Collaborate or compete

Game design paradigms for knowledge elicitation using LLMs

Literature review

Background

• **Games with a purpose (GWAPs)** - games designed to transform players' engagement in video games into distributed human computation to solve large-scale computational problems, making tasks more engaging and motivating by framing them as games rather than problems [1].

• **Knowledge elicitation** - process of extracting knowledge from individuals, using various techniques to convert data into explicit and usable knowledge [2].

• Game designs :

  • **Collaborative**: Focuses on team structure with a unified goal, where success is determined by the team's collective performance [3].

  • **Cooperative**: Requires teamwork to achieve common goals but does not guarantee equal or any benefits for non-cooperating players. The collective goal is usually more attractive than individual objectives [3].

  • **Competitive**: Involves direct competition between players, with the primary objective being to outperform opponents, often creating a zero-sum environment [4].

The **problem** emerges during the game design phase, as the game must be designed to be engaging and entertaining for players in order to maximize the knowledge collection [1].

The **goal** of this research is to summarize all of the necessary information and provide a concise description of the design principles useful for creation of **GWAPs for knowledge elicitation using LLMs**.

Research questions

What collaborative, cooperative, and competitive designs can be used for knowledge elicitation using LLMs?

- What are the benefits of each game design (collaborative, cooperative, competitive)?
- How can LLMs be incorporated into games?
- What impacts the efficiency of knowledge elicitation?

Methodology

• **PRISMA** systematic research workflow was chosen, because it provides a structured approach to conducting a literature review, ensuring that all relevant studies are considered and that the review process is replicable [5].

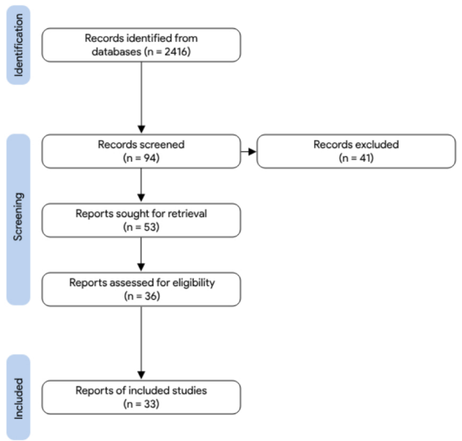

Figure 1: Applied PRISMA flow diagram

• **Keywords**: "knowledge elicitation", "large language models", "game with a purpose", "collaborative", "cooperative", "competitive". These keywords have been specifically chosen to target the essential elements of the research topic and formulate exhaustive search queries.

References

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Findings & Implications

• Due to the nature of **collaborative** and **cooperative** game designs [3], they might be preffered for eliciting knowledge from group interactions and behaviours.

• The design of **competitive** games [4], makes them useful in eliciting knowledge from individual behaviours in specific scenarios (e.g., pandemics, hostage situations).

• Player motivation does not change based on whether a **competitive** or **casual** design is chosen [6], thus the choice of the game design does not impact player's engagement and playtime.

• Current limitations of **large language models** do not allow them to efficiently act as a rational player [7].

• A significant research gap exists in **LLM-powered environments** for games [8].

• The application of **LLMs** as **non-player characters** [9] remains promising in non-competitive, adventurous environments due to their dynamic text generation.

Conclusions

In this review, we explored the incorporation of **large language models** into **games with a purpose** for enhanced **knowledge elicitation**. We found that **collaborative** and **cooperative** game designs allow for the elicitation of a wider variety of knowledge types compared to **competitive** designs. Although **LLMs** are currently inefficient as **rational players**, they show promise in acting as **NPCs**. Moreover, the choice of game design is irrelevant for the level of player engagement.

Future work should address improving **LLMs**' reliability in adapting to new patterns and decision-making to enhance their applicability as **rational players**. Additionally, future research should explore the promising topic of **LLM-powered game environments**. By investigating these areas, we can unlock new potential for **GWAPs**, benefiting a range of fields through innovative knowledge elicitation techniques.

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