The Ink Splotch Effect: A Case Study on ChatGPT as a Co-Creative Game Designer

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AIM

- Determine whether a general AI tool such as OpenAI's ChatGPT tool could create a game with a genuine, well-defined creative vision with little to no influence from the user.

- If so, how would those creative choices compare to ones made by a designer instead?

BACKGROUND

Collaborative Game Design

Collaborative Game Design is that AI agents interact in the development process with the game designer by generating or modifying some aspect of the game.

In past works, it has typically been applied to level design, or for developing entire games.

BACKGROUND

Designer Intent

The designer’s intent is expressed through the different aspects of the game such as the game’s art, music, level design, narrative, and general gameplay.

When automating game design by AI, maintaining the original game designer's intent is a challenge.

Various other works have looked to model and expand the creative intent of the designer and apply the output to generative game content or games themselves and then evaluate them on the player experience

BACKGROUND

LLM-Assisted Game Content Generation

The development and growing accessibility of LLMs for the use of content generation has become increasingly relevant in game design.

Most of the use cases of LLMs in PCG are used to generate game assets and more abstract content such as suggesting game features.

METHODOLOGY

Create three game genres:

- The platformer
- The space shooter
- The roguelike

Each genre had three games:

- A baseline game
- A pure human-designed game
- A game made from ChatGPT suggestions

The games were designed with minimalist graphics.

METHODOLOGY

- Request code implementation for up to 5 different features for each game.
- If a bug arose from any of the generated code, up to 3 attempts could be made to ask the program how to fix the error, after which its failure to do so would be noted.
- Request 1 general explanation of the provided code and could ask once which game feel elements should be associated with the feature.

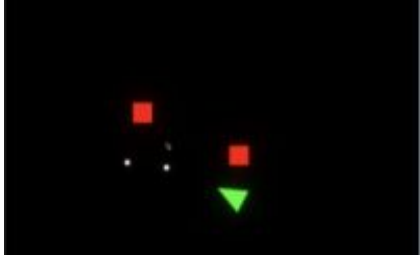
METHODOLOGY

Space Shooter - Game Prompt

Create a fast-paced, top-down shooter with 3 special abilities. Each ability should have a short cooldown. The goal is to survive for as long as possible while enemies randomly spawn into the scene and chase the player.

METHODOLOGY

Space Shooter - *Base Game*



1. Standard movement and a short-ranged omnidirectional dash.
2. Faces towards the mouse position, and fires a bullet in the same direction when pressing a button.
3. Pressing and holding the mouse button, fires bullets at a constant rate.
4. Enemies spawn at set intervals, from any one of 9 evenly spaced spawn points.
5. Enemies go to the player's position and are destroyed when they either hit and damage the player, or are shot by a bullet.
6. The game featured a black background and simple geometric shapes for all elements with no effects.
7. The only UI element was a countdown on the top left indicating the player's current health.

METHODOLOGY

Space Shooter - *Human-Designed Game*

1. Adding effects like shaking the screen any time an enemy was hit, triggering an explosive particle effect when enemies were killed, etc.
2. Incorporating a short, screen-wide glitch effect during enemy-player collision.
3. Creating ability comes from the elemental of "cold", "fire", and "wind" and these occur with appropriate sound effects and specialized particle effects:
   a. The cold ability freezes all enemies currently on screen in an instant and changes their colour to blue.
   b. The wind ability pushed all enemies away from the player and white lines from the centre outwards.
   c. The fire ability produced an arc of flames around the player and destroyed enemies on impact.
4. Cooldowns for abilities were visually indicated on the UI and each skill had a different cooldown time based on how powerful the ability was.

METHODOLOGY

Space Shooter - *ChatGPT Guided Game*

1. Creating the base game mostly worked out, especially setting up a more robust enemy spawning system.
2. The program made bugs like the player's rotation did not exactly match the mouse position.
3. ChatGPT suggested abilities:
    a. Teleportation: Instantly jump to a different location on the screen, useful for escaping dangerous situations or repositioning strategically.
    b. Nanobot Repair: Activate a healing ability that slowly restores your ship’s health over time.
    c. Time Manipulation: Slow down or temporarily freeze time to dodge bullets, aim precisely, or gain a tactical advantage.
4. Problems when implementing:
    a. Teleportation did not achieve the desired effect.
    b. Later, the same ability caused the player to disappear every time it was activated.
        =>The problem was fixed manually by recognizing the player’s location on the z-axis was being changed during teleportation.
5. Vague instructions for adding particle and sound effects:
    a. Basic suggestions such as having the teleport look like "a burst of stars or particles that appear and disappear quickly" were provided, but without detailed instructions on how to achieve them.

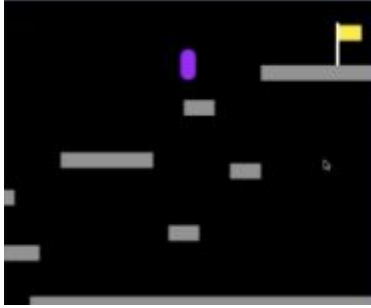
METHODOLOGY

Platformer - Game Prompt

Create a simple platformer where you need to reach the flag to win. Develop 3 transformative mechanics to the player which change their platforming. Design a short level that takes these abilities into accoun

METHODOLOGY

Platformer - *Base Game*



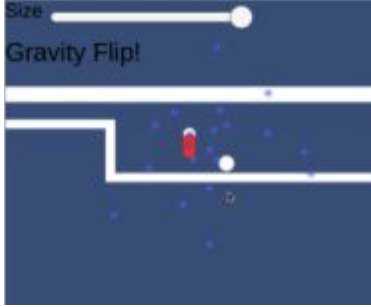
1. Contains only horizontal movement, gravity, and a jumping mechanic to allow the player to traverse floating platforms found in the level.
2. The player falls off the level, they are respawned to the original starting point.
3. Like the base space shooter game, the base platformer game contains no particle effects, sound effects, or any other elements of noticeable game feel.
4. The only UI is a transparent screen that tells the player when they have won the game.

METHODOLOGY

Platformer - *Human-Designed Game*

1. Adding "coyote jumping".
2. Creating ability comes from shape-shifting and these occur with appropriate sound effects and specialized particle effects and animations:
   a. The shrinking ability allows the player to traverse thin crevices, but makes the jump much smaller.
   b. The growing ability enables the player to pass through certain environments, but makes the jump proportionally higher.
   c. The hang glider ability added the shape of an umbrella on top of the character and allowed the player to extend their jumps by descending at a slower rate than normal.

METHODOLOGY



Platformer - *ChatGPT Guided Game*

1. Occurring the following problems when recreating the base game:
   a. Provided code for a 3D project despite multiple reiterations that the game was in 2D.
   b. Did not produce a reliable method of following the player with the camera.
2. ChatGPT suggested abilities:
   a. Time Manipulation: No meaning because this game has no enemies.
   b. Size Manipulation: Having two states, "normal" and "giant".
   c. Flip Gravity: Making the direction of the gravity opposite.
3. Problems when implementing:
   a. Flip Gravity only worked in one direction when implemented exactly as described. =>Recognized the need to flip the player character over the x-axis when on the roof for the code to operate correctly.
4. ChatGPT suggested the game have a section which was too narrow for the player to fit through if they were in their "giant" state. However, it did not suggest that the level should feature an area that was not traversable by the "normal" state.

METHODOLOGY

Roguelike - *Game Prompt*

Create a turn based stealth roguelike where the player must collect a key and then head to an exit to escape, all while avoiding patrolling enemies. The player can collect or recharge up to 3 abilities, but they must be stealth related. The player can also engage in direct combat with enemies.

METHODOLOGY

Roguelike - *Base Game*

1. Rooms of a random size are procedurally generated and connected with corridors using a binary-space partition algorithm.
2. The player's and enemies' movement and combat are turn-based.
3. The player can move in any directional space.
4. The player can also skip a turn and remain on the same tile.
5. To win the game, the player must find a randomly placed key, survive combat from enemies, and then use the key to unlock a randomly placed door.
6. If the player loses too many health points, they lose the game.
7. Enemies are randomly placed in the rooms, move in a random direction every 3 turns, and follow the player when they are within 5 spaces of them.

METHODOLOGY

Roguelike - *Human-Designed Game*

1. Created three abilities occur with appropriate sound effects and specialized particle effects:
   a. The invisibility ability makes the player invisible and makes the enemies lose sight of the player and continue on random patrol paths. If the player attacks enemies in the invisible state, instantly remove the invisibility effect.
   b. The smoke bomb ability makes all enemies inside the effect's radius completely stop and limits enemy sight lines. Even if the player directly attacks them, they are not able to identify the player's location. This was offset by a longer cooldown.
   c. The shuriken ability can be used for long-ranged combat and shows a line renderer indicating the player's aim.
2. Adding some sound effects and the user interface.
3. To incentivize combat, killing enemies shortened all cooldown times by a sizeable amount.

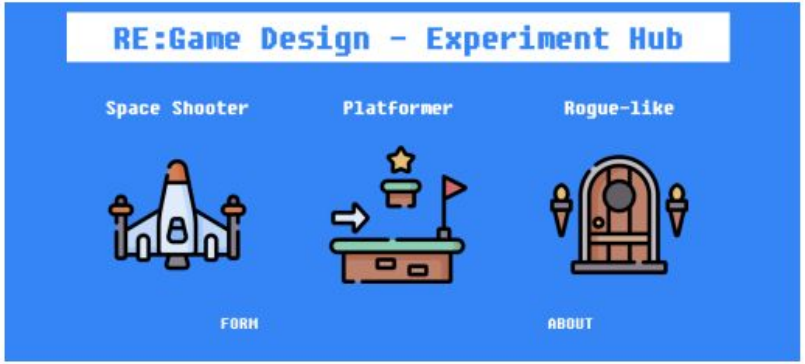
METHODOLOGY

Roguelike - *ChatGPT Guided Game*

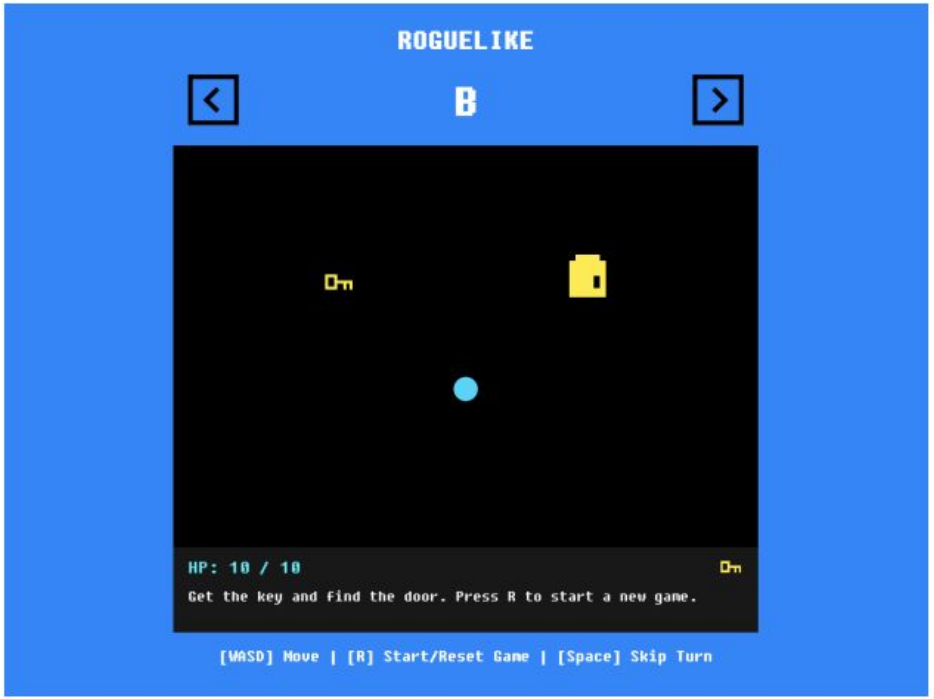
1. ChatGPT was unable to recreate the original design of the base game so the original Base Game was used as a starting point.
    a. It could not understand the 'turn-based' nature of the game and apply it to a real-time Unity game engine context.
    b. It was unable to correctly implement the binary-space partition algorithm for the rooms and the turn-based enemy AI movement.
2. ChatGPT suggested implementing a temporary invisibility feature.
3. ChatGPT suggested an energy system where players would need a certain amount of energy points in order to engage in combat and turn invisible.
4. In addition to the random chance to regain health from defeating an enemy, ChatGPT suggested that the player should have a chance to increase their energy restoration rate, decrease their energy consumption, or increase the invisibility time duration as an alternate reward.
5. Two suggested features could not be implemented due to bugs and a context misunderstanding:
    a. A shortcut algorithm allows the player to take an alternate path from the generated rooms.
    b. An enhanced enemy AI patrolling feature.
6. ChatGPT suggested adding game-feel elements:
    a. Character animation, UI indicator, colour-changing effects, proximity-based sound effects

EXPERIMENT DESIGN AND USER STUDY

Website



(a) Screen-capture of the website where users could play each of the 9 games and provide feedback.



(b) The base roguelike game labeled as 'B' on the website. Instructions and links to the form and home page are located below the game.

EXPERIMENT DESIGN AND USER STUDY

Survey

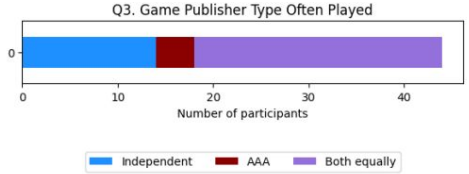
Table 1: Demographic survey questions asked in the user study separated by general topic.

Q#	Question
Q1	On average, how often do you play video games?
Q2	What are some of your favorite genres of video games to play?
Q3	What type of games do you play more? Independently made games or triple-A games?
Q4	What is your level of game design experience?
Q5	What kinds of games do you design?
Q6	Have you ever submitted a game or prototype to a game jam (either leisurely or for an assignment)?
Q7	Have you ever used an AI-assisted content generation tool?
Q8	On average, how often do you interact with a large language model?

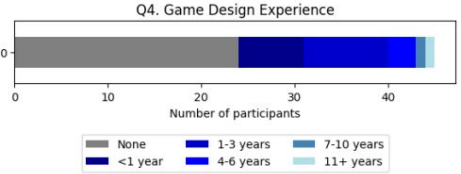
USER STUDY RESULTS

Demographic Information

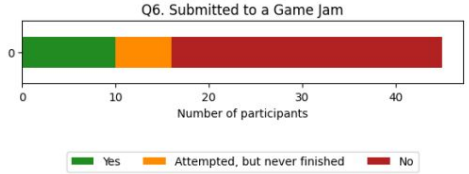
(a) Average time per week participants played video games (Q1)



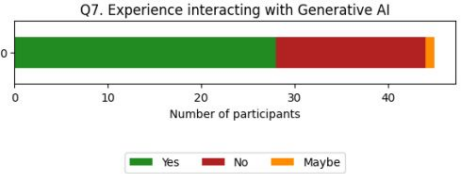
(b) Report of the types of games often played by participants (Q3)



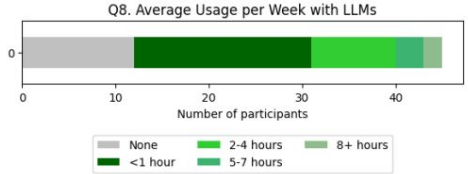
(a) Level of game design experience of participants by years (Q4)



(b) Experience submitting a prototype game to a game jam (Q6)



(a) Level of game design experience of participants by years (Q7)



(b) Experience interacting with LLMs averaged on a weekly basis (Q8)

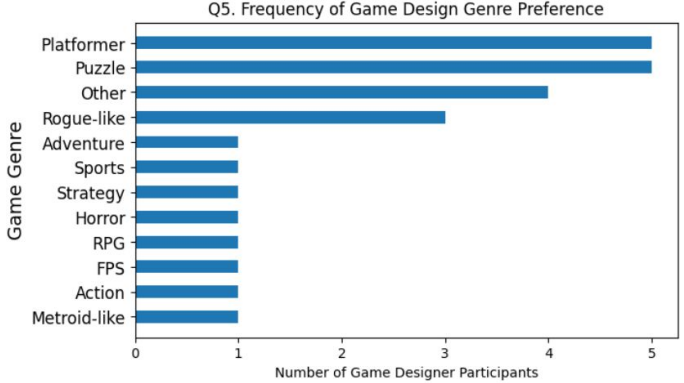


Figure 7: Frequency of reported genres designed from game designer participants.

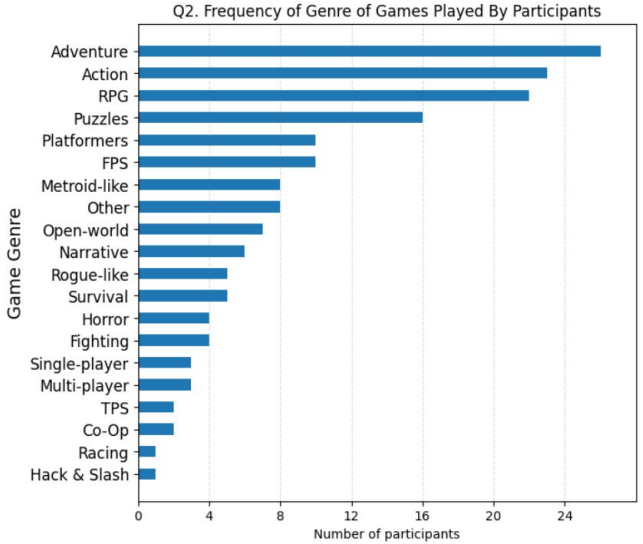


Figure 6: Frequency of preferential genres of games to play from all participants.

USER STUDY RESULTS

Game Ranking

Table 2: Scores for each game and genre using the formula S_G and category criteria Models with the highest score are colored in green, second highest in yellow, and lowest in red.

	Space Shooter			Platformer			Roguelike (%)		
	Human	ChatGPT	Base	Human	ChatGPT	Base	Human	ChatGPT	Base
Overall Preference	110	88	48	97	77	57	87	77	64
Game Feel	108	85	48	86	73	75	92	71	65
Innovation	93	95	49	104	76	48	93	65	52
Thematic Cohesion	91	80	63	98	66	58	79	66	65
Most Interesting Abilities	101	92	47	103	85	46	96	65	55
Visual Presentation	107	83	50	98	56	68	83	75	58

$S_G = 3V_B + 2V_M + V_W$

V_B is the number of “Best”.
V_M is the number of “Mid”.
V_W is the number of “Worse”.
S_G is the final score.

USER STUDY RESULTS

Participant Feedback and Comments

1. Space shooter games:
   a. 91% of comments concerned the player's "ability".
   b. 70% of comments pertained to the "feel" of the game.
   c. Participants commented positively on the “cool animations” and “interesting” -ness of the abilities of the game.
   d. Some participants had issues with the controls and accessibility of the game.
2. Platformer games:
   a. All of the comments concerned the "feel" of the game and half concerned the "level".
   b. A majority of the comments were negative.
   c. Some participants stated the controls were too “confusing” and “horrendous” – particularly in the ChatGPT-suggested and the human-designed platformer games.
3. Roguelike games:
   a. 26% of comments pertain to the feel of the game and 21% related to the "time" of the game.
   b. Many of the comments related to the “feedback” given by the game to players and the general “combat.”
   c. There were some complaints about “broken levels” in the games, a possible generation error from the PCG levels.

DISCUSSION

Human-ChatGPT Game Genre and Game Engine Knowledge Base

ChatGPT can only hallucinate "reasonable" game design decisions.

ChatGPT can suggest code because of the large breadth of online resources of Unity available.

The human implemented "coyote jumping" because the jump felt off.

Enemy spawn points were placed off-screen. However, it was not suggested by ChatGPT.

They recommend ChatGPT as a tool for ceceptual game ideas or for writing pseudocode.

DISCUSSION

Design Approach

An important distinction between human and AI designers comes in the designer's ability to pursue the right ideas, and their proclivity to remix existing ideas which better serve their creative vision.

Having access to both human and AI designers would certainly allow the developer to make the most informed decision.

DISCUSSION

ChatGPT as an Ink Splotch

AI can be the source of ideas like ink splotch.

The human designers did not consider non-offensive options for abilities and nearly instantly began to absorb AI's suggestion into their theme.

The human designer continued to curate the game and understand the importance of theme and consistency, while the AI provided an uninhibited list of recommendations to jumpstart that creative process.

FUTURE WORK

In the future, they would tackle experiments which better recreate real-life scenarios of human-AI creative collaborations and how they impact both the developers and the audience.

CONCLUSION

Human-designed games are better than AI guided games.

AI could act as a sufficient replacement for humans in game design

The AI games had enough appeal for players to want to see them explored in full.

However, AI can have an effective role in the creative process of game-making without undercutting the work of game developers.

Thank you for your attention!