Prototype: *Gemji*

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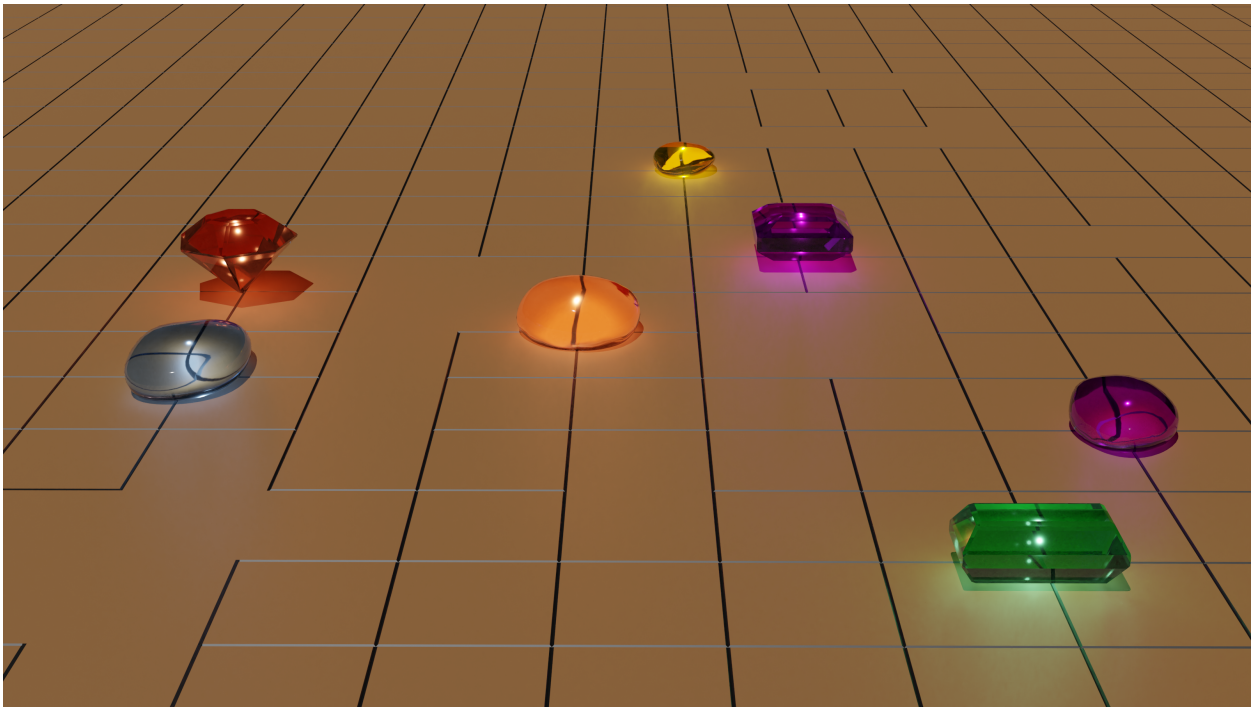

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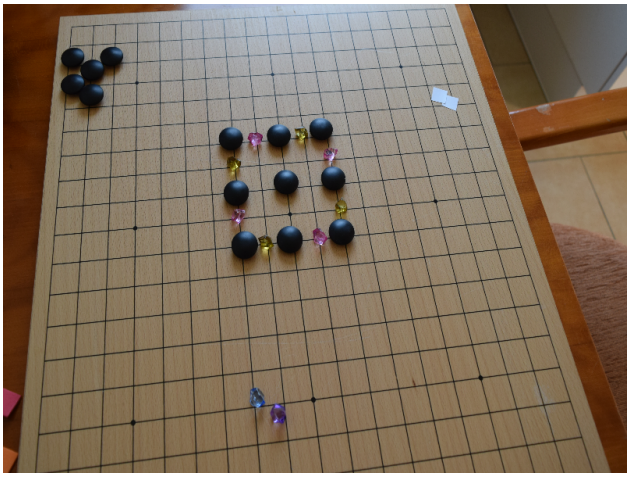
1 Prototype

With *Gemji* being a tile-based puzzle game we decided to build a real life approximation of what we had in mind for the game. The physical prototype stage was also something we were looking forward to in order to refine the test mechanics and rules that we had in mind. The gameplay concept we envision for our game is highly fitting for a phyiscal prototype which gave us ample opportunities to follow through with this approach. For simple levels one player was usually enough to enforce the rules and play the level at the same time. This encompasses the player move, activating the effects and considering the correct order of the chain reactions. Later on when we were testing more complex levels, one member was playing the level while the other team member was double-checking that the rules were implemented in the correct way. This allowed us to test several configurations for Gem effects and rule sets. In the following section we present the tools and materials we used as well as the levels we experimented with.

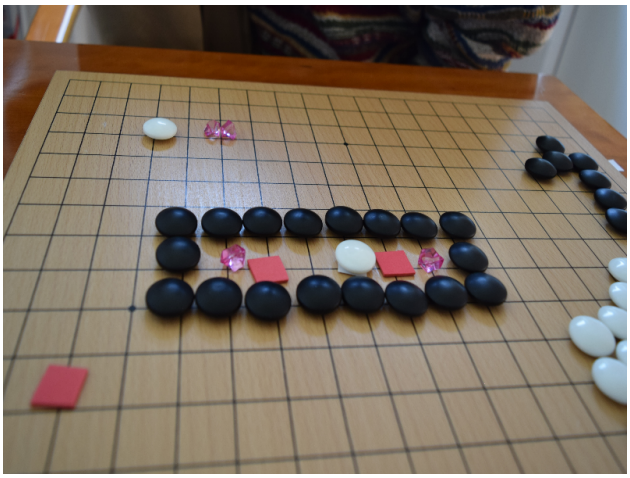


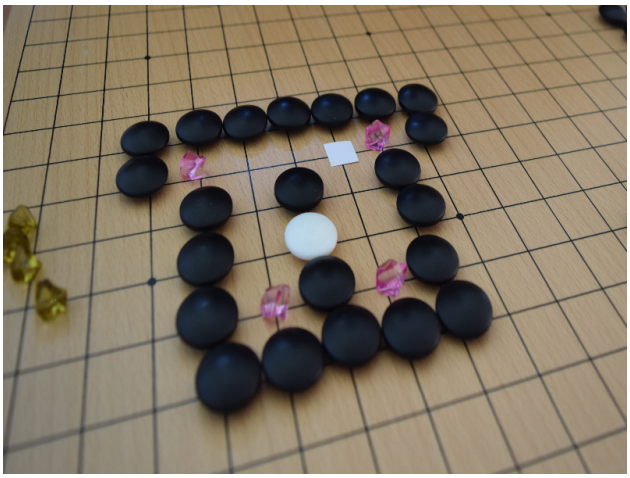
1.1 Prototype Setup

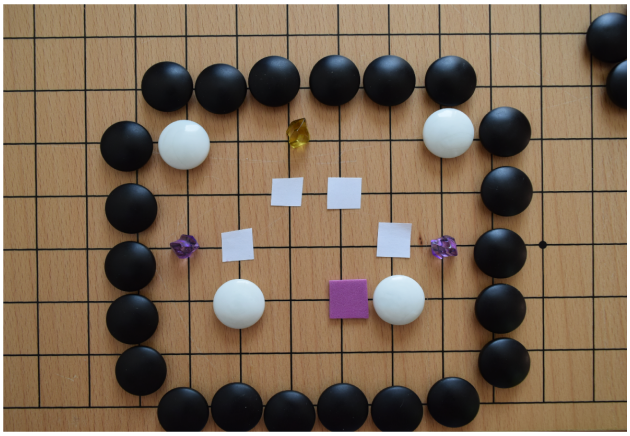
For the prototypes we used a Go board as basis. Additionally we had a variety of game tokens from other board games at our disposal which we used as Gems in our levels. To represent the finish tiles we cut out some paper and foam markers. Using the colors of the gems/stones we experimented with the following types:

- Red gems: push back adjacent gems by 1 tile
- Yellow gems: pull in gems that are at most 2 tiles away
- Blue gems: teleport back to the original position if the position remains free
- Purple gems:
  - if moved by an effect: swap position with the gem whose effect moved it
  - if moved by the player: swap position with the closest gem in clockwise order
- White stones:
  - cannot be moved by the player but by other effects
  - do not trigger other effects
- Grey gems: same as white gems but trigger other effects
- Black stones: serve as obstacles

1.2 Example Levels







2 Rules & Turn structure

To keep the gameplay consistent we had to agree on a specific set of rules that fit the gameplay we envisioned for *Gemji*. One of our goals was to create unexpected moments realised by the complexity of the chain reactions. At the same time we identified early on that we have to limit the length of the chain

reactions as infinite loops of reactions would otherwise occur. To limit the number of chain reactions we first had to define what a player's turn is.

2.1 Player Turn

1. The player's turn starts when the chain reactions & effects of the previous turn are done.
2. The player then selects a Gem that can be moved.
3. After the selection the player moves the Gem to one adjacent field on the board along the paths on the board.
4. The first effect to activate is the effect of the Gem that the player moved after it has reached the new position.
5. By resolving the effect of this first Gem the positions of the other Gems on the map (usually the neighbors) are influenced.
6. All the influenced Gems are then primed to activate their own effects and are put into the resolve queue going from closest to furthest.
7. This continues until the queue is empty and all effects in the queue have finished.

2.2 Rule set

When testing the prototype we realized that the specification for the order of the player's turn is not enough and we need further rules to create consistent gameplay. The main issues that had to be solved are explained in the following section.

2.2.1 Order of activation

When a Gem is resolving it's effect it can usually influence several other neighbouring Gems at the same time. Due to the underlying deterministic nature that we want to achieve for our game we needed to agree on a rule that determines in which order new effects are added to the resolve queue, which were triggered by the same effect. After our playtesting session we decided that a clockwise order would fit the game the best and also felt the most natural. Changing this rule could have consequences down the road in the way levels have to be approached by the players.

2.2.2 Infinite chain reactions

The problem of infinite chain reactions was an aspect that we were already aware of when we first sketched the base concept of the game. The two main ways we discussed to tackle this problem were either limiting the total amount of effects that could be activated per turn or limiting the effect activation for each Gem in each turn. After playtesting the physical prototype we decided on the latter option for now, by letting each Gem have it's effects only activated once per player turn. By limting the amount of effects in this way we realized that the game felt much more like a puzzle game. Additionally the order you chose to move the Gem was now much more significant and that the players would try to avoid the *chaos* of chain reactions by activating Gems in an *order* that minimizes interference.

2.2.3 Pattern of influence & neighbours

One important question we had to decide on, was the degree of freedom on which the Gems interact with each other. The physical prototype was played on a Go-board which has a regular pattern of nodes which each connect to four neighbouring nodes in horizontal and vertical directions. This was helpful when trying out the physical prototype as it clearly showed which Gems are neighbouring each other. After testing some levels of the prototype we decided that we want to stick to the four directions of interaction that the Go-board provided for both the movement and the consideration of what constitutes a neighbour and not allow for effects influencing Gems in diagonal directions. This limitation again had implications for the gameplay that we enjoyed during the testing session. One example of this were emerging gameplay patterns that allow the player to aptly move Gems around a corner and thereby not influencing other Gems.
Changing the layout of the map to allow an increased number of directions is something that could provide extra depth for the game in the 'Extra' Layer of development.

2.2.4 Move & Activate effect

During the testing of the prototype we realized that there are differences between an effect activated by a player move and one by a chain reaction. This is due to the fact that we want to incorporate Gems that affect another specific Gems, mainly the one that it was triggered from. This also means that we have to differentiate the effect for the player move and the chain reaction activation, when only the target that is designated. At the same time this could lead to interesting gameplay decisions for further Gem designs that we want to explore in the later parts of the project.

3 Observations & Revisions

As we tested our prototype, we made several observations that made us reflect on aspects of *Gemji*. These are elaborated on in the following.

3.1 Game Mechanics

When playing the game on a physical board we noticed that the game encourages the players to think about their moves rather than trying random things. This is due to the chaotic behavior of the Gems. Trying out random moves without thinking through the chains of actions that might happen, will result in an unexpected result most of the time.

In the levels we created until now we further noticed that the solutions avoid the chaotic effects by trying to move the Gems apart from each other so no unwanted chain reactions are set off. While this is already challenging, in the future we also want to create levels that use chain reactions to solve the levels instead of trying to avoid them.

3.2 Emergent Effects

A valuable outcome of this physical prototype was the knowledge that we gained about some emergent effects of the Gems. These are effects that a constellation of specific Gems has. For example a chain of yellow Gems in a line can form a train, when one end of it is moved along the line that the Gems form. We also realized, we can build simple logic gates using the Gems such as and-gates and or-gates, that transfer signals in the form of Gem activation impulses through a network of Gems. This can then be used as the key idea in a level. The player would have to notice the effect or meaning of the given constellation to solve the level.

3.3 Tool-assisted level generation

The levels we created for this prototype are quite simple. For most of them, there is a simple mechanic underlying the level design. It turned out to be very hard to create levels that are possible but at the same time challenging to solve. While this might be due to our own lack of knowledge of emergent effects between Gems, we decided to try a tool-assisted approach at level design.

We want to be able to quickly generate a large number of solvable levels, which we as a team can study together with the computer-suggested solutions, to get a better feeling about how Gems can interact with each other to solve levels.

Maybe some of these generated levels will find a place in the campaign of our game, but even if they do not, we still hope we will get valuable insight about level design.