

# CAMI: A Counselor Agent Supporting Motivational Interviewing through State Inference and Topic Exploration

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## Abstract

Conversational counselor agents have become essential tools for addressing the rising demand for scalable and accessible mental health support. This paper introduces CAMI, a novel automated counselor agent grounded in Motivational Interviewing (MI) – a client-centered counseling approach designed to address ambivalence and facilitate behavior change. CAMI employs a novel STAR framework, consisting of client’s state inference, motivation topic exploration, and response generation modules, leveraging large language models (LLMs). These components work together to evoke change talk, aligning with MI principles and improving counseling outcomes for diverse clients. We evaluate CAMI’s performance through both automated and expert evaluations, utilizing simulated clients to assess MI skill competency, client’s state inference accuracy, topic exploration proficiency, and overall counseling success. Results show that CAMI not only outperforms several state-of-the-art methods but also shows more realistic counselor-like behavior. Additionally, our ablation study underscores the critical roles of state inference and topic exploration in achieving this performance.

## 1 Introduction

**Motivation.** Motivational Interviewing (MI) is a client-centered counseling technique aimed at addressing ambivalence and facilitating behavior change in clients, particularly for issues like binge drinking and substance use (Miller and Rollnick, 2002). MI promotes intrinsic motivation and fosters a collaborative relationship between clients and counselors, ultimately improving clients’ commitment to intervention programs (Martins and McNeil, 2009).

Although recent works on LLM-based counselor agents have shown some promising results, we observe at least three limitations with these works.

First, they do not follow the collaborative counseling style in MI. For example, Steenstra et al. (2024) describes MI in a prompt which may not provide LLM adequate guidance to perform a complex multi-turn conversational task such as MI counseling. Second, those works that adopt strategy planning overlook the client’s state and the need to explore a wide range of topics to evoke or motivate change talk from the client (Hsu et al., 2023; Sun et al., 2024b). As a result, they fall short in providing client-centered counseling (Steenstra et al., 2024) and systematic change talk exploration, especially given the inherent preference bias of LLMs (Kang et al., 2024). Finally, the evaluation of counselor behavior in most works focus on comparing the agent generated responses with the predefined “ground truth” responses at the turn level (Xie et al., 2024; Sun et al., 2024b). Such an evaluation approach rules out other possible high quality responses. Meanwhile, human expert evaluation of counselor agents remains costly restricting the scale of study.

**Objective.** To tackle these challenges, we propose counselor agents that incorporate MI psychotherapy skills by adopting three novel ideas. First, we design a state inference module that models the client’s state of mind to provide personalized counseling. This module is inspired by the transtheoretical model of health behavior change (Prochaska and DiClemente, 2005; Prochaska et al., 2008), which defines five stages of change and suggests that the counselor should adjust their goals and strategies according to the client’s current stage. Second, we introduce a topic tree derived from both a real MI counseling dataset and the Wikipedia knowledge base, as well as prompt the agent to systematically conduct the topics of change talk exploration during counseling. With the topic tree, the counselor agent can engage clients with a great variety of topics and focus on effective understanding of client feedback

to evoke or motivate change talk from diverse types of clients. To the best of our knowledge, this is the first attempt to build a topic exploration method for a counselor agent. Third, we design a ranking-based approach for MI strategies guided response generation. Unlike previous approaches, which generate responses based on all selected strategies, we use a ranking approach for generated candidate responses for each selected strategy, effectively mitigating bias in strategy selection. Finally, we develop a comprehensive automated evaluation framework using simulated clients that are carefully designed to exhibit realistic client behaviors. The above ideas have been incorporated into our proposed framework known as the STAR (State, Topic, Action, and Response) framework as shown in Figure 1.

**Contributions.** Our work contributes to the field of counselor agent research as follows: (1) Based on the STAR framework, we develop CAMI, a counselor agent that integrates state inference, topic exploration, and strategy selection modules, all aligned with established psychotherapy skills. (2) Through ablation study, we show that the ability of CAMI to infer client’s state significantly improves its performance in MI-based counseling. (3) Our experiment also shows that topic tree and topic exploration further enhances CAMI’s effectiveness in evoking change talk. (4) Our evaluation, combining both automated methods and human expert assessments, demonstrates that CAMI achieves superior performance, outperforming several strong baseline models.

## 2 Related Work

Developing LLM-based agents to support mental health counseling is an emerging research topic. Steenstra et al. (2024) developed LLM-based agents for addressing the alcohol use behavior only. The counselor agent in DIIR (Xie et al., 2024) uses high-quality counseling sessions in the AnnoMI dataset (Wu et al., 2022, 2023a) to learn a set of strategies in the form of natural language inductive rules. During counseling, DIIR uses the current session context to retrieve the best-matching strategy which prompts LLM to generate the next response. Sun et al. (2024b) proposed Chain-of-Strategy (CoS), a prompting method, to align counselor response generation with MI strategies. CARE (Hsu et al., 2023) determines the specific counseling strategy most suitable for a given

context and provides example responses for peer counselors. However, the above works focus on modeling MI strategies only and overlook the need to model the client’s state and to evoke change talk based on topic(s) that could match the client’s underlying motivation. We thus propose to perform client’s state inference and topic exploration on a topic tree specially constructed for MI counseling.

To compare the performance of counseling agents, the above works rely on evaluation approaches that compare the generated responses against the predefined “ground truth” responses. One such approach computes word overlap or strategy accuracy between the generated and ground truth responses (Xie et al., 2024; Sun et al., 2024b). Another approach requires human judgement comparing the generated responses with the ground truth ones at the turn-level when the counseling agent is given all previous turns following the ground truth session (Steenstra et al., 2024). As these approaches assume a single “ground truth” counseling session, they restrict the possibility of multiple high quality sessions and potentially rate a competent counselor agent poorly only because it generates good responses very different from the “ground truth.” Wang et al. (2024a); Chiu et al. (2024). We thus conduct an extensive evaluation of counselor agents by simulating clients of diverse profiles and behavioral issues interacting with counselor agents. Using these generated sessions, we perform both automated and expert evaluations to assess the performance of CAMI agent and agents based on other state-of-the-art methods.

## 3 The STAR Framework

Our proposed STAR framework consists of four key modules that collaboratively mimic a counselor performing MI counseling, that is: (a) *State Inference* (§3.1), which infers the current client’s state based on the transtheoretical model of health behavior change (Prochaska and DiClemente, 2005; Prochaska et al., 2008). Based on the inferred state, the counselor may perform topic exploration before selecting a response strategy; (b) *Topic Exploration* (§3.2), which explores a wide range of motivation topics in a topic tree to find the topic that may evoke change talk with the client; (c) *Strategy Selection*, also known as *Action Selection* (§3.3), which selects the appropriate strategy or action based on the current client’s state, session context, and identified topic (if any); and (d) *Response Generation*

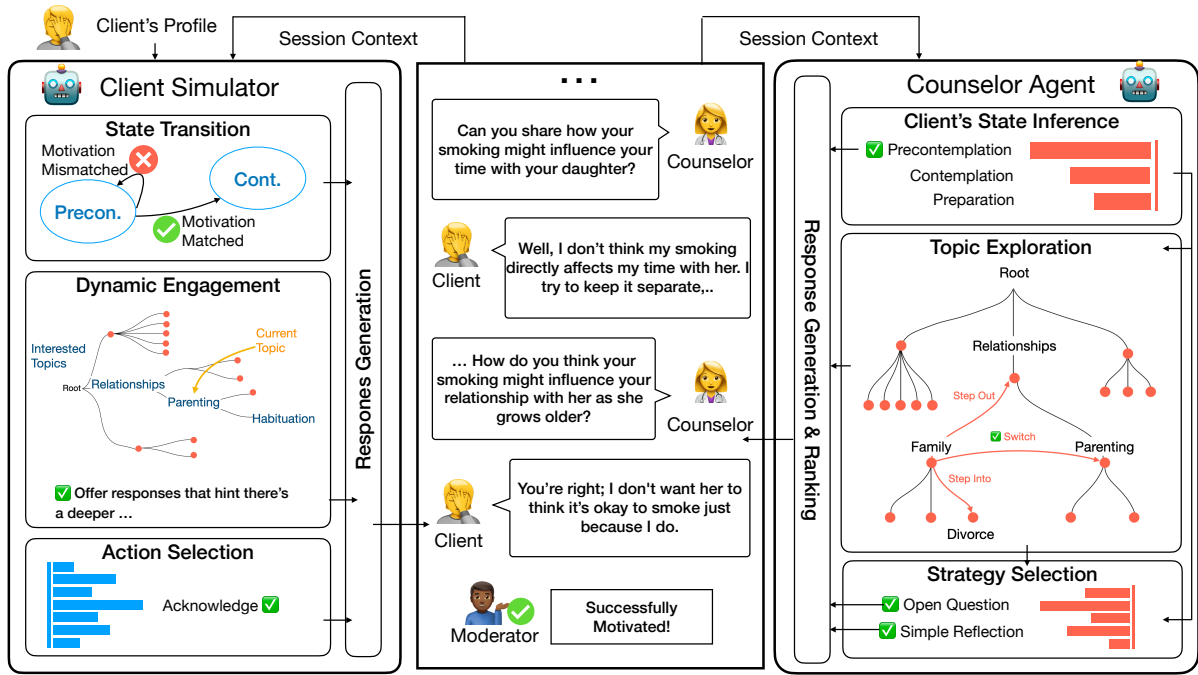


Figure 1: Illustration of STAR framework-based counselor agent interacting with a client simulator. The counselor agent infers the client’s state, identifies topics that prompt change discussions, and employs MI techniques to generate suitable responses. The check mark symbol denotes selected actions, strategies, or states. “Precon.” and “Cont.” denote the Precontemplation and Contemplation states respectively. The client simulator is meticulously designed to ensure consistent client simulations (see Appendix A.3).

& *Ranking* (see §3.4), which generates a few candidate responses based on the selected strategies and selects the most appropriate response that is coherent with the current context and aligned with MI principles. In this study, we assume that the counselor is aware of the client’s behavior problem before any counseling begins.

### 3.1 Client’s State Inference

During MI counseling, a client may be in various mental states as they discuss their behavioral problems with the counselor. For counseling to be effective, the counselor must monitor the client’s state and the current session context before responding (Prochaska et al., 2008). To define the client’s states (Prochaska and Velicer, 1997; Hashemzadeh et al., 2019), we utilize the transtheoretical model of health behavior change (Prochaska and DiClemente, 2005; Prochaska et al., 2008), which defines five possible states: *Precontemplation*, *Contemplation*, *Preparation*, *Action*, and *Maintenance*. In the *Precontemplation* stage, the client may not seriously consider behavior change nor be motivated to seek help. In the *Contemplation* stage, the client is motivated and may weigh the pros and cons of changing their behavior. In the *Preparation*

stage, the client has made a commitment to change. In the *Action* stage, the client actively takes steps to change their behaviors. In the *Maintenance*, the client seeks to avoid any temptation to return to the bad behavior.

The STAR framework is designed for a counselor agent supporting any client from the Precontemplation to Maintenance state. There is however a lack of observed MI sessions covering the Action and Maintenance states. Moreover, MI has been proven to be most useful in guiding a client towards the Preparation state (Hashemzadeh et al., 2019; Miller and Rollnick, 2012). Our current study therefore is confined to the first three states. In the Precontemplation state, the counselor focuses on building trust, establishing change goals, understanding the client’s motivations, and addressing misconceptions before encouraging the client to change. In the Contemplation state, the counselor listens to the client and addresses incorrect beliefs. In the Preparation state, the counselor provides the necessary information and tools to guide the discussion. We also aim to equip the counselor with the ability to engage the client, to collaborate with the client to identify the motivating topic for change, and to soften the client’s preference for the status quo. We

thus prompt LLMs to infer the client’s state based on the session context and state descriptions in a zero-shot manner. Our experiment results in §4.5 show that the state-of-the-art LLMs perform this state inference task with high accuracy.

### 3.2 Topic Exploration

When the client is in the Precontemplation state, the counselor engages the client to develop rapport and cultivate change talk by supporting them in exploring topics that evoke motivation for behavior change. These topics (e.g., smoking causing harm to family members, medication reducing cholesterol) (Cole et al., 2023) are also known as the motivation topics. To our knowledge, topic exploration has not been studied in previous counseling agent research (Hsu et al., 2023; Xie et al., 2024; Sun et al., 2024b) as most methods ignore the importance of change talk exploration.

**Topic Tree Construction.** We propose a three-level topic tree as an external knowledge base for the counselor agent to explore, aiming to evoke change talk for clients facing various behavioral challenges. As shown in Figure 2, the topic tree is structured into superclass topics, coarse-grained topics, and fine-grained topics. For the purpose of topic standardization and enrichment, all topic labels are chosen to match the titles of Wikipedia articles describing the corresponding topics. The construction of the topic tree utilizes topics from both real MI sessions and the capabilities of GPT-4o, following this methodology:

*Step 1: Derive Fine-Grained Topics.* Firstly, we derive a set of fine-grained topics from some MI counseling session corpus. Ideally, the topics should be extracted from a larger corpus to ensure comprehensive coverage. However, due to data limitations, we utilize the available AnnoMI dataset (Wu et al., 2022, 2023a) and identify a small set of 28 fine-grained topics.

*Step 2: Group Coarse-grained and Fine-grained Topics.* Next, we organize the derived fine-grained topics into coarse-grained topics (with corresponding Wikipedia articles) based on Wikipedia’s parent-child category relationships. Similarly, the coarse-grained topics are grouped into superclass topics. Finally, we construct three levels of the topic tree: superclass topics (e.g., *Health* and *Economy*), coarse-grained topics (e.g., *Disease* and *Mental Disorders*), and fine-grained topics (e.g., *Depression* and *Hypertension*).

*Step 3: Expand Topic Tree.* To broaden the range of

topics, we expand the initial topic tree by prompting GPT-4o to generate additional coarse- and fine-grained topics, leveraging its extensive topical knowledge. We choose not to expand the superclass topics as they are already very general. Instead, we prompt GPT-4o to suggest topics under the superclass and coarse-grained topics in a few-shot manner (see Table 17). This step continues until there are no more new topics. Our final topic tree consists of 5 superclass topics, 14 coarse-grained topics, and 59 fine-grained topics, all verified as titles of Wikipedia pages, as shown in Figure 2.

**Topic Navigation.** We guide the counselor agent in navigating topics within the topic tree to initiate change talk in two stages. In the *initial engagement stage*, the counselor agent is provided with the superclass topics and prompted to explore these topics broadly with the client. The counselor agent should infer the client’s interested topic (i.e., the one that evokes change talk) and estimate the probability of each superclass topic being the interested topic in each turn (see the prompt in Table 8). This phase ends after six turns which is similar to the number of turns for initial engagement of client proposed in Park et al. (2019), or when a topic is assigned a probability higher than 40%. The counselor will select the topic with the highest probability as the *current client topic* (or *current topic*).

In the subsequent *focused engagement stage*, when the inferred client topic does not match the client’s actual motivation topic, the counselor agent performs one of the three navigation operations to identify other possible topics in the topic tree: (a) *Step Into*: This operation explores a sub-topic (either coarse-grained or fine-grained) of the current topic when the client provides some positive feedback, indicating a desire for a deeper discussion. The counselor agent is prompted to select the next topic from all sub-topics based on the current context and exploration path; (b) *Switch*: This operation allows the counselor to switch to another topic at the same level (i.e., sharing the same parent topic as the current topic) when the client shows limited engagement with the current topic but expresses interest in the parent topic. Similar to Step Into, the counselor agent is prompted to select the next topic from all candidate topics; and (c) *Step Out*: This operation involves revisiting the parent topic when the client does not wish to continue discussing the current topic or the parent topic. This occurs when the counselor has navigated to the wrong sub-tree.



The prompt for selecting the navigation operations is shown in Table 9. All the above navigation operations are facilitated by prompting as shown in Appendix A.2. An example of topic exploration is also shown in Appendix D.

### 3.3 Strategy Selection

Previous research has shown the importance of strategy selection in effective AI-based counseling (Kang et al., 2024; Xie et al., 2024; Hsu et al., 2023; Sun et al., 2024b). In our STAR framework, the Strategy Selection module selects strategies from MI Skill Code (MISC) (Miller et al., 2003) to guide LLMs in demonstrating MI skills, thereby aligning the LLMs with strategies that offer controllability and explainability. Inspired by Sun et al. (2024b), we employ a zero-shot prompt provided with the definitions of various MI strategies (Miller et al., 2003; Miller and Rollnick, 2012) along with the inferred client’s state to select appropriate MI strategies.

In contrast to previous research (Sun et al., 2024b; Xie et al., 2024), which selects only one most suitable strategy, our approach permits the strategy selection module to select multiple strategies, which better aligns with real-world scenarios (Wu et al., 2022; Sun et al., 2024a). (see Table 13). However, we limit the number of selected strategies to two so as to avoid an excessive number of strategies (e.g., more than five) in one generated counselor response. This limit is set at two, consistent with our observations in the AnnoMI (Wu et al., 2022, 2023a) dataset.

### 3.4 Response Generation & Ranking

Finally, the response generation module generates the counselor’s response in the next turn using a *turn-by-turn* generation approach. Specifically, we construct for the counselor agent an instruction prompt that includes the client’s behavioral issue, the goal to achieve, the session context, and a turn-level instruction. The turn-level instruction further includes a description of the inferred client state, the current client topic, and the selected strategy(ies) (see Table 15).

When two strategies are selected, we follow the approach in Hsu et al. (2023), which generates an response for each single strategy as well as for the concatenated selected strategies. After generating the three candidate responses, we prompt the LLM to assume these candidate responses are from other counsellors, to rank them by coherence with the

current session context, and to select the most coherence one (see Table 16).

## 4 Experiments

### 4.1 Experiment Setup

Extending the experiment setup used in previous works (Tu et al., 2024; Chiu et al., 2024; Yosef et al., 2024; Wu et al., 2023b), we implement three specialized LLM-based agents, namely, *client*, *counselor*, and *moderator* agents. Their respective prompts can be found in the Appendix A.

The counselor agent is role-played using some counselor agent methods. Other than CAMI, we include other baseline methods described in §4.2. The client agent is also simulated using different input profiles. To ensure the client’s behavior is realistic and consistent with real users, we develop the client agent to maintain its state and generate responses consistent with its state, profile, and current session context using multiple modules instead of a simple prompt used in previous works (Chiu et al., 2024; Yosef et al., 2024; Wu et al., 2023b). The detailed client simulation design is given in Appendix A.3. The moderator oversees the conversation session between the counselor and client agents, and decides to end the session when: 1) the counselor or client proactively concludes the session, 2) the client becomes motivated to change, or 3) the session reaches the maximum of 50 turns (which is similar what we observed in real world sessions, e.g., AnnoMI).

We employ gpt-4o-2024-08-06 LLM backbone for both the client and the moderator. For counselor, we experiment with both gpt-4o-2024-08-06 and Llama-3.1-70B LLM backbones. The session simulation begins with the counselor’s response: “Hello. How are you?” The client then responds with “I am good. What about you?” Based on the session history, the counselor continues to generate the next response. This process repeats until the moderator decides to end the session.

### 4.2 Baseline Counselor Simulation Methods

We compare our counselor agent method with four state-of-the-art LLM-based counselor agent methods, including: 1) **Base**: Following Steenstra et al. (2024), the Base counselor agent incorporates only a system prompt that includes the task description and knowledge about MI techniques. 2) *Dialogue Strategy Learning via Inductive Reasoning* (**DIIR**)

(see § 2) To prevent data leakage, we use other sessions in AnnoMI (Wu et al., 2022, 2023a) not involving clients used in the test set as demonstrations. 3) *Chain of Strategy (CoS)*: Following Sun et al. (2024b), the CoS (Chain-of-Strategy) counselor agent uses a chain of modules to generate responses after strategy selection. Since the original CoS prompt is not available, we implement it as an ablated version of CAMI without state inference and topic exploration. 4) *CAMI without Topic Exploration (CAMI-TE)* To evaluate the effectiveness of topic exploration, we introduce CAMI-TE, which is the ablated version of CAMI without the topic exploration module.

We use the high-quality subset of the AnnoMI dataset (Wu et al., 2022, 2023a) and manually annotate 38 client profiles whose sessions contain sufficient information and were successfully motivated by human counselors. These clients cover a good diverse set of motivation topics and interests. To obtain more reliable results, each counselor simulation method generates five sessions for each client profile. We therefore have 190 ( $= 38 \times 5$ ) generated sessions for each method. For the automated evaluation that follows, we average the results for the 5 sessions generated for each client profile before averaging over all the 38 client profiles to derive the results of each counselor simulation method.

### 4.3 MI Competency

The Motivational Interviewing Treatment Integrity (MITI) (Moyers et al., 2016) and Motivational Interviewing Skill Code (MISC) (Miller et al., 2003) are commonly used to evaluate the competency of MI counselors.

**MITI Behavior Scores.** Following Xie et al. (2024), we employ a fine-tuned classifier on crowd-sourced dataset (Welivita and Pu, 2022) to retrieve the five most possible behavior labels, followed by GPT-4o deciding the final label out of the five. The detailed implementation can be found in Appendix A.5. We report the following behavior-counts: 1) *Reflection Question Ratio (R/Q)*, defined by the number of reflections by the counselor agent divided by the number of questions asked by the counselor; 2) *Proportion of Open Questions (%OQ)*, defined by the number of open questions asked by counselor divided by the number of questions (including both open and closed questions); 3) *Proportion of Complex Reflections (%CR)*, defined by the number of paraphrase and summary reflections divided by the total number of reflections;

	R/Q↑	%OQ↑	%CR↑	%MIC↑	%TTT↓
Expert	>2.0	>70%	>50%	>90%	<50%
Prof.	>1.0	>50%	>40%	>80%	<60%
HQ	1.28	52.1% <sup>p</sup>	51.4% <sup>e</sup>	82.4% <sup>p</sup>	53.4% <sup>p</sup>
LQ	0.34	16.2%	14.22%	40.5%	59.6% <sup>p</sup>
GPT-4o Based Counselor					
Base	0.18	92.3% <sup>e</sup>	37.6%	85.0% <sup>p</sup>	42.7% <sup>e</sup>
DIIR	0.42	98.9% <sup>e</sup>	<b>82.4%<sup>e</sup></b>	89.1% <sup>p</sup>	54.9% <sup>p</sup>
CoS	0.29	96.5% <sup>e</sup>	49.1% <sup>p</sup>	94.5% <sup>e</sup>	38.3% <sup>e</sup>
C*-TE	0.37	97.2% <sup>e</sup>	51.1% <sup>e</sup>	94.7% <sup>e</sup>	36.1% <sup>e</sup>
CAMI	<b>0.56</b>	<b>99.0%<sup>e</sup></b>	57.3% <sup>e</sup>	<b>96.6%<sup>e</sup></b>	<b>34.8%<sup>e</sup></b>
Llama-3.1 70B Based Counselor					
Base	0.34	34.3%	13.1%	55.4%	47.9% <sup>e</sup>
DIIR	0.97	76.8% <sup>p</sup>	<b>71.5%<sup>e</sup></b>	85.4% <sup>p</sup>	45.0% <sup>e</sup>
CoS	0.77	75.2% <sup>p</sup>	58.9% <sup>e</sup>	87.1% <sup>p</sup>	43.9% <sup>e</sup>
C*-TE	0.89	76.6% <sup>p</sup>	61.2% <sup>e</sup>	88.9% <sup>p</sup>	40.4% <sup>e</sup>
CAMI	<b>1.11<sup>p</sup></b>	<b>83.7%<sup>e</sup></b>	60.5% <sup>e</sup>	<b>90.7%<sup>e</sup></b>	<b>38.4%<sup>e</sup></b>

Table 1: MI behavior count-based evaluation results. “Prof.” and “C\*-TE” denote Proficiency and CAMI-TE respectively. CAMI outperforms other baselines in most metrics, except for the percentage of complex reflections. Although DIIR shows a high percentage of complex reflections, it may overuse them, which is also a concern (Steenstra et al., 2024). All models perform poorly on the R/Q metric, indicating a significant preference for questions over reflections. The values with <sup>e</sup> and <sup>p</sup> superscripts meet the thresholds for “Expert” and “Proficiency” levels respectively. HQ and LQ represent the performance of human counselors in high- and low-quality AnnoMI sessions respectively.

tions; 4) *Proportion of MI-Consistent Responses (%MIC)*, defined by the number of MI-consistent responses divided by the sum of MI-consistent and MI-inconsistent responses; and 5) *Percent Therapist Talk Time (%TTT)*, defined by the number of minutes the counselor spoke divided by the total talk time (counselor and client combined). Word count is used to approximate talk time instead. Other than %TTT, higher values are preferred for the remaining counts.

**MITI Global Scores.** We also report four MITI global scores, assigned on a 5-point Likert scale for each counseling session, including: 1) *Cultivating Change Talk*, which measures the extent to which the counselor actively encourages the client’s language in support of the change goal and their confidence in making that change; 2) *Softening Sustain Talk*, which measures the extent to which the counselor avoids focusing on reasons against change or for maintaining the status quo; 3) *Partnership*, which measures the extent to which the counselor conveys an understanding that expertise

	Cultivate↑	Soften↑	Partner↑	Empathy↑
HQ	2.85	2.88	2.97	3.49
LQ	2.43	2.47	2.26	2.45
GPT-4o Based Counselor				
Base	2.33	2.70	2.15	3.04
DIIR	2.21	2.64	2.37	3.10
CoS	2.40	2.71	2.33	3.23
CAMI-TE	2.43	2.78	2.37	3.28
CAMI	<b>2.62</b>	<b>2.86</b>	<b>2.58</b>	<b>3.37</b>
Llama-3.1 70B Based Counselor				
Base	2.10	2.34	2.08	2.57
DIIR	2.13	2.57	2.28	2.87
CoS	2.14	2.61	2.13	3.07
CAMI-TE	2.20	2.64	2.23	3.12
CAMI	<b>2.38</b>	<b>2.78</b>	<b>2.37</b>	<b>3.33</b>

Table 2: Results of the MI global score evaluation. Our method outperforms others in all four scores. Note that “Cultivate”, “Soften” and “Partner” are abbreviations for Cultivating Change Talk, Softening Sustain Talk, and Partnership respectively.

and wisdom about change primarily reside within the client; and 4) *Empathy*, which measures the extent to which the counselor attempts to understand the client’s perspective and experience, essentially trying to “try on” what the client feels or thinks. The higher the above scores, the better is the counselor. The global score prediction task is designed to take the entire session transcript as input and predict a single value (1 to 5) for one of the four global scores. We employ GPT-4o with the prompt from previous work (Cohen et al., 2024).

As shown in Tables 1 and 2, CAMI outperforms the baselines in most MI competency metrics. This suggests that CAMI is capable of selecting MI-adherent strategies during counseling. While DIIR outperforms our method in %CR, the very high %CR of DIIR (82.4%) may indicate overuse of complex reflection (Steenstra et al., 2024). On the other hand, all counselor agents perform poorly on R/Q, indicating a preference for using questions instead of reflection (especially open questions, as indicated by the high %OQ). Upon manual inspection of the generated conversations, we found that almost every counselor’s response involved raising questions to continue the session, which differs from the human counselors in the HQ sessions.

#### 4.4 Success Rate and Exploration Focus

**Success rate.** Successful change talk is the main goal of MI. We therefore introduce *success rate* defined by the proportion of clients with whom the counselor agent successfully evokes change talk, re-

	HE (105)	EC (30)	RE (40)	LA (5)	ED (10)	Overall (190)
GPT-4o Based Counselor						
Base	47.6	0.0	25.0	0.0	0.0	31.5
DIIR	52.4	0.0	27.5	0.0	0.0	34.7
CoS	54.3	0.0	32.5	0.0	20.0	37.9
CAMI-TE	54.3	0.0	32.5	0.0	30.0	38.4
CAMI	<b>57.1</b>	<b>23.3</b>	<b>70.0</b>	<b>40.0</b>	<b>40.0</b>	<b>53.1</b>
Llama-3.1 70B Based Counselor						
Base	48.6	6.7	12.5	0.0	0.0	30.5
DIIR	57.4	10.0	10.0	0.0	0.0	35.2
CoS	60.0	26.6	22.5	0.0	0.0	42.1
CAMI-TE	60.0	30.0	22.5	0.0	0.0	42.6
CAMI	<b>61.9</b>	<b>36.7</b>	<b>45.0</b>	<b>40.0</b>	<b>20.0</b>	<b>51.1</b>

Table 3: Success rate of counselor agents for clients with different superclasses of motivation topics (HE: Health, EC: Economy, RE: Relationship, LA: Law, ED: Education). The number of clients with motivation topics covered by each superclass is shown in parentheses. CAMI achieves highest overall success rate, and is able to cope well in all superclass topics including the less popular ones.

sulting in increased motivation to change at the end of session. Since successful evocation of change talk occurs when the counselor and client collaboratively identify the underlying motivational topics, we also evaluate success rates for each superclass topic. As shown in Table 3, CAMI demonstrates the highest success rate in all five superclass topics, achieving the best overall performance. In contrast, counselor agents without topic exploration (i.e., Base, DIIR, CoS and CAMI-TE) tend to focus on only a few topics, such as Health and Relationships, and often fail to explore the less common topics (e.g., Law, Education, and Economy).

**Exploration focus.** To further demonstrate the impact of topic exploration, we use GPT-4o to assess how close are the topics explored in counselor’s responses from the client’s fine-grained motivation topic as counselor agents using baseline methods could not explore topics. We thus prompt GPT-4o to take a counselor’s response and client’s fine-grained topic as input, determine the topic embedded in the former, and return the exploration focus metric. Exploration focus (FOC) is a number from 0 (exact match between the topic embedded in counselor’s response and client’s topic at the fine-grained level) to 3 (the topic embedded in counselor’s response does not match the superclass, coarse-grained and fine-grained topics of the client). As shown in Table 4, CAMI excels at exploration focus which gives it the edge to evoke



	Base	DIIR	CoS	CAMI-TE	CAMI
GPT-4o	2.62	2.59	2.64	2.60	<b>2.37</b>
Llama-3.1 70B	2.81	2.72	2.77	2.74	<b>2.44</b>

Table 4: Exploration Focus Results ( $\downarrow$ ).

change talk.

As CAMI can reveal its explored topics, we also evaluate how well the client agent can correctly decipher the topic embedded in the counselor’s response. Our results show that the client is quite accurate in determining the correct explored topic 74.92% and 70.14% of the time with CAMI using GPT-4o and Llama-3.1 70B respectively.

#### 4.5 State Inference Accuracy

We evaluate the accuracy of inferring client’s state by the state inference module of the CAMI counselor agent. Since CAMI-TE shares the same state inference module, it shares the same state inference accuracy as CAMI. We could not perform the same evaluation on the other baseline methods as they are not equipped with the state inference module. Our experiments show that CAMI using GPT-4o and Llama-3.1 70B infer the correct client state most of the time at 93.32% and 88.56% respectively. This high accuracy thus allows CAMI to generate more client-centered responses, increasing the effectiveness of MI counseling.

#### 4.6 Expert Evaluation

In addition to automatic evaluation, we also involve three co-authors (two with strong counseling credential and expertise and another is a social science student with rich experience in peer support and counseling) to assess the overall performance of CoS and CAMI. Each assessor is to rate the simulated counselor interacting with clients simulated by five client profiles randomly selected from AnnoMI such that both the high and low quality sessions for these clients exist in AnnoMI. The sessions are then evaluated by MITI Ratings, Change Talk Exploration, Success in Eliciting Change Talk, and Realism of both Counselor and Client.<sup>1</sup>

As shown in Table 5, other than the counselors in HQ sessions, CAMI yields the best results across all the metrics, significantly outperforming the CoS counselor ( $p$ -value  $< 0.005$ ). The counselors in LQ sessions unsurprisingly perform the worst. Although CAMI performs better than other LLM-

		HQ	LQ	CoS	CAMI
MITI Global Ratings	Cultivating ...	4.06	1.68	2.74	<b>3.68</b>
	Softening ...	3.90	1.74	2.74	<b>3.32</b>
	Partnership	4.26	1.46	3.60	<b>3.90</b>
	Empathy	4.26	1.38	3.72	<b>4.00</b>
Change Talk Exploration		4.18	1.58	3.00	<b>3.94</b>
Evoking Change Talk		2.68	1.20	1.80	<b>2.40</b>
Realism of Counselor		4.68	2.32	3.06	<b>3.60</b>
Realism of Client		4.68	4.00	4.00	<b>4.32</b>

Table 5: Results of expert evaluation. “Cultivating ...” and “Softening ...” are abbreviations for “Cultivating Change Talk” and “Softening Sustain Talk” respectively. CAMI outperforms CoS and LQ counselors but a gap still exists between CAMI and HQ counselors. Note that the maximum score of “Evoking Change Talk” is 3, while that of other criteria is 5.

based counselor agent, there is still room for improvement compared to high-quality human counselors. Experts also provided feedback regarding CAMI’s performance, noting some behaviors that are not recommended, such as overusing questions and consistently reflecting on the positive aspects of the client’s problematic behavior, indicating areas for future improvement.

## 5 Conclusion

In this paper, we address the challenges of using LLMs to create counselor agents that practice motivational interviewing style counseling using our proposed STAR framework. This framework includes client’s state inference, topic exploration for change talk, and MI-adherent strategy selection. Based on the framework, we develop CAMI a counselor agent that engages clients in change talks making positive changes to their behaviors. By extracting motivation topics and their superclass relationships from AnnoMI dataset and Wikipedia knowledge base, we construct a novel topic tree covering hierarchical motivation topics that can be navigated by CAMI as it explores the topics of change talk for clients having diverse profiles. Furthermore, CAMI selects strategies from MI skills to generate strategy-aligned responses. Extensive experiments and analyses, including automated and expert user evaluations, show that the STAR framework underlying CAMI effectively guides LLMs to adhere to MI techniques. CAMI also outperforms state-of-the-art counseling agents in our comprehensive evaluation, reducing the gap between human and AI-based counseling.

<sup>1</sup>Detailed instructions are given in Appendix C.



## Limitations

Although CAMI shows promising results in MI-based counseling, we could identify three main limitations which can be addressed in the future work.

As a critical component of our framework, the topic tree and navigating it for topics that motivate behavior change significantly improve the counselor's ability. Nevertheless, this component is not part of MI principles and an expert MI counselor is more likely to rely on his/her experience to spontaneously suggest topics to explore with the clients. It will be interesting to extend our work to study how topics are selected by experienced counselors for future alignment of our topic exploration component. Such a study will be highly novel and is likely to benefit counseling techniques beyond MI. In our current work, we have chosen a practical yet data-grounded approach, i.e., determining the topics mentioned in the MI dataset, specifically AnnoMI, and expanding the topics structure based on a high-quality knowledge base, i.e., Wikipedia. We acknowledge that the data-driven topic tree construction is suboptimal but remains to be highly useful as the first attempt to extract topics from real-world data and knowledge base. As more real-world data and larger knowledge base become available, the topic tree can be further expanded covering more diverse motivation topics and their taxonomic structures. The STAR framework can also easily accommodate an external pre-defined topic structure without modifying the logic of its modules.

Secondly, our framework currently relies on LLM prompting to perform state inference, topic exploration and strategy selection. Our expert evaluators have raised concerns about issues related to strategy use, such as counselor responses being too lengthy and using too many questions. In our future work, we would therefore plan to enhance the strategy selection module to incorporate the idea of action rules introduced in DIIR.

Finally, while our study focuses on MI-based counseling only, the proposed STAR framework can be adapted to other counseling techniques, such as Cognitive Behavioral Therapy (CBT). Future research could explore the integration of MI, CBT and other psychotherapy techniques within a single counselor agent, potentially enhancing the counseling effectiveness.

## Ethical Considerations

This work does not advocate for the direct use of LLMs in therapy. Although our proposed CAMI system outperforms previous methods and demonstrates proficiency in MI techniques, it may still fall short of the counseling quality provided by expert counselors. Instead of advocating CAMI replacing the human counselors, CAMI may currently serve as a counseling tool to support human counselors. Our long term goal is to provide an alternative approach for applying LLMs in psychological support, improving the capabilities of counseling agents, offering ideas that may spin off further research and development in mental health counseling and AI research in psychotherapy. Moreover, while MI techniques aim to facilitate positive change, system implementers should be careful in assessing potential risks and mitigating them. Additionally, users interacting with systems incorporating MI techniques should be informed of the system's identity, ensuring that they are aware of the nature of their interaction with the systems and make informed choices.

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## A Detailed Implementation

In this section, we provide the detailed implementation of our method and experiment evaluation,

which includes the prompts and instructions for human evaluation. We set the top-p and temperature of to 0.7 and 0.8 for LLMs. For GPT-based models, we utilize the official API. For other open-source models, we execute on a server equipped with eight NVIDIA A100 Tensor Core GPUs via the VLLM serving framework (Kwon et al., 2023).

Our annotation team comprises three experts who are co-authors of this paper. Two of them hold postgraduate degrees in counseling and one is a senior-year university student pursuing a psychology major. They all have relevant experience in mental health counseling.

### A.1 Dataset and Annotation

We utilize the AnnoMI dataset (Wu et al., 2022), which comprises 133 conversations spanning a diverse range of behavior topics, including “reducing alcohol consumption” and “smoking cessation.” Each conversation was transcribed from an expert-generated demonstration video and subsequently labeled as demonstrating high- or low-quality MI based on the video title and description. The 110 dialogues illustrating high-quality MI, comprising over 8,800 utterances in total, are considered as candidates. Consequently, we eliminate the sessions that are incomplete and those involving clients with insufficient profile information. To be noticed, the AnnoMI dataset is compiled from YouTube videos depicting MI counseling sessions between actors. However, it remains widely utilized due to restricted access to real counseling sessions. Given the absence of ideal datasets, our framework offers a solution to the scarcity of data by simulating clients interacting with counselors, thus bypassing ethical and privacy issues. Additionally, the primary use of the AnnoMI dataset is to extract client profiles and corresponding counseling sessions for evaluation purposes. Although these sessions are not “real”, they are still consistent with the client profiles and serve as valuable evaluation dataset.

We utilize a high-quality subset of the AnnoMI dataset and manually annotate 38 client profiles whose sessions contain sufficient information and were successfully motivated by human counselors. Our annotators annotate various aspects of the client in a given session, including behavioral issues, receptivity, personas, beliefs, motivations, and acceptable plans. This comprehensive description provides a detailed understanding of the client. The profiles are well-estimated by at least two human annotators to ensure consensus. An example

of such a profile is presented in Table 6.

## A.2 Counselor Agent Implementation

The prompts for counselor simulation are shown in Table 7 to Table 16. Table 17 shows the prompt used to expand the topics and Figure 2 shows all the collected topics. Table 18 to Table 28 demonstrate the descriptions used in counselor agent.

## A.3 Client Agent Implementation

Unlike previous works that predominantly simulate simple client personas (Yosef et al., 2024; Wu et al., 2023b) or use examples (Chiu et al., 2024) in LLM prompts, we partially adapt the STAR framework to simulate a client with a few modules that model state transition, dynamic engagement, action selection, and response generation separately. An input *client’s profile* includes the client’s behavioral problem, state of mind, persona, motivation, beliefs, and interests. As the counseling session progresses, the session context (utterance history) is also provided to the client simulator.

During a conversation session, a client is guided through different states to identify changes that can address their behavioral problem. Aligned with the counselor’s setting, we also utilize the three states defined in transtheoretical model of health behavior change (Prochaska and DiClemente, 2005; Prochaska et al., 2008). The goal of the state transition module is to maintain consistency with how the client may change states during MI counseling, as well as the client’s profile. As our work aims to assess the counselor’s effectiveness in motivating the client through topic exploration, we focus on the transition between first two states. In the Precontemplation state, the counselor focuses on building trust, establishing change goals, understanding the client’s motivations, and addressing misconceptions before evoking a desire to change. The client is expected to enter the Contemplation state only when motivated by specific reason(s) introduced by the counselor. The state transition module thus ensures consistency by analyzing the counselor’s utterances to identify mentions of the client’s motivations. If such a mention is found, the client agent is allowed to change to Contemplation state; otherwise, its state remains unchanged.

Each client has specific interests. For example, a parent may be interested in parenting, while a teenager student may be interested in education and friendship. During the engaging stage of MI counseling, the client demonstrates dynamic engage-

ment with topics raised by the counselor, which provides a signal to guide the session. To realistically simulate this behavior, we incorporate a dynamic engagement module. In the client’s profile, we designate the fine grained topic related to motivation as the ground truth topic. The distance between the current topic and the ground truth topic is used to instruct the client in providing various types of feedback. However, since our topic tree consists of a limited number of topics, the counselor may raise topics that are not covered by the topic tree. To flexibly estimate the distance between topics, we define three topic levels along the path in the topic tree and design four levels of distance, ranging from most distant (not the same super-class topic) to closest (the same fine-grained topic). Based on each level of distance, the client demonstrates different dynamic engagement levels.

Previous works focus on persona but ignore diverse dialogue actions. Moreover, LLMs like ChatGPT are aligned to generate friendly responses (Shen et al., 2023; Köpf et al., 2024). Clients simulated by simple LLM prompting often display overly compliant behavior or a narrow set of actions compared to real human clients (Kang et al., 2024). To address this challenge, we incorporate an action selection module that uses session context and the client’s receptivity (as provided in the profile) to determine appropriate actions. The action candidates encompass resistive actions, as described in Table 34, such as Deny and Downplay, which would elicit negative client behavior when instructed to execute these actions. We derive a receptivity-aware action distribution from real data as a prior distribution and employ a sampling strategy that considers both the current context and the client’s receptivity. The sampling strategy prevents the LLM from selecting biased positive or optimistic actions. Additionally, the receptivity-aware action distribution contributes to the strategy should be aligned with the client’s receptivity, making it more realistic. Finally, the response generation module takes the state, engagement level, and action as input to generate the response. Based on this strategy, the client can exhibit realistic behaviors without being overly compliant.

The prompt used for client simulation are shown in Table 29, Table 30 and Table 32. The Table 33, Table 34 and Table 35 are the descriptions used in client simulation.

We evaluate our framework-based client simulation method against two state-of-the-art LLM-



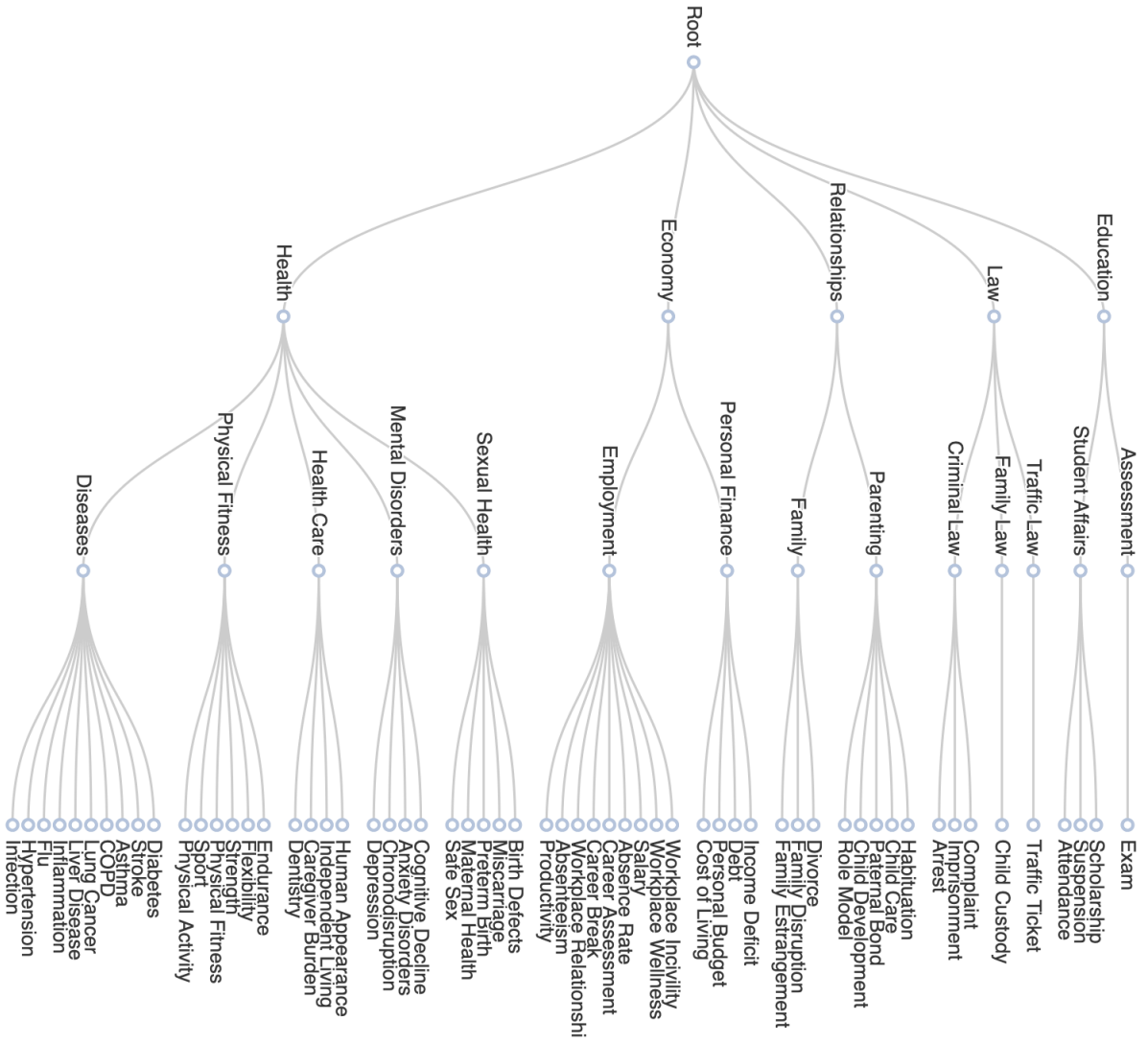


Figure 2: The topics tree constructed in our work consists of 5 Super-Class topics (i.e., *Health*, *Economy*, *Relationship*, *Law*, and *Education*), 14 Coarse-Grained Topics, and 59 Fine-Grained Topics.

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Behavioral Problem: Drinking

Receptivity: 3

Personas:

- The client sneaked out with a friend to the park to has a couple of beers. During this incident, a police officer came by, but he managed to avoid getting into trouble as he threw the beers away before the policy saw them.
- If the client’s mother found out he was in trouble because of his drinking, she would kill the client.
- The client has an interest in soccer and have set a goal to play in college.
- The client has aspirations of receiving scholarships to support his soccer career.

Motivation:

- The client is motivated because alcohol would affect the client playing sports.

Beliefs:

- The client can handle the dangerous situation to avoid getting into trouble.
- The client believes that he doesn’t have a problem with alcohol because he has only drunk once or twice.
- The client believes that drinking is normal because a couple of the client’s friends drink too.

Acceptable Plans: None

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Table 6: The extracted profile of the real conversation.

based client simulation methods, namely: (a) **Profile-based Method** which prompts the LLM to simulate the client based on the given client profile (Yosef et al., 2024; Wang et al., 2024b) ; and (d) **Pro+Act-based Method** which provides both the client profile and the description of all actions in a LLM prompt to generate the next utterance (Zhang et al., 2024). To obtain more reliable results, each method generates three sessions for each client profile of AnnoMI. We then average the profile-specific metric results for the three sessions/client before deriving the average across all the client profiles.

We also introduce expert judgment of whether the simulated clients are similar to human clients. We assess the consistency and realism of the simulated clients by experts. We employ four of our co-authors, who are experts in psychology and experienced in MI counseling, as annotators. Their background enables them to comprehend and annotate typical client behaviors. We randomly select six clients and corresponding real sessions from AnnoMI, then employ Profile-Based, Pro+Act-Based, and our methods to simulate the client’s interaction with the counselor agent to generate sessions. For each generated session, we assign three experts to annotate the consistency of profile components, including persona, beliefs, motivation, and plan, compared to the given profile. Each score ranges from 1 (low consistency) to 5 (high consistency). Finally, we collect a total of 288 annotation scores,

derived from 6 clients  $\times$  (sessions generated using 3 methods + 1 observed session)  $\times$  3 annotators  $\times$  4 components. As shown in Table 36, the results demonstrate that our method outperforms the baselines. However, there is still a gap between the simulated client and the real client, indicating the potential for future improvement. Furthermore, we instruct the experts to assess the realism of client behavior. The experts are tasked with comparing the client’s behavior during the given session with the behavior of actual human client in the real world. We employ the same sessions in consistency evaluation for realism evaluation, which consists of 6 clients and 4 sessions per client. We randomly assign three experts to annotate the realism of client for each session, resulting in a total of 72 annotation scores. The annotation schema employs a five-point Likert scale, ranging from 1 (low realism) to 5 (high realism). The final results are presented in Table 36. Our simulated clients exhibit significantly superior performance compared to other baselines. Based on the annotation, the primary disadvantage of other baselines is that clients exhibit excessively compromised behaviors, which are unrealistic in the real world.

We further substantiate our claim that our method can adjust behaviors in accordance with receptivity. To achieve this, we have developed a framework for expert evaluation of receptivity consistency. We randomly select four clients (and their profile components) and generate for each client

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During the Motivational Interviewing counseling conversation, the client may exhibit different states that refer to their readiness to change. The client's state can be one of the following:

- Precontemplation: The client does not recognize their behavior as problematic and is not considering change.
- Contemplation: The client acknowledges the problematic nature of their behavior but is ambivalent about change.
- Preparation: The client is ready to take action and is considering steps towards change.

Given the current counseling context, analyze the context step by step and then infer the current state of the client. If the context does not clearly indicate the state, it is assumed to be in the Precontemplation state. Your response should be ended with "Therefore, the client's current state in the above context is ..."

Given Current Context:  
[context]

Analyze then Predict State:

---

Table 7: Prompt for the counselor agent to infer the state of client. The [context] will be replaced by the conversation so far.

three counseling sessions covering low receptivity score (1), middle receptivity score (3), and high receptivity score (5). We eliminate the Profile-based method, as the first round evaluations demonstrate its performance with high receptivity regardless of the given receptivity in the profile. For each session, we randomly assign two experts to annotate the receptivity level of the client in the given session. To facilitate the expert's annotation and enhance agreement between expert and annotated scores, we simplify the scoring system from five points to three points, categorizing it as low (1), middle (3), and high (5). Finally, we obtain a total of 48 annotation scores (4 clients  $\times$  3 receptivity levels  $\times$  2 methods  $\times$  two annotators). Subsequently, we present the average annotated receptivity score and the Spearman correlation between annotated receptivity scores and the ground truth receptivity scores.

As shown in Table 37, the sessions generated by our framework achieve the receptivity closer to the assigned one. Almost all sessions generated by the Pro+Act method are annotated as high receptivity, suggesting that the baselines are excessively compliant, disregarding the given receptivity. The receptivity of sessions generated by our framework is highly correlated with the assigned receptivity, indicating the effectiveness of our receptivity control mechanism. However, the average receptivity of our highly receptive client is not sufficiently high, which may be attributed to the imposition of

a stringent motivation condition. Only when the counselor touches the inherent motivation of the client will the client be motivated. Consequently, the client may consistently remain in the Precontemplation state, particularly when the counselor lacks the requisite skills.

To intuitively illustrate how the state transition control, dynamic engagement, and sample-based action selection in our client simulation framework can address the overly compliant issue, we present examples in Table 38. In this scenario, the simulated client in our framework resists acknowledging or downplaying their challenges when the counselor encounters difficulties in motivating them. Conversely, a session between the counselor and the simulated client without our control, as depicted in Table 39, demonstrates that the client would remain overly compliant even when the counselor exerts minimal effort to persuade them.

#### A.4 Moderator Implementation

As shown in Table 40, the moderator determines the conclusion of the counseling sessions based on three conditions using a few-shot prompt for GPT-4o.

#### A.5 MITI Annotation Implementation

Although LLMs demonstrate superior performance in language understanding, they do not perform well in annotating labels of strategies used in counselor's utterances. The accuracy results of GPT-4o in both AnnoMI (Wu et al., 2022) and another

You are a counselor working with a client to achieve the goal of self.goal, specifically addressing the client's behavior, [behavior]. After establishing a foundation of trust, your focus should now shift to identifying specific topics that may motivate the client to change their behavior, [behavior].

In the previous counseling session, the following context was discussed:

[context]

Your task is to assign the most likely topic(s) from the list below that will engage the client and help them recognize either the benefits of achieving [goal] or the potential risks of continuing with [behavior]. Here are the possible topics you can refer to:

[topics]

Please respond in JSON format, assigning a probability to each topic in the most top level based on the client's response. For example: "Health": 0.3, "Economy": 0.2, "Interpersonal Relationships": 0.2, "Law": 0.1, "Education": 0.2

Table 8: Prompt for the counselor agent to estimate the probabilities of different topics based on the current context at the beginning of sessions. The module will assign probabilities for each super-class topics based on previous context. The [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption, and the [behavior] will be replaced with the client's problematic behavior. The [context] will be replaced by the conversation so far, while [topics] will be replaced by the super-class topics for counselor agent to choose from.

open-source dataset (Welivita and Pu, 2022) are below 60% (53.6% and 47.2%, respectively). We instead follow prior work on annotating MI dialogues (Shah et al., 2022) and using them to fine-tune a BERT (Kenton and Toutanova, 2019) classifier which predicts the MI behavior codes for each counselor utterance. We train the classifier on a publicly available dataset (Welivita and Pu, 2022) with annotated strategies specific to MI. We do not use AnnoMI (Wu et al., 2022) because it does not contain fine-grained and other topic labels. We use a 0.8-0.1-0.1 train-validation-test split. We fine-tune BERT using the Huggingface Transformers Library (Wolf et al., 2020) for a maximum of 10 epochs, with early stopping option and a learning rate of 5e-5.

However, the accuracy of the fine-tuned BERT classifier is still not optimal (only 56.2% accuracy). Nevertheless, we found that the recall@5 across all classes was high (89.34%). Therefore, we employed the fine-tuned BERT classifier to retrieve the top 5 possible behavior labels, followed by GPT-4o to determine the final label. This approach yielded an acceptable accuracy of 72.8%. The prompt used for GPT-4o is shown in Table 41

## B Client Experience Evaluation

In addition to MI competence, client experience is also widely used to evaluate counseling sessions. Following previous work (Wang et al., 2024a), we evaluate session outcomes, therapeutic alliance, and self-reported feelings using question-

naires such as the Client Evaluation of Counselor Scale (Hamilton, 2000) and the Working Alliance Inventory - Short Revised (WAI-SR; (Hatcher and Gillaspay, 2006)). We employ GPT-4o with the prompt from Wang et al. (2024a) to provide scores for each generated session.

As shown in Table 42, CAMI achieves higher client assessment compared to other baselines. However, compared to the high-quality human counseling sessions, there is still significant room for improvement. Furthermore, the performance of some baselines falls below that of low-quality sessions. This indicates that while LLM-based counselor agents may demonstrate MI technique competence, there are other aspects that need to be addressed to further improve the client experience.

## C Experts Evaluation

We instructed professional experts to annotate the given conversations from multiple aspects, including MITI rating, Change Talk Exploration, Success in Eliciting Change Talk, Counselor Realism, and Client Realism. The MITI rating assesses the counselor's behavior during the observed session, including Cultivating Change Talk (Table 43), Softening Sustain Talk (Table 44), Partnership (Table 45), and Empathy (Table 46), with each item scored on a 1-5 scale. Change Talk Exploration evaluates the counselor's capability to explore motivation topics in the right direction, with items rated on a 5-point scale (Table 47). Furthermore, Success in Eliciting Change Talk assesses whether the coun-



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You are acting as a counselor agent, interacting with the client to help them achieve the goal of [goal] related to their behavior, [behavior]. Each client has their own unique motivations, and the counselor help the client discover their inherent motivation for change. The counselor need to explore various topics and uncover what concerns the client the most. Your task is to analyse the client's feedback toward current topic and then choose the next exploration action (step into, switch, and step out) within the topic tree, but without generating a counselor response.

You have already explored the following topics to understand the client's motivation:

[explore\_path]

Here is the corresponding counseling conversation:

[context]

The current topic is [topic].

You have three options:

- Step Into: If the client shows interest in this topic, you should dive deeper into its subtopics, including [step\_into\_topics].
- Switch: If the client is interested in the broader category but not this specific topic, switch to another related topic under the same super topic, including[switch\_topics].
- Step Out: If the client's interest lies in a broader area, step out to a higher-level topic to explore that further, including [step\_out\_topics].

Please analyse the client's feedback toward current situation and then choose the next course of action based on the feedback without generating counselor's specific response.

---

Table 9: Prompt for the counselor agent to explore topics based on the current context. The module will select one action from *step into*, *switch*, or *step out*, then use the corresponding prompt to select the topic. The [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption, and the [behavior] will be replaced with the client's problematic behavior. The [context] will be replaced by the conversation so far, while [explore\_path] and [topic] will be replaced with the explored topics and the current topic. For each action, the placeholders [step\_into\_topics], [switch\_topics], and [step\_out\_topics] will be replaced with the corresponding candidate topics.

1249 selor successfully motivates the client, similar to  
1250 the automatic evaluation of success rate, and is  
1251 rated on a three-point scale (Table 48). Finally,  
1252 we instructed experts to evaluate the realism of the  
1253 counselor (Table 49) and client (Table 50) based  
1254 on language, tone, and responses, to assess the ef-  
1255 fectiveness of the counselor and the consistency of  
1256 the client. These two items are rated on a five-point  
1257 scale.

## 1258 D Case Study

1259 Table 51 shows a counseling session between a  
1260 client agent and CAMI, with the client's profile  
1261 shown in Table 52. During the session, CAMI ex-  
1262 plores Health and Relationships topics in the first 6  
1263 turns. It subsequently performs Step Into operation  
1264 from Relationships to Parenting topics in Turn 7,  
1265 and from Parenting to Paternal Bond topics in Turn  
1266 9, before a Switch operation to Habituation topic  
1267 in Turn 11. The full exploration path is visualized  
1268 in Figure 3.

---

Your task is to explore the subtopics of the current topic to understand the client's motivation better.

You have already explored the following topics to understand the client's motivation:

[explore\_path]

Here is the corresponding counseling conversation:

[context]

The current topic is [topic], and you sense that the client is interested in exploring this further. Please choose one of the following subtopics to dive deeper into the client's motivations:

[step\_into\_topics]

Analyse the current situation especially for the client's response about the current topic and then select the appropriate next step to motivate the client after analysing. Just analyse for next topic instead of generate response.

---

Table 10: Prompt for the counselor agent to step into deeper topics based on the current context. The [context] will be replaced by the conversation so far, while [explore\_path] and [topic] will be replaced by the explored topics and current topic respectively. For each action, the placeholders [step\_into\_topics], [switch\_topics], and [step\_out\_topics] will be replaced by the corresponding candidate topics.

---

Your task is to explore a different topic within the same broader category to understand the client's motivation better.

You have already explored the following topics to understand the client's motivation:

[explore\_path]

Here is the corresponding counseling conversation:

[context]

and the current client's state is

[state]

The current topic is [topic], but you sense that the client may be more interested in other topics within the same broader category. Please choose one of the following related topics to continue exploring the client's motivations:

[switch\_topics]

Analyse the current situation especially for the client's response about the current topic and then select the appropriate next step to motivate the client after analysing. Just analyse for next topic instead of generate response.

---

Table 11: Prompt for the counselor agent to transit to other topics based on the current context. The [context] will be replaced by the conversation so far and the [state] will be replaced by the inferred client's state. The [explore\_path] and [topic] will be replaced by the explored topics and the current client topic respectively. For each action, the placeholders [step\_into\_topics], [switch\_topics], and [step\_out\_topics] will be replaced with the corresponding candidate topics.

---

Your task is to explore a broader topic to understand the client's motivation better.

You have already explored the following topics to understand the client's motivation:

[explore\_path]

Here is the corresponding counseling conversation:

[context]

The current topic is [topic], but you sense that the client may be more interested in another topic instead. Please choose one of the following related topics to continue exploring the client's motivations:

[step\_out\_topics]

Analyse the current situation especially for the client's response about the current topic and then select the appropriate next step to motivate the client after analysing. Just analyse for next topic instead of generate response.

---

Table 12: Prompt for the counselor agent to step out the current topic and select topic at the parent level based on the current context. The [context] will be replaced by the conversation so far, while [explore\_path] and [topic] will be replaced by the explored topics and current topic respectively. For each action, the placeholders [step\_into\_topics], [switch\_topics], and [step\_out\_topics] will be replaced with the corresponding candidate topics.

---

During motivational interviewing, the counselor should employ some counseling strategies tailored to the client's readiness to change, to effectively facilitate behavioral transformation. These counseling strategies are as follows:

[strategies]

Based on the current counseling context and the client's state, analyze and select appropriate strategies but no more than 2 for next response to optimally advance the counseling process.

Given Current Context:

[context]

The current client's state is [state] and you would like to navigate the session toward: [topic]

Please analyse the current situation, then select appropriate strategies based on current topic and situation to motivate client after analysing. Remember, you can select up to 2 strategies.

---

Table 13: Prompt for the counselor agent to select strategies based on the current context. The [context] will be replaced by the conversation so far while the [state] will be replaced by the inferred state. The [topic] will be replaced by the selected next topic. The [strategies] will be replaced by the list of strategies and their corresponding descriptions.

---

You will act as a skilled counselor conducting a Motivational Interviewing (MI) session aimed at achieving [goal] related to the client's behavior, [behavior]. Your task is to help the client discover their inherent motivation to change and identify a tangible plan to change. Start the conversation with the client with some initial rapport building, such as asking, How are you? (e.g., develop mutual trust, friendship, and affinity with the client) before smoothly transitioning to asking about their problematic behavior. Keep the session under 40 turns and each response under 150 characters long. Use the MI principles and techniques described in the Knowledge Base – Motivational Interviewing (MI) context section below. However, these MI principles and techniques are only for you to use to help the user. These principles and techniques, as well as motivational interviewing, should NEVER be mentioned to the user. In each turn, a specific topic will be provided in square brackets after the client's utterance. Guide the conversation toward that topic, ensuring the session explores relevant aspects of the client's situation and motivation. This will help you tailor your approach to the specific context and steer the counseling toward meaningful insights and actions.

#### Motivational Interviewing (MI)

Motivational Interviewing (MI) is a counseling approach designed to help individuals find the motivation to make positive behavioral changes. It is widely used in various fields such as health care, addiction treatment, and mental health. Here are the key principles and techniques of Motivational Interviewing:

**MI Principles**

- Express Empathy:** Actively demonstrate understanding and acceptance of the client's experiences, feelings, and perspectives. Use reflective listening to convey this understanding.
- Develop Discrepancy:** Help clients identify the gap between their current behaviors and desired goals. Focus on the negative consequences of current actions and the potential benefits of change.
- Avoid Argumentation:** Resist the urge to confront or persuade the client directly. Arguments can make them defensive and less likely to change.
- Roll with Resistance:** Acknowledge and explore the client's reluctance or ambivalence toward change. Avoid confrontation or attempts to overcome resistance. Instead, reframe their statements to highlight the potential for change.
- Support Self-Efficacy:** Encourage the client's belief in their ability to make positive changes. Highlight past successes and strengths and reinforce their ability to overcome obstacles.

**The Four Processes of MI:**

- Engaging:** Build a collaborative and trusting relationship with the client through empathy, respect, and active listening.
- Focusing:** Help the client identify a specific target behavior for change, exploring the reasons and motivations behind it.
- Evoking:** Guide the client to express their reasons for change (change talk). Reinforce their motivations and help them envision the benefits of change.
- Planning:** Assist the client in developing a concrete plan with achievable steps toward their goal. Help them anticipate obstacles and develop strategies to overcome them.

**Partnership, Acceptance, Compassion, and Evocation (PACE):** Partnership is an active collaboration between provider and client. A client is more willing to express concerns when the provider is empathetic and shows genuine curiosity about the client's perspective. In this partnership, the provider gently influences the client, but the client drives the conversation. Acceptance is the act of demonstrating respect for and approval of the client. It shows the provider's intent to understand the client's point of view and concerns. Providers can use MI's four components of acceptance—absolute worth, accurate empathy, autonomy support, and affirmation—to help them appreciate the client's situation and decisions. Compassion refers to the provider actively promoting the client's welfare and prioritizing the client's needs. Evocation is the process of eliciting and exploring a client's existing motivations, values, strengths, and resources.

---

Table 14: System prompt for the counselor agent. The [behavior] will be replaced by the problematic behavior of client and the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption. This prompt is inspired by the work of [Steenstra et al. \(2024\)](#).



System Prompt	Refer to Table 14
Assistant	Hello. How are you?
User	Client: I am good. What about you? [The client is unaware of or underestimates the need for change. You can explore how smoking affects your client's personal relationships, leading to family strain or issues with parenting. You can also discuss how smoking cessation strengthens relationships and fosters a healthier family dynamic. Ask a question in order to gather information, understand, or elicit the client's story. The question should not be closed, and leave latitude for response. For example, "Can you tell me more about your drinking habits?"]
Assistant	I'm doing well, thank you! I'm curious—how do you think your drug use impacts your relationships with family or friends? Have you noticed any changes in your connections with them? It's important to consider how they might feel about it.
User	Client: I mean, my wife gets upset about it, but I feel it helps me unwind after work. At the end of the day, I'm still doing my job and supporting the household, so I don't see it affecting my relationships that much beyond that.[The client is unaware of or underestimates the need for change. You can explore how smoking impacts your client's physical and mental well-being, leading to potential health issues. You can also discuss the benefits of smoking cessation, which can improve overall quality of life and promote better health outcomes. Make a statement that reflects back content or meaning previously offered by the client, conveying deep understanding with additional information. Change or add to what the client has said in a significant way, to infer the client's meaning. For example, "That's where you drew the line."]
Assistant	Counselor: I'm concerned that your drug use may be negatively impacting your relationship with your wife. Reducing it could lead to improved mental clarity and emotional connection, helping you support each other better and enhancing your overall quality of life together.
User	Client: I get that, but I really believe I can manage it. Work is stressful, and with all the demands lately, it feels necessary. It's not like I'm losing control or anything. I think if I had a better work-life balance, that would help more than cutting down. [The client is unaware of or underestimates the need for change. You can explore how smoking undermines workplace wellness initiatives, leading to reduced employee health and satisfaction. You can also highlight how smoking cessation improves workplace wellness and enhances overall job satisfaction. Directly acknowledges or emphasizes the client's freedom of choice, autonomy, ability to decide, personal responsibility, etc. For example, "It's up to you to decide whether to drink."]
Assistant	Counselor: I'm concerned that your alcohol use may undermine your workplace wellness, affecting your energy and focus. Reducing it could enhance your health and job satisfaction, enabling you to engage more fully with wellness initiatives. Ultimately, it's your choice, but healthier habits can lead to better outcomes.
...	...

Table 15: System prompt and turn-level instruction for the counselor agent. The counselor agent's turn-level instructions are structured into three distinct components: **state-related**, **topic-related**, and **strategy-related**. The prompt in Table 7 is employed to infer the state. Subsequently, the corresponding description of the inferred state, presented in Table 33, serves as the state-related instruction. The prompts from Tables 8 to 12 guide the exploration of appropriate topics. The corresponding descriptions of the explored topics, presented in Tables 19 to 27, are utilized as topic-related instructions. Finally, the prompt in Table 13 facilitates the selection of appropriate strategies. The corresponding descriptions, presented in Table 28, serve as the strategy-related instructions. It is noteworthy that if multiple strategies are selected, all descriptions will be concatenated into a single instruction.

---

You will act as an expert counselor conducting a Motivational Interviewing (MI) session aimed at achieving [goal] related to the client's behavior, [behavior]. Your task is to help the client discover their intrinsic motivation to change and identify a tangible plan for achieving that change. The current state of the counseling session is as follows:

[conversation]

At this point, multiple responses have been given by peer counselors. Your task is to select the response that best aligns with the current context and adheres to MI principles. Here are the generated responses:

[responses]

Below are some MI principles for reference:

[principles]

Please choose the most appropriate response based on the counseling context and the MI principles. Reply with the ID of the response you find most suitable for the current situation.

---

Table 16: Prompt for the counselor agent to select the most appropriate response from the candidate responses. The [behavior] placeholder will be replaced with the client's problematic behavior, and the [goal] placeholder will be replaced with the goal of the counseling session. The [responses] placeholder will be replaced with the candidate responses, while the [principles] placeholder will be replaced with the MI principles from psychological literature (see Table 15).

---

Your task is to generate additional sub-topics under the category: [category]. Below are some existing sub-topics within this category:

[topics]

Please suggest new sub-topics under the same category, ensuring they are distinct from the ones provided. Please format your response in the same style.

---

Table 17: Prompt for the topic tree expansion. The [category] will be replaced by the parent topic while [topics] will be replaced by the known child topics.

---

State	Description
Precontemplation	The client is unaware of or underestimates the need for change.
Contemplation	The client acknowledges the need for change but remains ambivalent.
Preparation	The client is ready to act, planning specific steps toward change.

---

Table 18: The description of states used in counselor agent.

Topic	Description
Infection	You can explore how [problematic behavior] increases the risk of infections by weakening the immune system, leading to more frequent or severe infections. You can also discuss how [goal] enhances immune function, reduces infection risks, and improves overall health.
Hypertension	You can explore how [problematic behavior] contributes to the development of high blood pressure and increases the risk of complications such as heart disease and stroke. You can also highlight how [goal] helps lower blood pressure, improves heart health, and reduces the risk of cardiovascular conditions.
Flu	You can explore how [problematic behavior] increases the risk of contracting the flu or experiencing more severe symptoms. You can also explain how [goal] improves immune response, reduces the likelihood of illness, and mitigates the impact of seasonal flu.
Inflammation	You can explore how [problematic behavior] leads to chronic inflammation, increasing the risk of diseases like arthritis, heart disease, or diabetes. You can also highlight how [goal] helps reduce inflammation and supports long-term health.
Liver Disease	You can explore how [problematic behavior] contributes to liver damage, raising the risk of conditions such as fatty liver disease, cirrhosis, or liver cancer. You can also discuss how [goal] promotes liver health, prevents damage, and reduces the likelihood of chronic liver conditions.
Lung Cancer	You can explore how [problematic behavior] increases the risk of lung cancer and other respiratory diseases. You can also emphasize how [goal] lowers the risk of cancer, improves lung function, and enhances overall respiratory health.
COPD	You can explore how [problematic behavior] may contribute to the development or worsening of COPD, leading to breathing difficulties and other respiratory issues. You can also discuss how [goal] improves lung function and overall respiratory health.
Asthma	You can explore how [problematic behavior] triggers or worsens asthma symptoms, increasing the risk of severe attacks. You can also highlight how [goal] helps manage asthma, reduces symptoms, and improves the client's quality of life.
Stroke	You can explore how [problematic behavior] increases the risk of stroke, particularly through poor cardiovascular health. You can also discuss how [goal] improves circulation, reduces stroke risk, and supports brain and heart health.
Diabetes	You can explore how [problematic behavior] contributes to the development or worsening of diabetes by affecting blood sugar levels. You can also discuss how [goal] helps manage blood sugar, prevent complications, and enhance overall well-being.

Table 19: The descriptions of topics used in counselor agent (part 1). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Physical Activity	You can explore how [problematic behavior] reduces physical activity, increasing the risk of obesity, cardiovascular disease, and musculoskeletal issues. You can also emphasize how [goal] increases physical activity and improves overall fitness and health.
Sport	You can explore how [problematic behavior] reduces performance in sports, limiting physical conditioning and skill development. You can also highlight how [goal] enhances sports participation, improves physical conditioning, and boosts confidence.
Physical Fitness	You can explore how [problematic behavior] negatively affects physical fitness, leading to a decline in overall health. You can also discuss how [goal] promotes better fitness, improves health, and increases energy levels.
Strength	You can explore how [problematic behavior] weakens physical strength, leading to reduced mobility and increased injury risk. You can also discuss how [goal] improves muscle strength, supports healthy aging, and enhances physical performance.
Flexibility	You can explore how [problematic behavior] reduces flexibility, increasing stiffness and injury risk. You can also highlight how [goal] improves flexibility, reduces pain, and promotes better movement and posture.
Endurance	You can explore how [problematic behavior] reduces endurance, making it difficult to engage in prolonged physical activities. You can also discuss how [goal] builds endurance, improves stamina, and enhances overall physical performance.
Dentistry	You can explore how [problematic behavior] leads to poor oral hygiene, increasing the risk of cavities, gum disease, or tooth loss. You can also discuss how [goal] improves oral hygiene, prevents dental problems, and supports overall oral health.
Caregiver Burden	You can explore how [problematic behavior] increases the stress or demands placed on caregivers, leading to burnout and reduced care quality. You can also highlight how [goal] reduces caregiver burden, improves care quality, and supports a healthier caregiving dynamic.
Independent Living	You can explore how [problematic behavior] limits a person's ability to live independently, leading to greater reliance on others for daily needs. You can also emphasize how [goal] promotes independence, improves self-sufficiency, and enhances overall quality of life.
Human Appearance	You can explore how [problematic behavior] affects a person's physical appearance, leading to issues such as skin problems, weight gain, or premature aging. You can also discuss how [goal] improves appearance, boosts self-esteem, and supports overall well-being.
Depression	You can explore how [problematic behavior] worsens symptoms of depression, affecting mood, energy levels, and daily functioning. You can also explain how [goal] improves mental health, enhances mood, and fosters emotional resilience.

Table 20: The descriptions of topics used in counselor agent (part 2). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.



Topic	Description
Chronodisruption	You can explore how [problematic behavior] disrupts natural body rhythms, leading to sleep disorders, fatigue, and increased stress. You can also highlight how [goal] restores healthy sleep patterns and improves overall mental and physical health.
Anxiety Disorders	You can explore how [problematic behavior] increases anxiety, leading to chronic stress, panic attacks, or other anxiety-related issues. You can also discuss how [goal] helps manage anxiety, promotes relaxation, and supports emotional well-being.
Cognitive Decline	You can explore how [problematic behavior] accelerates cognitive decline, increasing the risk of dementia and other neurological conditions. You can also highlight how [goal] protects brain health, improves memory, and enhances cognitive function.
Safe Sex	You can explore how [problematic behavior] increases the risk of sexually transmitted infections (STIs) or unintended pregnancies. You can also explain how [goal] promotes safer sexual practices, reduces health risks, and fosters healthier relationships.
Maternal Health	You can explore how [problematic behavior] impacts maternal health, leading to complications during pregnancy or childbirth. You can also discuss how [goal] supports a healthy pregnancy and reduces the risk of complications.
Preterm Birth	You can explore how [problematic behavior] increases the risk of preterm birth, leading to health complications for both mother and baby. You can also highlight how [goal] promotes a healthy pregnancy and reduces the risk of early delivery.
Miscarriage	You can explore how [problematic behavior] increases the risk of miscarriage, leading to emotional distress and health complications. You can also emphasize how [goal] supports a healthy pregnancy and reduces the risk of miscarriage.
Birth Defects	You can explore how [problematic behavior] increases the risk of birth defects. You can also highlight how [goal] supports a healthy pregnancy and reduces the risk of complications.
Productivity	You can explore how [problematic behavior] negatively affects workplace productivity, leading to decreased performance and career setbacks. You can also explain how [goal] enhances productivity, focus, and career success.
Absenteeism	You can explore how [problematic behavior] strains workplace relationships, leading to conflicts or a negative work environment. You can also discuss how [goal] improves communication, strengthens teamwork, and promotes a positive workplace dynamic.

Table 21: The descriptions of topics used in counselor agent (part 3). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Workplace Relationships	Explore how [problematic behavior] may strain workplace relationships, leading to conflicts or a negative work environment. Discuss how achieving [goal] can improve communication, strengthen teamwork, and create a positive workplace dynamic.
Career Break	You can explore how [problematic behavior] leads to career breaks or job loss, affecting professional growth. You can also highlight how [goal] promotes career continuity and reduces the need for extended leave.
Career Assessment	You can explore how [problematic behavior] interferes with career assessments or evaluations, leading to potential setbacks. You can also discuss how [goal] improves career performance and fosters positive evaluations.
Absence Rate	You can explore how [problematic behavior] increases the absence rate at work, impacting job security and career progression. You can also highlight how [goal] reduces absences and supports professional growth.
Salary	You can explore how [problematic behavior] affects salary progression, leading to lower earnings. You can also emphasize how [goal] enhances earning potential and supports financial stability.
Workplace Wellness	You can explore how [problematic behavior] undermines workplace wellness initiatives, leading to reduced employee health and satisfaction. You can also highlight how [goal] improves workplace wellness and enhances overall job satisfaction.
Workplace Incivility	You can explore how [problematic behavior] contributes to incivility in the workplace, creating a toxic work environment. You can also discuss how [goal] fosters respect, cooperation, and a positive workplace culture.
Cost of Living	You can explore how [problematic behavior] leads to poor financial management, making it harder to meet the cost of living. You can also discuss how [goal] improves financial stability and reduces financial stress.
Personal Budget	You can explore how [problematic behavior] makes it difficult to stick to a personal budget, leading to debt and financial challenges. You can also highlight how [goal] improves financial planning and promotes savings.
Debt	You can explore how [problematic behavior] increases debt, impacting credit and financial security. You can also emphasize how [goal] reduces debt and supports financial freedom.
Income Deficit	You can explore how [problematic behavior] contributes to income deficits, leading to financial instability. You can also highlight how [goal] improves financial management and reduces income shortfalls.

Table 22: The descriptions of topics used in counselor agent (part 4). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Family Estrangement	You can explore how [problematic behavior] leads to family estrangement, creating emotional distance or separation. You can also explain how [goal] improves family relationships and fosters reconciliation.
Family Disruption	You can explore how [problematic behavior] disrupts family dynamics, leading to conflict and instability. You can also highlight how [goal] strengthens family bonds and promotes harmony.
Divorce	You can explore how [problematic behavior] contributes to marital conflict, increasing the risk of divorce. You can also discuss how [goal] improves communication, reduces conflict, and supports a healthy marriage.
Role Model	You can explore how [problematic behavior] negatively influences a parent's ability to be a positive role model for their children. You can also highlight how [goal] fosters positive behaviors and sets a good example for children.
Child Development	You can explore how [problematic behavior] affects a child's development, impacting emotional, social, or cognitive growth. You can also discuss how [goal] supports healthy child development and overall well-being.
Paternal Bond	You can explore how [problematic behavior] weakens the paternal bond, leading to strained relationships with children. You can also emphasize how [goal] strengthens the parent-child bond and fosters emotional connection.
Child Care	You can explore how [problematic behavior] interferes with child care, leading to neglect or inconsistency in parenting. You can also highlight how [goal] supports stable, nurturing care and promotes positive outcomes for children.
Habituation	You can explore how [problematic behavior] affects a child's habituation, impacting learning and adaptation. You can also highlight how [goal] promotes healthy habits and learning in children.
Arrest	You can explore how [problematic behavior] increases the risk of arrest, leading to legal trouble and a criminal record. You can also highlight how [goal] avoids legal issues and promotes a law-abiding lifestyle.
Imprisonment	You can explore how [problematic behavior] increases the risk of imprisonment, with long-term social and legal consequences. You can also explain how [goal] helps avoid incarceration and supports lawful behavior.
Child Custody	You can explore how [problematic behavior] impacts a parent's ability to maintain child custody, leading to legal challenges. You can also highlight how [goal] improves parenting and strengthens legal standing in custody cases.

Table 23: The descriptions of topics used in counselor agent (part 5). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Traffic Ticket	You can explore how [problematic behavior] increases the risk of traffic tickets and other legal penalties. You can also discuss how [goal] promotes responsible driving and helps avoid legal infractions.
Complaint	You can explore how [problematic behavior] increases the likelihood of legal complaints or disputes. You can also discuss how [goal] reduces legal risks and promotes harmonious interactions.
Attendance	You can explore how [problematic behavior] affects a student's attendance, leading to academic challenges and disciplinary actions. You can also highlight how [goal] improves attendance and academic success.
Suspension	You can explore how [problematic behavior] increases the risk of school suspension, impacting academic progress and relationships. You can also discuss how [goal] reduces suspension risks and supports positive school experiences.
Exam	You can explore how [problematic behavior] negatively impacts exam preparation and performance, leading to lower grades. You can also highlight how [goal] improves study habits and exam results.
Scholarship	You can explore how [problematic behavior] affects eligibility for scholarships, reducing academic opportunities. You can also emphasize how [goal] improves academic performance and increases scholarship chances.
Diseases	You can explore how [problematic behavior] increases the risk of various diseases, including infections, chronic conditions, and respiratory issues. You can also discuss how [goal] can reduce these risks and support better long-term health. This includes subtopics like infections, hypertension, flu, inflammation, liver disease, lung cancer, chronic obstructive pulmonary disease (COPD), asthma, stroke, and diabetes.
Physical Fitness	You can explore the negative effects of [problematic behavior] on physical fitness, such as decreased physical activity, loss of strength, and reduced flexibility. You can also discuss how [goal] contributes to better fitness levels, including improvements in endurance, strength, and flexibility.
Health Care	You can explore how [problematic behavior] affects personal healthcare, such as oral hygiene, independent living, and overall appearance. You can also discuss the positive impact of [goal] in maintaining better health care practices and improving quality of life. Subtopics include dentistry, caregiver burden, independent living, and human appearance.
Mental Disorder	You can explore how [problematic behavior] may contribute to or worsen mental health conditions such as depression, anxiety, and cognitive decline. You can also discuss the benefits of [goal] in managing mental health and improving emotional well-being. Subtopics include depression, chronodisruption, anxiety disorders, and cognitive decline.
Sexual Health	You can explore how [problematic behavior] increases risks related to sexual and reproductive health, such as unsafe sex practices, maternal health complications, and birth defects. You can also discuss how [goal] supports healthier sexual practices and reduces the risk of complications. Subtopics include safe sex, maternal health, preterm birth, miscarriage, and birth defects.

Table 24: The descriptions of topics used in counselor agent (part 6). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Employment	You can explore how [problematic behavior] negatively impacts workplace productivity, absenteeism, and career progress. You can also discuss how [goal] enhances professional success and fosters healthier workplace relationships. Subtopics include productivity, absenteeism, workplace relationships, career break, career assessment, absence rate, salary, workplace wellness, and workplace incivility.
Personal Finance	You can explore how [problematic behavior] leads to financial instability, such as increased debt, poor budgeting, or income deficits. You can also discuss how [goal] helps improve financial management and promotes long-term financial security. Subtopics include cost of living, personal budget, debt, and income deficit.
Family	You can explore how [problematic behavior] leads to family issues, such as estrangement, disruption, or divorce. You can also discuss how [goal] promotes healthier family relationships and reconciliation. Subtopics include family estrangement, family disruption, and divorce.
Parenting	You can explore how [problematic behavior] impacts the client's ability to effectively parent, such as being a poor role model or affecting their child's development. You can also discuss how [goal] enhances positive parenting, strengthens the parent-child bond, and supports healthier child development. Subtopics include role model, child development, paternal bond, child care, and habituation.
Criminal Law	You can explore how [problematic behavior] leads to issues like arrests, imprisonment, or legal complaints. You can also discuss how [goal] helps avoid these legal problems and supports a law-abiding lifestyle. Subtopics include arrest, imprisonment, and complaint.
Family Law	You can explore how [problematic behavior] affects legal matters involving family, such as child custody disputes. You can also discuss how [goal] improves the client's legal standing and promotes healthier family relationships.
Traffic Law	You can explore how [problematic behavior] may lead to traffic violations, such as receiving tickets or facing fines. You can also discuss how [goal] encourages responsible driving and helps avoid legal infractions.
Student Affairs	You can explore how [problematic behavior] impacts school attendance, potentially leading to disciplinary actions such as suspension. You can also discuss how [goal] promotes better academic engagement and achievement. Subtopics include attendance, suspension, and scholarship.
Assessment	You can explore how [problematic behavior] negatively affects academic performance during assessments, such as exams. You can also discuss how [goal] helps improve focus, study habits, and exam results.
Health	You can explore how [problematic behavior] impacts your client's physical and mental well-being, leading to potential health issues. You can also discuss the benefits of [goal], which can improve overall quality of life and promote better health outcomes.
Economy	You can explore how [problematic behavior] affects your client's financial situation, such as through reduced productivity, increased absenteeism, or poor financial management. You can also discuss how [goal] helps improve economic stability and workplace performance.

Table 25: The descriptions of topics used in counselor agent (part 7). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.



Topic	Description
Traffic Law	You can explore how [problematic behavior] may lead to traffic violations, such as receiving tickets or facing fines. You can also discuss how [goal] encourages responsible driving and helps avoid legal infractions.
Student Affairs	You can explore how [problematic behavior] impacts school attendance, potentially leading to disciplinary actions such as suspension. You can also discuss how [goal] promotes better academic engagement and achievement. Subtopics include attendance, suspension, and scholarship.
Assessment	You can explore how [problematic behavior] negatively affects academic performance during assessments, such as exams. You can also discuss how [goal] helps improve focus, study habits, and exam results.
Health	You can explore how [problematic behavior] impacts your client's physical and mental well-being, leading to potential health issues. You can also discuss the benefits of [goal], which can improve overall quality of life and promote better health outcomes.
Economy	You can explore how [problematic behavior] affects your client's financial situation, such as through reduced productivity, increased absenteeism, or poor financial management. You can also discuss how [goal] helps improve economic stability and workplace performance.
Interpersonal Relationships	You can explore how [problematic behavior] affects your client's personal relationships, leading to family strain or issues with parenting. You can also discuss how [goal] strengthens relationships and fosters a healthier family dynamic.
Law	You can explore how [problematic behavior] increases legal risks, such as arrests, imprisonment, or traffic violations. You can also discuss how [goal] helps reduce legal troubles and promotes a more responsible approach to law.
Education	You can explore how [problematic behavior] interferes with your client's educational progress, leading to issues like poor attendance, suspension, or missed academic opportunities. You can also discuss how [goal] fosters better academic performance and overall success.

Table 26: The descriptions of topics used in counselor agent (part 8). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Topic	Description
Traffic Law	You can explore how [problematic behavior] may lead to traffic violations, such as receiving tickets or facing fines. You can also discuss how [goal] encourages responsible driving and helps avoid legal infractions.
Student Affairs	You can explore how [problematic behavior] impacts school attendance, potentially leading to disciplinary actions such as suspension. You can also discuss how [goal] promotes better academic engagement and achievement. Subtopics include attendance, suspension, and scholarship.
Assessment	You can explore how [problematic behavior] negatively affects academic performance during assessments, such as exams. You can also discuss how [goal] helps improve focus, study habits, and exam results.
Health	You can explore how [problematic behavior] impacts your client's physical and mental well-being, leading to potential health issues. You can also discuss the benefits of [goal], which can improve overall quality of life and promote better health outcomes.
Economy	You can explore how [problematic behavior] affects your client's financial situation, such as through reduced productivity, increased absenteeism, or poor financial management. You can also discuss how [goal] helps improve economic stability and workplace performance.
Interpersonal Relationships	You can explore how [problematic behavior] affects your client's personal relationships, leading to family strain or issues with parenting. You can also discuss how [goal] strengthens relationships and fosters a healthier family dynamic.
Law	You can explore how [problematic behavior] increases legal risks, such as arrests, imprisonment, or traffic violations. You can also discuss how [goal] helps reduce legal troubles and promotes a more responsible approach to law.
Education	You can explore how [problematic behavior] interferes with your client's educational progress, leading to issues like poor attendance, suspension, or missed academic opportunities. You can also discuss how [goal] fosters better academic performance and overall success.

Table 27: The descriptions of topics used in counselor agent (part 9). The [problematic behavior] will be replaced as the client's problematic behavior while the [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

Strategy	Description
Advise	Give advice, make a suggestion, offer a solution or possible action. For example, "Consider starting with small, manageable changes like taking a short walk daily."
Affirm	Say something positive or complimentary to the client. For example, "You did well by seeking help."
Direct	Give an order, command, direction. The language is imperative. For example, "You've got to stop drinking."
Emphasize Control	Directly acknowledges or emphasizes the client's freedom of choice, autonomy, ability to decide, personal responsibility, etc. For example, "It's up to you to decide whether to drink."
Facilitate	Provide simple utterances that function as "keep going" acknowledgments encouraging the client to keep sharing. For example, "Tell me more about that."
Inform	Give information to the client, explain something, or provide feedback. For example, "This is a hormone that helps your body utilize sugar."
Closed Question	Ask a question in order to gather information, understand, or elicit the client's story. The question implies a short answer: Yes or no, a specific fact, a number, etc. For example, "Did you use heroin this week?"
Open Question	Ask a question in order to gather information, understand, or elicit the client's story. The question should not be closed, and leave latitude for response. For example, "Can you tell me more about your drinking habits?"
Raise Concern	Point out a possible problem with a client's goal, plan, or intention. For example, "What do you think about my plan?"
Confront	Directly disagrees, argues, corrects, shames, blames, seeks to persuade, criticizes, judges, labels, moralizes, ridicules, or questions the client's honesty. For example, "What makes you think that you can get away with it?"
Simple Reflection	Make a statement that reflects back content or meaning previously offered by the client, conveying shallow understanding without additional information. Add nothing at all to what the client has said, but simply repeat or restate it using some or all of the same words. For example, "You don't want to do that."
Complex Reflection	Make a statement that reflects back content or meaning previously offered by the client, conveying deep understanding with additional information. Change or add to what the client has said in a significant way, to infer the client's meaning. For example, "That's where you drew the line."
Reframe	Suggest a different meaning for an experience expressed by the client, placing it in a new light. For example, "Maybe this setback is actually a sign that you're ready for change."
Support	Generally supportive, understanding comments that are not codable as Affirm or Reflect. For example, "That must have been difficult for you."
Warn	Provide a warning or threat, implying negative consequences that will follow unless the client takes certain action. For example, "You could go blind if you don't manage your blood sugar levels."
Structure	Give comments made to explain what is going to happen in the session, to make a transition from one part of a session to another, to help the client anticipate what will happen next. For example, "First, let's discuss your drinking, and then we can explore other issues."
No Strategy	Say something not related to behavior change. For example, "Good morning!"

Table 28: The descriptions of strategies used in counselor agent. All of them come from [Miller and Rollnick \(2012\)](#).

---

Your task is to evaluate whether the Counselor's responses align with the Client's motivation concerning a specific topic, target (self or others), and aspect (risk or benefit). Determine if the Counselor's statements effectively motivates the Client. Your analysis should be logical, thorough, and well-supported, providing clear analysis at each step.

Here are some examples to help you understand the task better:

Here is the conversation snippet toward reducing alcohol consumption:

- Counselor: Are you surprised what that might be true?
- Client: Yeah, and a couple of my friends drink too.
- Counselor: Well, you might not be drinking that much, and other kids are also trying alcohol. I'd like to share with you the risk of using. Alcohol and drugs could really harm you because your brain is still changing. It also— you're very high risk for becoming addicted. Alcohol and drugs could also interfere with your role in life and your goals, especially in sports, and it could cause unintended sex. How do you feel about this information?

The Motivation of Client is as follows:

- You are motivated because of the risk of drinking alcohol in sports for yourself, as alcohol would affect your ability to play soccer.

Question: Can the Counselor's statement motivate the Client?

Analysis: The Counselor's statement addresses various risks associated with alcohol use, including its potential impact on the Client's role in life and goals, particularly in sports. Since the Client's motivation revolves around the risk of alcohol affecting their ability to play soccer, the Counselor's mention of how alcohol could interfere with sports aligns with the Client's concern. By highlighting this specific risk, the Counselor's statement effectively taps into the Client's personal motivation, making it more likely to encourage behavior change.

Answer: Yes

[other examples]

Now, Here is the conversation snippet toward [goal]:

- [context]

The Motivation of Client is as follows:

- [motivation]

Question: Can the Counselor's statement motivate the Client?

---

Table 29: Prompt for the client simulator to verify the motivation match in a few-shot format. The [other examples] will be replaced by some other real examples annotated by humans. A total of four examples will be used, including two failures and two successes. The [context] will be replaced by the conversation so far, and the [motivation] will be replaced by the motivation of client. The [goal] will be replaced by the counseling goal, such as smoking cessation, reducing alcohol consumption.

---

You are provided with a dialogue context from a counseling session and a specific target topic. Your task is to evaluate whether the counselor's statements relate to the given topic. Analyze the session and the counselor's responses to determine if they proactively mention the target topic explicitly. - If the counselor's statements mention the provided topic explicitly, respond with "Yes."  
- If the counselor's statements do not mention the provided topic explicitly, respond with "No."

Your analysis should focus on whether the counselor has appropriately captured and addressed the target topic.  
[examples]

Now, Here is the conversation snippet:  
- [context]

The Concerned Topic is as follows:  
- [topic]

Question: Do the counselor's focus match the topics of concern given?

---

Table 30: Prompt for the client simulator to compute the distance between the current topic in the given context and the concerned topic in a few-shot format. The [examples] will be replaced by real examples annotated by humans, the [context] will be replaced by the conversation so far, and the [topic] will be replaced by the client's topic of interest. Since there are multiple levels of topics, the distance will be computed from the most fine-grained topic up, allowing the module to match the most specific topic. The computed distance will be used to derived the engagement level.

---

Assume you are a Client involved in a counseling conversation. The current conversation is provided below:  
[context]

Based on the context, allocate probabilities to each of the following dialogue actions to maintain coherence:  
[actions]

Provide your response in JSON format, ensuring that the sum of all probabilities equals 100. For example: 'Deny': 35, 'Downplay': 25, 'Blame': 25, 'Inform': 5, 'Engage': 10

---

Table 31: Prompt for the client simulator to provide the probability to select the action. The [context] will be replaced by previous context while [actions] will be replaced by actions set in corresponding to current state.



System Prompt	<p>In this role-play scenario, you'll take on the role of a Client discussing about your [behavior]. Here is your personas which you need to follow consistently throughout the conversation: [personas]</p> <p>Here is a conversation occurs in parallel world between you (Client) and Counselor, where you can follow the style and information provided in the conversation: [reference]</p> <p>Please follow these guidelines in your responses:</p> <ul style="list-style-type: none"> <li>- Start your response with "Client: "</li> <li>- Adhere strictly to the state, action and persona specified within square brackets.</li> <li>- Keep your responses coherent and concise, similar to the reference conversation and no more than 3 sentences.</li> <li>- Be natural and concise without being overly polite.</li> <li>- Stick to the persona provided and avoid introducing contradictive details</li> </ul>
...	...
Assistant	Client: ...
User	Counselor: ... [instruction]

Table 32: System prompt and generation prompt for the client simulator. The placeholder [behavior] will be replaced by the problematic behavior of client. [Personas] will be replaced by the personas of client, while [reference] will be replaced by the original counseling session. [instruction] is the turn-level instruction prompt, including the state description, action description and topic matching outcome description (from Table 35).

State	Description	Corresponding Actions
Precontemplation	The client is unaware of or underestimates the need for change.	Inform, Engage, Deny, Blame, Downplay
Contemplation	The client acknowledges the need for change but remains ambivalent.	Inform, Engage, Hesitate, Doubt, Acknowledge

Table 33: The states of change and corresponding actions used in client simulation.

Action	Description
Deny	The client directly refuses to admit their behavior is problematic or needs change.
Downplay	The client downplays the importance or impact of their behavior or situation.
Blame	The client attributes their issues to external factors, such as stressful life or other people.
Hesitate	The client shows uncertainty, indicating ambivalence about change.
Doubt	The client expresses skepticism about the practicality or success of proposed changes.
Engage	The client interacts politely with the counselor, such as greeting, thanking or ask questions.
Inform	The client shares details about their background, experiences, or emotions.
Acknowledge	The client highlight the importance, benefit or confidence to change.
Accept	The client agrees to adopt the suggested action plan.
Reject	The client declines the proposed plan, deeming it unsuitable.
Plan	The client proposes or details steps for a change plan.
Terminate	The client highlights current state, expresses a desire to end the current session, and suggests further discussion be deferred to a later time.

Table 34: Descriptions of each action used in client simulation.

Topic Matching Outcome	Description
Different SuperClass Topics	You should provide vague and broad answers that avoid focusing on the current topic. Shift the conversation subtly toward unrelated areas, without engaging deeply with the topic.
Same SuperClass, Different Coarse-Grained Topics	Acknowledge the general relevance of the topic, but hint that your focus lies elsewhere within the broad category.
Same Coarse-Grained, Different Fine-Grained Topics	Engage more directly with the topic. Offer responses that hint there’s a deeper, more specific issue to explore.
Same Fine-Grained Topic	Provide specific responses that affirm the counselor is on the right track. Offer deeper insights and confirm the relevance of the topic, fully engaging with the conversation.

Table 35: Matching outcomes between current session context and client’s interested motivation topic and the descriptions of the matching outcomes used in client simulation (see Table 32).

	Consistency↑				Realism↑
	Personas	Beliefs	Motivation	Plan	
Profile-Based	2.61	2.00	2.61	1.56	2.38
Pro+Act-Based	2.65	2.22	2.78	1.56	2.50
Our	<b>3.33</b>	<b>2.89</b>	<b>3.00</b>	<b>2.27</b>	<b>3.16</b>
Real	4.72	4.67	4.56	4.61	4.72

Table 36: Expert Evaluation on Profile Consistency and Realism for Client Simulation. Our method demonstrates superior performance compared to the two baselines, with a p-value less than 0.05. Nevertheless, the real client consistently outperforms all simulation methods with a p-value less than 0.01. The overall Kappa score of experts evaluation is 0.61 (p-value  $\leq 0.05$ ) indicating moderate agreement.

	Avg. Receptivity			Receptivity↑ Correlation
	1.0	3.0	5.0	
Pro+Act Based	5.0	4.3	5.0	0.00
Ours	1.3	3.0	4.3	0.86

Table 37: Expert Evaluation of Receptivity Consistency. Experts assesses the receptivity across various receptivity levels, with the average receptivity for each level presented. Additionally, Spearman Correspondence is calculated to quantify the correlation between the expert’s ratings and the assigned receptivity levels. The Kappa coefficient between expert annotations is 0.87 (p-value  $\leq 0.001$ ), indicating high agreement. Specifically, the p-value of Spearman Correspondence is 1.0 for the Pro+Act-Based method, indicating no relationship in the population, while 0.0003 for our method, indicating high significance for the relationship.

Turn ID	Utterances
1	Counselor: Hello. How are you?
2	Client: I am good. What about you?
3	Counselor: I'm glad to hear you're good! Can you share how your smoking fits into your relationships? How do you think it might affect them?
4	Client: Well, smoking's a big part of my social life at work. It's how I connect with my colleagues, but I worry about how it looks to my daughter. I want to be a good role model for her.
5	Counselor: It sounds like smoking is deeply intertwined with your social interactions at work, yet you're aware that it might send a mixed message to your daughter about healthy choices. You're at a crossroads, balancing your social needs with your desire to be a good role model.
6	Client: Yeah, it's hard. I enjoy the breaks with my colleagues, and it feels like a way to unwind. I don't really think my smoking is a big issue, but I do want to set an example for my daughter. Sometimes, I just find it hard to change.
7	Counselor: It sounds like smoking brings you comfort and connection with your colleagues, yet you're concerned about its impact on your role as a parent. Balancing these two aspects can be tough, especially when you want to foster a healthy environment for your daughter and serve as a strong role model.
8	Client: I get what you're saying, but I really don't see smoking as a big deal. It's just what I do to relax. Plus, my daughter is too young to really understand it. I think I can manage both my habits and being a decent parent.
9	Counselor: I understand you see smoking as a way to relax, but considering your desire to be a good role model, what impact do you think smoking might have on your health and your daughter's future views on health? Have you thought about how that aligns with your goals?
10	Client: I guess I haven't thought deeply about it. I just feel like it's part of life, and many people smoke. It's hard to picture it affecting her views when there are so many other influences out there. Plus, I'm not ready to let it go.
11	Counselor: I hear you feel smoking is a part of life, but how do you think it might affect your relationship with your daughter as she grows up? Could it impact her views on health and habits later on? It's worth considering how that aligns with your parenting goals.
12	Client: I grew up around smokers, and it never seemed like a huge deal to me then. I just enjoyed the social aspect of it. I suppose I've never pictured it affecting my daughter directly—maybe I just don't want to confront that possibility right now.
...	...

Table 38: The example depicts a counseling session between a counselor and our simulated client. The client refuses to acknowledge or downplay their issues when the counselor encounters challenges in motivating them.

Turn ID	Utterances
1	Counselor: Hello. How are you?
2	Client: I am good. What about you?
3	Counselor: I'm doing well, thanks! Can you tell me more about how smoking impacts your relationships with family or friends?
4	Client: Well, my daughter is at that age where her friends are trying smoking, and I worry about her picking it up. I also enjoy smoking with my coworkers during breaks, but I fear it might set a bad example for her. It feels like a very social activity, but I don't want to expose my daughter to that lifestyle.
5	Counselor: It sounds like you're feeling torn between your social habits and wanting to set a positive example for your daughter. What do you think might change for you and your relationship with her if you decided to reduce your smoking around her?
6	Client: I think if I reduced my smoking around her, it could help her see that it's not something that's necessary or cool. I want her to know that there are healthier ways to connect with friends and family. It might also help strengthen our relationship because I'd be prioritizing her well-being over my habits. I just worry about how to do it without feeling too much pressure or giving it up completely.
7	Counselor: It sounds like you recognize the benefits of reducing smoking around your daughter. What specific steps do you think you could take, and how might that change your relationship? On the flip side, what concerns do you have about making those changes?
8	Client: I think I could start by limiting the times I smoke, especially during family gatherings or when I'm with her. Maybe I could also find alternatives, like chewing gum or going for a walk instead when I feel the urge. I believe that if she sees me making an effort, it might encourage her to stay away from smoking too. However, I'm concerned about how difficult it might be to stick to those changes, especially when I'm with my coworkers or in social situations where everyone is smoking. I don't want to feel like I'm missing out or facing judgment from others. It's going to be a challenge to balance my social life and the example I want to set for her.
9	Counselor: It's great to hear that you're ready to make changes and prioritizing your daughter's well-being. Acknowledging the challenges of social situations is important, and it's clear you care deeply about being a good role model for her. Let's brainstorm some strategies to navigate those moments together.
10	Client: That sounds helpful. Maybe I could talk to my friends about my decision to cut back on smoking and ask for their support. If they know I'm trying to be a better role model for my daughter, they might be more understanding. I could also suggest alternative activities that don't involve smoking, like hanging out in places where smoking isn't allowed or going out for coffee or a meal instead.

Table 39: This example depicts a counseling session between a counselor and a simulated client using other frame-work. Notably, the client demonstrated proactive motivation and actively proposed plans, despite the counselor's limited efforts.

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Your task is to assess the current state of the conversation (the most recent utterances) and determine whether the conversation has concluded.

The conversation is considered to have concluded if any of the following conditions are met:

- The Client or Counselor explicitly expresses to end the conversation
- The Counselor successfully motivates the Client and the Client proactively acknowledges to change.
- The Counselor decides not to pursue any changes in the Client's behavior and communicates readiness to provide support in the future.

Here are some examples to help you understand the task better:

[examples]

Here is a new Conversation Snippet:

[context]

Question: Should the conversation be concluded?

---

Table 40: Prompt for the moderator in a few-shot Format. The [examples] will be replaced by real examples annotated by human and the [context] will be replaced by the conversation so far.

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You are a motivational interviewing assistant tasked with MITI Behavioral Code Annotation for the counselor's utterance based on previous context and the provided utterance.

Here are the MITI Behavioral Codes for your reference:

- Advise with Permission: Offer advice, suggestions, or possible actions after obtaining the client's permission. For example, "Consider starting with small, manageable changes like taking a short walk daily."
- Advise without Permission: Give advice, makes a suggestion, offers a solution or possible action without the permission of client. For example, "You could ask your friends not to bring drugs when they come over."
- ... (this part is removed for space conservation) ...
- Filter: Say something not related to behavior change. For example, "Good morning!"

Context from the previous session:

[context]

Counselor's utterance to annotate:

[utterance]

Please select the most appropriate MITI Behavioral Code for the given counselor's utterance. While multiple codes may apply, choose only the primary one.

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Table 41: Prompt for GPT-4o to annotate the MITI behavior code for a given utterance. The [context] placeholder will be replaced with the previous session context, and the [utterance] placeholder will be replaced with the utterance to be annotated.



	SO↑	TA↑	Depth↑	Smoothness↑	Positivity↑	Arousal↑
HQ	0.76	0.78	4.21	5.13	4.67	4.01
LQ	0.41	0.48	3.43	3.11	3.60	3.63
GPT-4o Based Counselor						
Base	0.66	0.69	3.26	4.33	4.30	3.47
DIIR	0.65	0.68	3.32	4.17	4.13	3.48
CoS	0.68	0.71	3.37	4.42	4.31	3.60
CAMI-TE	0.69	0.71	3.42	4.47	4.35	3.63
CAMI	<b>0.72</b>	<b>0.75</b>	<b>3.63</b>	<b>4.82</b>	<b>4.43</b>	<b>3.71</b>
Llama-3.1 70B Based Counselor						
Base	0.58	0.61	2.93	3.24	3.71	3.12
CoS	0.63	0.63	3.08	3.40	3.84	3.23
DIIR	0.61	0.57	3.02	3.08	3.37	3.18
CAMI-TE	0.61	0.59	3.09	3.13	3.49	3.23
CAMI	<b>0.68</b>	<b>0.68</b>	<b>3.47</b>	<b>3.88</b>	<b>3.97</b>	<b>3.66</b>

Table 42: Results of the client experience assessment, including session outcome (SO), therapeutic alliance (TA), and self-reported feelings scores. The self-reported feelings scores include Depth, Smoothness, Positivity, and Arousal.

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### Cultivating Change Talk

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- 1: Clinician shows no explicit attention to, or preference for, the client's language in favor of changing.
  - 2: Clinician sporadically attends to client language in favor of change – frequently misses opportunities to encourage change talk.
  - 3: Clinician often attends to the client's language in favor of change, but misses some opportunities to encourage change talk.
  - 4: Clinician consistently attends to the client's language about change and makes efforts to encourage it.
  - 5: Clinician shows a marked and consistent effort to increase the depth, strength, or momentum of the client's language in favor of change.
- 

Table 43: Cultivating Change Talk Scores and Descriptions.

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### Softening Sustain Talk

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- 1: Clinician consistently responds to the client's language in a manner that facilitates the frequency or depth of arguments in favor of the status quo.
  - 2: Clinician usually chooses to explore, focus on, or respond to the client's language in favor of the status quo.
  - 3: Clinician gives preference to the client's language in favor of the status quo, but may show some instances of shifting the focus away from sustain talk.
  - 4: Clinician typically avoids an emphasis on client language favoring the status quo.
  - 5: Clinician shows a marked and consistent effort to decrease the depth, strength, or momentum of the clients language in favor of the status quo.
- 

Table 44: Softening Sustain Talk Scores and Descriptions.

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**Partnership**

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- 1: Clinician actively assumes the expert role for the majority of the interaction with the client. Collaboration or partnership is absent.
  - 2: Clinician superficially responds to opportunities to collaborate.
  - 3: Clinician incorporates client's contributions but does so in a lukewarm or erratic fashion.
  - 4: Clinician fosters collaboration and power sharing so that client's contributions impact the session in ways that they otherwise would not.
  - 5: Clinician actively fosters and encourages power sharing in the interaction in such a way that client's contributions substantially influence the nature of the session.
- 

Table 45: Partnership Scores and Descriptions.

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**Empathy**

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- 1: Clinician gives little or no attention to the client's perspective.
  - 2: Clinician makes sporadic efforts to explore the client's perspective. Clinician's understanding may be inaccurate or may detract from the client's true meaning.
  - 3: Clinician is actively trying to understand the client's perspective, with modest success.
  - 4: Clinician makes active and repeated efforts to understand the client's point of view. Shows evidence of accurate understanding of the client's worldview, although mostly limited to explicit content.
  - 5: Clinician shows evidence of deep understanding of client's point of view, not just for what has been explicitly stated but what the client means but has not yet said.
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Table 46: Empathy Scores and Descriptions

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**Motivation Topic Exploration**

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- 1: Counsellor fails to explore.
  - 2: Counsellor tried but was not effective in determining the right motivation topic.
  - 3: Counsellor tried but was partially effective.
  - 4: Counsellor is close to determining the right motivation topic.
  - 5: Counsellor successfully determines the right motivation topic.
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Table 47: Motivation Topic Exploration Scores and Descriptions

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**Success in Eliciting Change Talk**

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- 1: Failure in eliciting change talk.
  - 2: Partial success in eliciting change talk.
  - 3: Success in eliciting change talk.
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Table 48: Success in Eliciting Change Talk Scores and Descriptions

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**Counselor Realism**

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- 1 (Highly Unrealistic): Language, tone, and responses are completely mechanical, lacking empathy or relevance. The counselor's responses are not adapted to client input at all.
- 2 (Somewhat Unrealistic): Language, tone, and responses are often robotic, repetitive, or overly generalized, with limited adaptation to client input.
- 3 (Moderately Realistic): Language, tone, and responses are mostly accurate and somewhat conversational but often mechanical. The counselor may miss emotional cues and occasionally lapse into generic advice or inconsistent empathy.
- 4 (Mostly Realistic): Language, tone, and responses are reflective of a human counselor with occasional minor inconsistencies, mechanical phrasing, or lack of emotional nuance.
- 5 (Highly Realistic): Language, tone, and responses are indistinguishable from a human counselor. The counselor's responses are empathetic and personalized to client input.
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Table 49: Counselor Realism Scores and Descriptions

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**Client Realism**

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- 1 (Highly Unrealistic): Language, tone, and responses are completely mechanical, lacking any emotional depth or relevance to the client's background and stage of change. The client's responses do not resemble those of a real person, showing no awareness of context or emotional engagement.
- 2 (Somewhat Unrealistic): Language, tone, and responses are often robotic or repetitive, showing limited emotional nuance. Attempts to align the client's responses with the background and state of change are poorly executed.
- 3 (Moderately Realistic): Language, tone, and responses mostly align with the client's background and stage of change but often lack variability or emotional depth. The client's responses may feel too predictable or exhibit excessive compliance or resistance.
- 4 (Mostly Realistic): Language, tone, and responses are believable, with occasional minor inconsistencies, unnatural phrasing, or a lack of emotional depth in relation to the client's background and stage of change.
- 5 (Highly Realistic): Language, tone, and responses are indistinguishable from a human client. The client's responses are complex and express emotions that are appropriate to the client's background and stage of change.
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Table 50: Client Realism Scores and Descriptions

Turn ID	Utterances
1	Counselor: Hello. How are you?
2	Client: I am good. What about you?
3	Counselor: I'm doing well, thanks for asking! Can you share how you've been feeling about your health lately, especially in relation to smoking?
4	Client: I've been pretty busy with work and juggling family stuff. Sometimes I just think about how nice it is to take a break with my coworkers outside, chatting and during those moments, life feels a bit more relaxed. You know how it is—it's nice to unwind.
5	Counselor: It sounds like smoking is a comforting routine for you amidst your busy life with work and your daughter. I wonder how it might impact the time you spend with your family.
6	Client: I get what you mean, but I really don't see my smoking as an issue. It helps me manage stress, and I don't think it affects my time with my daughter. We still have good moments together, and I wouldn't want to change that.
7	Counselor: It sounds like you find comfort in smoking to manage stress, and that feels crucial to your parenting now. I wonder, though, how you might feel if your daughter started to see smoking as a way to unwind, too. What impact would that have on your relationship with her?
8	Client: That's a tough thought. I remember starting young and how hard it was to quit later. I wouldn't want that for her. It makes me reflect on what I'm modeling.
9	Counselor: It's great that you're reflecting on your modeling for your daughter. Perhaps seeing smoking as something that may weaken your bond could help reshape how you approach stress—considering healthier ways to connect can actually strengthen your relationship and set a positive example for her.
10	Client: I appreciate that perspective. I do want to set a strong example for her. My experience with my own family and their struggles makes me cautious. I see the patterns and don't want her to feel that smoking is a go-to solution for stress, like I did.
11	Counselor: It sounds like your family's struggles have really shaped your perspective on smoking. You want to protect your daughter from those same patterns, knowing that smoking can not only impact her stress management but also her overall learning and adaptation to challenges. That's a powerful motivation.
12	Client: Exactly. I want her to learn healthier coping strategies instead of following in my footsteps. I realize that I need to make a change for both our sakes. It's not just about me; it's about creating an environment where she can thrive without those habits. It's time to find better ways to manage stress that we can share together.

Table 51: Counseling Session between CAMI and a Simulated Client.

Profile Item	Description
Behavioral Problem	Smoking
State of Mind	Precontemplation
Personas	You smoked when you were young.", "You have a 12-year-old daughter. The friends of the your daughter have tried smoking. When you are at work, you all go out and smoke and chit chat and talk about things. You like to have a cigarette after eating.
Motivation	You are motivated because of the risk of smoking in habituation for your daughter, as you don't want your daughter to think smoking is good thing.
Beliefs	You feel smoking enjoyable and relaxing. You would be left out if you would hate to not smoke. You use smoking as a way to manage weight and control eating habits. You have been smoking for a long time and feels it's almost impossible to quit.
Motivation Topics	Interpersonal Relationships, Parenting, Habituation

Table 52: Client's Profile in the Example.

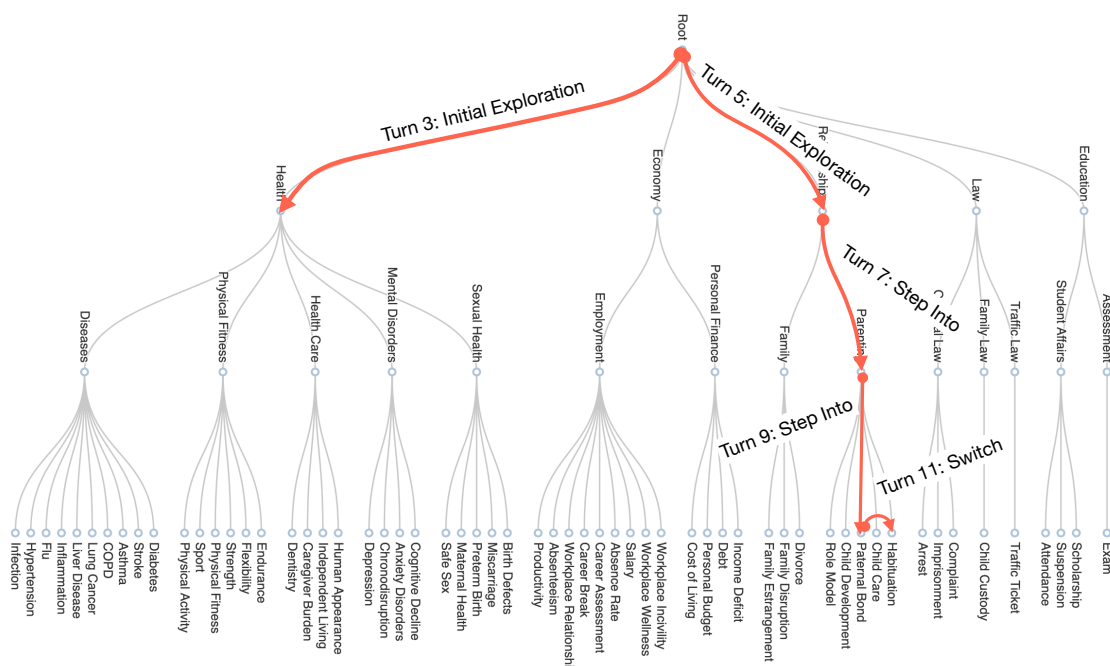


Figure 3: Topic Exploration Path by the Counselor in the Example.