Exploring Automation in Digital Tabletop Board Games

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Abstract
Digital tabletops present the opportunity to combine the social advantages of traditional tabletop games with the automation and streamlined gameplay of video games. However, it is unclear whether the addition of automation enhances or detracts from the game experience. A study was performed where groups played three versions of the cooperative board game Pandemic, with varying degrees of automation. The study revealed that while game automation can provide advantages to players, it can also negatively impact enjoyment, game state awareness, and flexibility in game play.

Keywords
Tabletop display, interaction design, gaming, automation.

ACM Classification Keywords
H5.2. User Interfaces.

General Terms
Design, Experimentation, Human Factors.

Introduction
Traditional tabletop gaming is a social activity. Players gather around a table and collaboratively create a shared, engaging, and entertaining experience, in which their actions are conveyed through tangible interactions with physical objects. Large horizontal digital surfaces present the opportunity to design

games that combine the social advantages of traditional tabletop games with the more engaging gameplay, dynamic visuals and interactions of video games. Recent digital conversions of traditional tabletop games for interactive surface platforms, including RealTimeChess (Chaboissier & Vernier, 2009) and False Prophets (Mandryk & Maranan, 2002) , demonstrate that these are promising platforms for board games.

Automation and Board Games

After an initial survey of commercially available digital versions of board games, we identified four uses for automation that could enhance gameplay as the target for investigation:

- ***Performing complex or routine in-game activities*** such as setting up the game, shuffling cards, placing game objects to carry out in-game events, or managing resources such as money.
- ***Acting as an impartial referee.*** Keeping track of all of the rules of a game can be a burden, even for experienced players; automation enables the impartial enforcement of rules.
- ***Automating game progression.*** Keeping track of what the players are currently doing in the game.
- ***Digital media can provide a more dynamic sensory experience*** through the use of sound and animation for score boards, events or in-game prompts, and can personalize information to meet the needs of each player.

Study: Automation and Gameplay

To explore how automation impacts play, we conducted a within-subjects, mixed-methods study where 12 groups of 3 players were asked to play the board game Pandemic using three different interfaces.

Figure 1: The board game Pandemic. Interface elements include: A) infection cubes, B) player pawns, C) infection draw pile and infection discard pile, D) player draw pile and player discard pile, E) infection rate counter, F) outbreaks counter, G) cure discovery indicator, H) player hand.

The first interface was the original, commercially available board game (Figure 1). The traditional board game consists of many game pieces including two card decks, four sets of disease cubes, two counters, and other miscellaneous player pieces. Players take on the role of emergency response personnel fighting a global epidemic, and are asked to treat and cure four diseases before they spread across the world map.

The first digital interface, called the *low automation* interface (Figure 2), was designed to closely resemble the tangible interaction of the original game. All game objects are represented as digital artefacts that players manually drag around the board. With the low automation interface, only the shuffling of decks and initial board setup are automated; players enforced rules and managed game progression themselves.

Figure 2: The Low Automation interface. This version closely resembles the physical board game, but is played using pens on a digital tabletop. Differences between the Physical interface and this interface include: A) on-board storage areas for unused disease cubes; and B) automation of deck interactions, including drawing cards from the top/bottom of the deck and shuffling.

The second digital interface, the *high automation* interface (Figure 3), incorporated more automated features of the game. This version contained all of the automated features of the low automation interface, as well as automated rule enforcement, management of game pieces, and animations of automated game events. Both digital interfaces were designed to run on a large interactive digital tabletop computer that used Anoto-digital pens to capture user input (Haller, Brandl, Leithinger, Leitner, & Seifried, 2007).

All groups played their first game with the physical board game, and games played with the two digital interfaces were counterbalanced to reduce learning effects.

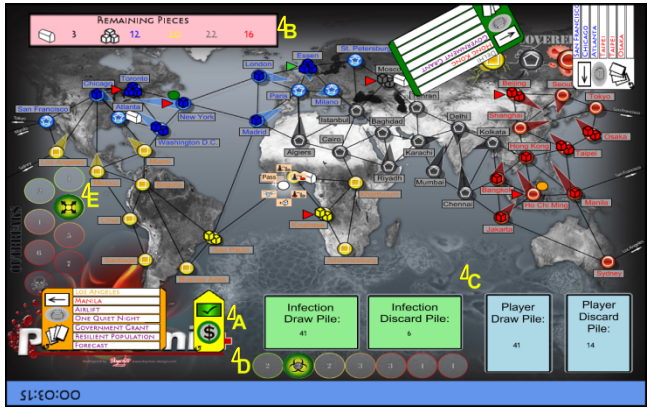

Figure 3. The High Automation interface. Several forms of automation were incorporated into this interface, including: A) action pointers to carry out special card actions; B) counts of remaining pieces were displayed in one corner of the board; C) player and infection card "piles" and discard piles were maintained by the interface; D) infection rate counter; and (E) outbreak counter.

Preliminary Results

Our initial analyses provided feedback on each of the four identified uses of automation. Overall, participants reported liking the automation of in-game activities. For example, 11/36 participants reported liking that game objects were automatically placed. The automation of routine activities significantly reduced the level of effort required to play Pandemic, at the expense of players' enjoyment. Participants reported that they had more fun playing the physical game than the high automation interface, and that they liked that the low automation interface was more like the board game. Players also reported feeling that playing the physical game took less effort than the digital games. We interpret these difficulties as the design considerations in adapting board games to the digital platform.

Moreover, automation changed the game flow. In the physical and low-automation versions of the game, players discussed strategies as they carried out their turns. However, in the high-automation interface, players would sometimes miss automated actions (indicated by animations in the interface). This often led to player confusion, especially after complex events. Players would then need to take time to assess the game board to get 'caught up' with the new game state. Consequently, extended pauses occurred when, in the other two interfaces, players would otherwise be discussing strategy or taking game actions.

Players also consulted the rulebook less often in the high automation interface. However players' comments regarding incorrect implementations of the rules highlights a pitfall that removing players' from the rule interpretation process also prohibits the development of 'house rules', or the allowances made to novice or less capable players in more social settings. Participants used the flexibility of the physical or low automation interfaces to make sense of the current game state, and to facilitate decision-making processes.

Finally, the efficient use of game space is a particularly important design consideration for digital tabletops. When playing in the physical interface, players were not bound to the extents of the game board and often commandeered nearby space to store extra pieces, or to put down private or shared hands of cards.

Conclusions and Future Work

We ran a mixed-methods study in which we compared gameplay of the cooperative board game Pandemic across interfaces that incorporated varying levels of automation. The automation handled game events and progression, communicated the results through animation, and enforced rules. We found that while game automation can positively affect gameplay, it can also negatively impact player awareness and enjoyment of the game. We also identified areas where flexibility is particularly valuable at the interface level: in supporting 'House Rules', allowing users to manipulate the game board to strategize, and in providing a workspace that accommodates physical artefacts. In future work, we hope to explore in more depth how automation may impact gameplay. In particular, how can automation support novice and expert users differently? And do players take on different roles when playing games, and if so, how can we support those roles through automation?

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