. Utilizing natural language processing could be a potential validating method for this kind of research.

In terms of future research, it may be worthwhile to explore the impact of different sample sizes on the results of qualitative research. Additionally, exploring the potential use of different analytical methods, such as sentiment analysis or cluster analysis, could provide further insight into the data. Finally, it may be worth exploring the use of alternative research designs, such as mixed-methods research,

to provide a more comprehensive understanding of the phenomenon being studied.

Reference

Barak A, Gluck-Ofri O. Degree, and reciprocity of self-disclosure in online forums. Cyberpsychol Behav. doi: 10.1089/cpb.2006.9938. PMID: 17594265, Lee, Y. C. Yamashita, N., Huang, Y.

Appendix

Python script and datasets can be found here.