THE HANDWAVEY GAME

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In this design case, we describe The Handwavey Game (Handwavey)—a tabletop, cooperative role-playing game created to study how people can come to converge on novel physical gestures around meaning. In Handwavey, players are novice wizards who cast spells through signaling abstract images with hand movements: success is rewarded in-game and failure has humorous in-game consequences. This case walks through the path of exploration and development from the starting point of a research question to the development of game mechanics and concludes with a set of design recommendations for people interested in designing novel games with specific research or learning meta-goals.

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INTRODUCTION

The Handwavey Game (Handwavey) was developed as part of a research study to explore sign creation and shared meaning making. We hypothesized that a well-designed role-playing game environment would provide a compelling context for learning to sign, but lacking an existing game to properly fit our needs meant that we would need to modify or develop a game explicitly to use for the study.

This paper describes the design case of Handwavey. It starts with the motivations of the study, a look at meaning-making in role-playing games, and the final design of *Handwavey*. It follows with the design process we took from the original motivations to the game itself. Finally, we conclude with lessons learned and the reactions of players.

MOTIVATING RESEARCH CONTEXT

The motivating study investigated the question "How do learners co-develop new gestural signifiers in contexts in which they are intrinsically motivated to do so?"

The co-development of meanings and learning new modes of communication is common in games. A large body of work in game studies has focused on the degree to which we do and do not take on different identities, modes of expression, and even values within games (Huizinga, 1938/1970). While school cultures come to share modes of signification over time, the timelines (seconds rather than days, months, or years) make the context distinct enough that games can provide an interesting window on how people generate that signification. The study followed other work in how informal learning environments can provide contextual grounding for signifying (Myers, 2006).

Thus, the goals of the study presented us with a design challenge—both to design a mode of communication open for the players to create for themselves as well as an engaging and satisfying game environment and rule-set that would incentivize and support its spontaneous and rapid development. Furthermore, allowing such freedom of creation must also include designing for moments of *failure* (as per Berland et al., 2013) tied to learning objectives so that we

might generate data that could be used to probe learners' thinking. More concisely, we had two design questions:

1. Which design features motivate players to communicate through learning new gestures?
2. How can we design a game to be self-evaluative, so that through game play, learners gather feedback in response to learning goals?

These two questions formed the foundation of designing *Handwavey*.

DESIGNING MEANING-MAKING IN ROLE-PLAYING GAMES

In a Role-Playing Game (RPG), players adopt the roles of characters and play out a story, typically sitting around a table with friends. They might be high-tech thieves, medieval heroes, or members of a small fishing village (Hardy et al., 2013; Wizards RPG Team, 2014; Vuga, 2013). These RPGs are, in some effect, a kind of mutual improv theatre, in which the director (often called "Game Master" or "Dungeon Master") adds complications and focuses the players. However, RPGs also typically feature game mechanics that restrict and constrain what unfolds. Some RPGs have many rules—they can look like modern board games with dice, boards, and figures– but in most RPGs, rules exist to resolve events. A detective is being chased, but can they slip away? You have gossiped about your neighbor; do they care? The rules determine outcomes, and RPG players accept and incorporate them into the story, even when unfortunate (the detective runs into a dead end and gets caught!) or unexpected (the neighbor overhears the slander!). As the majority of the game is (traditionally) conveyed verbally across people, players must continually negotiate meaning in constructing the narrative and rules. This negotiation can be implicit or explicit and is present in the way players communicate with each other, both verbally and nonverbally.

We wanted to harness and test this meaning-making as a feature. As such, we incorporate communication through signs and gestures as gameplay. The RPG structure allows players to focus on experiencing shared narrative while signs are presented to them as secondary. Developing effective signs is viewed as a strategy to successfully completing the session, rather than a goal by itself (Gee, 2005). Despite the vast number and variety of pen-and-paper (heretofore, PnP) RPGs, we could not find any examples of game mechanics in which players develop gestures to communicate.

At the beginning of the process, we considered building the game off of an existing game, such as *Dungeons & Dragons* (heretofore *D&D*, Wizards RPG Team, 2014), in order to leverage players' familiarity with the rules and structure. However, we encountered the following issues in integrating gestural gameplay components:

1. The gestural gameplay components felt detached from the rest of the gameplay.
2. The elaborate rules and gameplay of D&D distracted (and provided alternatives) to any gestural gameplay components.

A key features of PnP RPGs (as opposed to videogames) is that they support infinite pathways to overcome any challenge—they are limited only by a human's judgement and decisions. For our purposes, this feature proved a detriment; if the system using gestural gameplay components was only one such option, then players could choose to not engage with it. A simple pilot study (as well as common sense) suggested that players would *only* rely on prior modes of signification if given the opportunity to do so.

There are, however, many "charades-style" party games that explicitly require gestures or pantomime to communicate meaning, but there are three critical differences between how gestures are used in these games and our design goals: First, charades do not typically involve the longitudinal use of a coherent set of developed gestures. Gestures/pantomime are used to communicate a single idea once, and those gesture/idea pairs are unlikely to be reused. Players may develop common gestural signifiers over a long game of charades, but these similarities are diffuse, harder to detect, and somewhat random. Second, gestures used in charades communicate pre-existing meanings with which players may already have a wealth of experience and/or knowledge. A player may try to use gestures to communicate an object (e.g., a table), public figure (e.g., Walt Disney), or piece of media (e.g., *Game of Thrones*). We wanted to see gestures being created around—and alongside—new 'meanings' that the players first encounter in the game, as learners are likely to encounter new situations for which they do not share an agreed-upon vocabulary (as you might in most games of charades). Third, gesture use and interpretation in charades is unidirectional. That is, one player is using gesture to communicate an idea while the 'guessers' provide verbal feedback, which the gesturer adapts until consensus is reached. We wanted to observe feedback in the form of other players communicating meaning through gesture as well, so that over the course of the game, players contribute to meaning-making in a relatively symmetric fashion.

We concluded that gestural game components needed to be the central game mechanic. Every other game mechanic would need to either be subordinate or, at least, not distract/redirect from gestures.

To address this design challenge, we designed this game as a "Micro-RPG" (as per Horowitz, 2017). Micro-RPGs are a type of PnP RPG that typically focus narrowly on telling a story with simple, limited game mechanics. In a hobby environment in which RPG rule-books may measure in the hundreds of pages, Micro-RPGs have rules that fit on just a page or

two and are typically free online. Micro-RPG rules are explicitly non-exhaustive and rarely address minutiae; nuance is left to the players' discretion.

DESIGN OF *"THE HANDWAVEY GAME"*

In *The Handwavey Game*, four players sitting around a table adopt the role of novice wizards working together to pass a remedial exam, and a fifth takes on the role of the facilitator, taking on other roles as required and arbitrating the narrative. The wizards utilize a system of magic that relies heavily on somatic components—manual signs that bring a spell to life. Each player has a set of seven Sigil cards (Figure 1), each with a unique abstract symbol as well as a unique list of known spells. The designed scenario lasts around two hours during which the facilitator guides a narrative in which players must overcome a series of challenges using their magic. Players describe the actions of their characters, and the facilitator determines and describes the consequences of those actions—or rejects them if they determine the actions to not be possible.

Casting a Spell

The core rule of the game is how players cast spells; how players adopt and appropriate the signs that we observe in the study. When a player wants to cast a spell, they announce their intent to cast a spell, which pauses the roleplay. They next secretly mark down on their Spell Sheet the name of the spell they are attempting to cast. This documentation did not have an effect on the game; it was for the reviewers watching the replay to know what spell (and thus which Sigils) the player intended to cast. Next, the player performs a series of three signs, one for each Sigil. The other three players (in clockwise order around the table) are each responsible for interpreting one of the Sigils. They each chose the card matching their interpretation and display them when the casting player finishes. The facilitator compares the three interpreted Sigils with their list of all possible combinations, narrates the effect, and play resumes. This was consistent with the narrative of the "novice spellcaster"—in this narrative, novices (especially in the beginnings of playing this game) frequently fail to cast the spell that they intended.
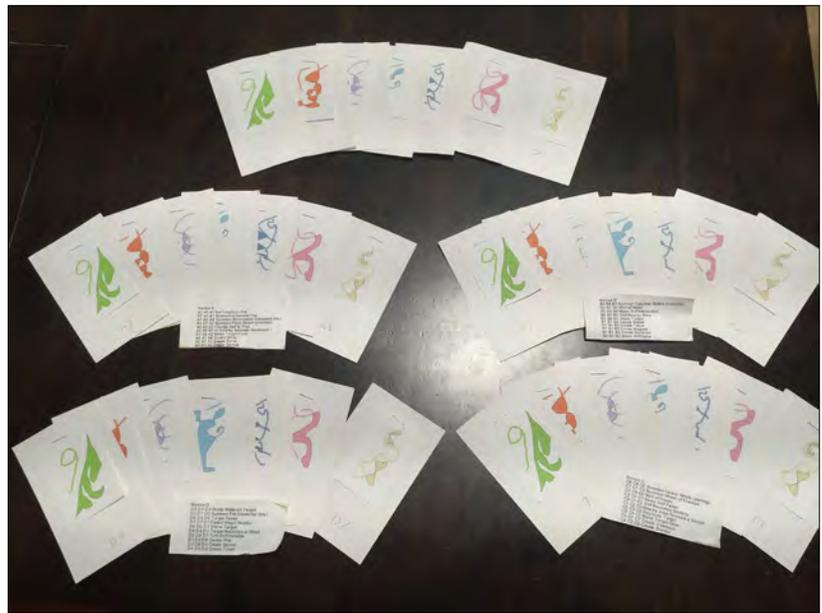

FIGURE 1. The seven Sigils Cards and Starting Spell Lists. The fifth set is for the Facilitator's reference.

FIGURE 2. An example Sigil and three different example signs for it.

Sigil Signing Rules

The players are not provided with signs; they decide on them on their own. Signs must use hands alone (one or both hands), take up to three seconds, and may not involve pointing to or interacting with the surrounding environment. (Figure 2 shows a few examples of potential signs for

a simple Sigil.) Players may not talk about the Sigils or the signs used to communicate them until the end of the entire session.

This prohibits providing direct verbal feedback about incorrect interpretations of individual Sigils. Players are only allowed to confirm whether their spell had the intended effect or not, but (due to context and outcome) this is frequently obvious to the other players without any explanation needed!

Scenario Premise and Outline

The overall narrative and specific scenario open with instructors (role-played by the facilitator) explaining that because the novices failed all their final exams, they will be faced with a special remedial exam consisting of a series of tests. The novices must use magic to accomplish the objectives in each test, and they should work together—they will all pass or fail as a group.

The first test is 'easy' and specific. The novices are locked in the library and assigned specific tasks to accomplish with magic (move a book, light/extinguish a candle, open the locked door). After the first test, the novices have a series of intermediate tests which are increasingly open ended in execution and result (clean a cave, catch a monster, prepare a meal). The final test is a sequence of puzzles as the novices delve into a dragon-professor's lair to recover accidentally stolen dining-hall silverware from their hoard—overcoming lava, traps, a magical lock, and a lightly sleeping dragon!

DESIGN PROCESS

Therefore, for this study, we designed a game in which players are motivated to communicate meaningfully through learning new gestures, *The Handwavey Game*. *Handwavey* builds on existing designs, integrating three new features: the development of novel gestures and gesture interpretation, the mutual evaluation of gesture, and the structure that gestures are woven intrinsically into the core game mechanics.

But let us take a step back. We had a decided upon game type (Micro-RPG) and two fundamental issues:

1. Which design features motivate players to communicate through learning new gestures?
2. How can we design a game to be self-evaluative, so that through game play, learners gather feedback in response to learning goals?

Design Solution I: Gesture interpretation as a core game mechanic

Many of the popular PnP RPGs include some sense of "spells" or "magic" that involves gesture, though the gestures are almost always within the narrative rather than performed

by the players. In many of these different magic systems (e.g., *D&D*, *Pathfinder*), casting spells involves characters in the world moving their hands to generate effects. Whether through waving wands, tracing sigils, forming patterns with fingers, or just gesticulating wildly, somatic components are a recognizable part of using magic. This recurring feature of magic spawned our idea to create a PnP RPG with a gestural mechanic for spellcasting; contextualizing the abstract gestures in a background situation should make it much easier to process (Barsalou, 2008).

This created two issues:

1. If Somatic Components are the central mechanic for all players, then they must *all* be mages—or spellcasters of some variety, regardless of taxonomy. Typically, these games offer many options for "type of adventurer" (e.g., thief, fighter).
2. Casting spells needed to have clear and understandable mechanics for resolution.

The first issue could be resolved tautologically—the players were all mages because the game was about playing mages—and at first it was, but we would later find a more satisfying answer to this.

The second issue was more troubling. If there were correct and incorrect ways of performing components, then how would that be determined? PnP RPGs have an inherent solution to resolving ambiguous situations—the Game Master—a facilitator who is the arbiter of the rules among other responsibilities. However, this would devolve into charades in which one player uses gesture to communicate an idea with a static gesture and communication is asymmetric. The 'correct answers' would need to be determined by the other players. This was partially inspired by Todorov's (1984) idea of the 'recipient's non-passive role in communication and tied in with Design Question II (How can we design this game to be self-evaluative?) and provided us with a solution.

Design Solution II: Players mutually evaluate gesture

If we distributed gesture evaluation across the players, rather than having the facilitator evaluate gestures, players would be directly invested and engaged with the gestures in both directions—communicating and interpreting. We would still need a discrete way for players to interpret gestures and convert that interpretation into the resolution of a spell. Once again, this answer cascaded into new issues:

1. How do we distribute the act of interpretation across multiple players? How would disputes be resolved?
2. How does the players' interpretation lead to the resolution of the spell?

We devised two possible solutions for the first issue. Either the other players could vote on their interpretations of
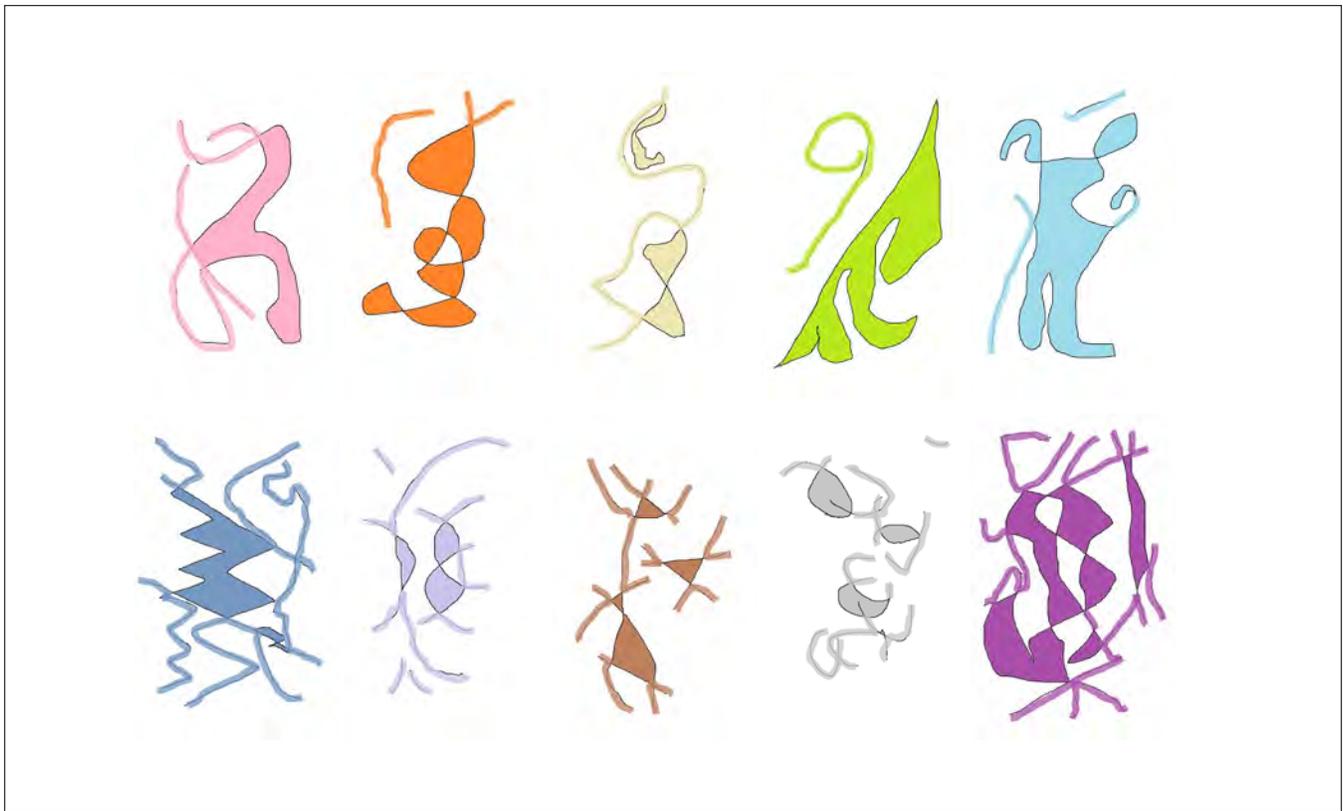
FIGURE 3. Ten Sigils in the order drawn (starting at the top, left to right)

the gesture or the gesture could be broken into several gestures—each of which would be interpreted by a different player. While the first option only led to more issues (how to handle three-way disagreements in interpretation and risk of too many degrees of freedom), the second option actually cascaded into a solution for the second issue as well.

If a spell was cast with (say) three gestures, then a large number of spells could be available in the game by assigning them to combinations of gestures. Rather than trying to communicate Spells somatically, the players would be trying to communicate Components that we could represent as abstract art (to avoid bringing their own meaning) on cards. We called these components 'Sigils'. Spells could be defined by a specific three Sigil pattern, the players would use gestures to communicate the Sigils to the other players who could express their interpretation by lifting physical cards, and the facilitator could quickly see the lifted cards and determine which pattern was represented—and thus which Spell was cast.

Sigil Design

The lead author used *MS Paint* to make the first Sigils. He started with a template in the tarot card shape and traced "squiggles" freehand. This led to the first problem: If the Sigils were all line-work, it might incentivize finger tracing the shape as the 'correct' way to communicate it. Solid sections

were added to break curves and lines that were disconnect-ed from the larger parts of the Sigil. The impact and/or value of complexity yet unknown, the ten Sigils were designed with varying complexity, as shown in Figure 3. The last three were cut to reduce the spell count from 1000 to 343 which still seemed sufficient.

While the players were intended to struggle and nonverbally negotiate the meanings/identities of the Sigils, the Facilitator would need to be able to quickly identify Sigils from cards to provide accurate and timely feedback in the form of narrat-ing spell effects. To resolve this, the Sigils were given different colors for easier identification from across the table.

Design Solution III: Compelling Spellcasting

Finally, there was the issue of design features that would support the new core mechanic. Engaging in the spellcast-ing mechanic was an inherently experimental process that involved risk both mechanically (failure may result in count-er-productive spells being cast) and socially (failure may be frustrating and make either the communicator or interpreter look bad in front of their peers). Success had to be meaning-ful, and failure had to be 'okay' to encourage experimentation and provide opportunities to learn (Barab et al., 2011).

Novice A	Novice B
A1 A5 A1 Set Target on Fire	B5 B5 B1 Summon Calzone Golem (medium)
A7 A1 A7 Summon a Second You	B3 B7 B7 Wall of Water
A7 A4 A4 Summon Abominable Snowman (tiny)	B2 B2 B4 Make Self Intoxicated
A1 A7 A3 Summon Flesh Golem (medium)	B6 B6 B3 Chill Nearby Area
A5 A3 A1 Change Self to Frog	B4 B6 B4 Warm Target
A4 A5 A7 All Nearby Become Intoxicated	B7 B1 B6 Create Bread
A3 A6 A2 Make Target Float	B7 B4 B5 Create Table
A6 A1 A6 Control Metal	B1 B1 B5 Create Magnet
A2 A7 A2 Create Pants	B1 B4 B3 Create Bananas
A6 A4 A5 Create Carrots	B2 B7 B2 Make Self Grow
Novice C	**Novice D**
C6 C4 C2 Summon Heavy Winds (swirling)	D3 D4 D4 Dump Water on Target
C7 C7 C3 Summon Wheel of Cheese	D5 D7 D5 Summon Fire Elemental (tiny)
C7 C5 C6 Wall of Roses	D6 D3 D6 Target Grows
C3 C4 C7 Make Self Faster	D7 D7 D1 Detect Magic Nearby
C3 C1 C2 Self Becomes Stretchy	D6 D3 D7 Shrink Target
C1 C2 C5 Nearby Area Reveals a Secret	D6 D4 D2 Target Becomes a Panda
C2 C3 C2 Duplicate Target	D3 D6 D1 Turn Self Invisible
C6 C1 C2 Make Target Glow	D1 D5 D6 Control Fire
C4 C7 C7 Create Shampoo	D1 D6 D5 Create Spoon
C4 C3 C2 Create Blanket	D4 D3 D2 Create Towel

FIGURE 4. Unique starting spell lists for the players, intentionally seeded with some spells that would be immediately useful.

Initially Limited

Having decided to link spells to permutations of Sigils meant that there would be hundreds of different spells. Presenting players with a full list of possibilities would be overwhelming in terms of options and choice paralysis. On the opposite end, presenting them with no list would make early spell-casting purely arbitrary. We reached a happy middle ground of providing each player the Sigil Patterns for ten spells, so that they could have expectations about spells, as well as initial Sigil Patterns to intentionally try to communicate. We also decided to give each player a unique list (shown in Figure 4) so that each player could feel like they were bringing unique knowledge as well as not knowing what effects the other players were trying to achieve (at least initially). Starting with a partial list also added value to failure as it would be a way of discovering new Spells because players could see what accidental Sigil Patterns resulted in them. Each players' set of Sigil cards was labeled differently so they would have a convenient short-hand for taking notes during the game, but because the number on each card differed between players (as shown on the key in Figure 5), it wasn't a useful element to communicate through gestures—which was an issue we ran into with universal numbers/labels.

GM	A	B	C	D
1	A7	B3	C7	D5
2	A1	B5	C6	D3
3	A6	B7	C5	D1
4	A2	B1	C4	D2
5	A5	B2	C3	D4
6	A3	B4	C2	D6
7	A4	B6	C1	D7

FIGURE 5. Sigil Label Key (for constructing and labeling Sigil Cards; not used in gameplay).

Significant

The spells (enough of them at least) had to have substantive effects in order to compel players to use them as problem solving tools or be worth learning from an accidental cast.

Safe

No one spell—especially an accidental one—should be capable of ending the game by itself. It would be one thing for a spell to make the problem harder, but risking making things impossible would be too punishing if we wanted players to experiment and possibly fail in unexpected ways.

As such, there were not primarily destructive or lethal spells. Even the 'dangerous spells' (e.g., Set Everything on Fire) were phrased as changes to the situation rather than the consequences (Burn Everything) to allow for player reactions and solutions.

Obvious

The spells had to be straightforward and immediately understandable so that players could understand what happened when a spell was 'miscast' and consider its potential for intentional use in the future. All spells would fall under simple templates and have clear names that made their effect known with minimal need for clarification. "Summon" spells would make a living creature appear in front of you. "Create" spells would make an inanimate object appear in front of you. "Change" spells would imbue a specific change on a thing. "Control" spells would let you manipulate a specific element for a short time.

Mechanically Simple

It was important to keep the Sigil signing system as the bulk of the game mechanics of how to cast spells, which meant that other aspects of decision-making in the spell had to be simple to minimize or ideally eliminate negotiation of effect with the Facilitator.

Spells that made things appear would always make them appear right in front of the caster. Each spell had a set effect. Spells that affected things were the biggest concern, how would players choose 'targets' for such spells? We limited targeting to 'Self', 'Target' (one thing the character is looking at) or 'Nearby' (affecting EVERYTHING within a few yards) and separated them into distinct spells. So 'Make Self Invisible', 'Make Target Invisible', and 'Make Nearby Invisible' were three distinct spells.

Fun

Especially for the 'less useful' spells, it was important for spell-effects to be entertaining—either by being inherently amusing (e.g., Grow Mustache on Target) or by creating surprising consequences that changed the way problems needed to be approached (e.g., Flood Area). The entertainment value of spells—especially accidental ones—provided an alternative reward to failure: humor. Many of the most entertaining and memorable moments in play resulted from miscasts.

Incorporating Failure into the Premise

We wanted to set expectations for players so that they were comfortable with and prepared for failure. The players would not just be *mages*, they would be *novice mages working together to pass a remedial magic exam*. Failure was not just a risk—it was an *expectation*. More than that, *failure was expected to happen and be overcome*. From the premise,

failure would be a core aspect of their characters' identity, but by the goal-oriented nature of the game's scenario (pass the exam), success was highlighted and defined.

Research-Goal-Driven Scenario

Just as the game itself was designed for the research study, a scenario was designed specifically for both the game and the study, and it too played an important role in providing a designed experience to facilitate the gestural experimentation and allow for failure. We wanted the scenario to provide clear and tangible goals so players can choose spells to attempt with objectives in mind. The first tasks are as straightforward as possible: Light a candle, move a book, open a door. The expectation was that players would immediately be motivated to engage in the Sigil system, and failures could not make the tasks significantly harder. The final task, on the other hand, would be much more demanding and require players to be able to accurately cast a number of spells. In the interim, the tasks would serve to escalate complexity and open-endedness to allow for more experimentation and creative play.

REFLECTING ON OUR EXPERIENCE

While *The Handwavey Game* itself presents a niche learning goal in a specific context, we learned a number of lessons from the design process that should apply to any game designed around learning. The three most important lessons we learned were the Path of Least Resistance, Lesson/Play Alignment, and Designing Failure. We also identified limitations of the Sigil designs which we will need to resolve if we want to expand on the motivating research.

Path of Least Resistance

Players will try to win games. Consciously or unconsciously they will lean towards the most efficient way of winning that is the easiest (or most entertaining) for them. This is often called 'gaming the system' and players will use shortcuts or exploits that they find. Thus, it is important to make sure that players cannot take shortcuts that avoid needing to learn the lessons you intend them to learn. For example, we explicitly defined the scenarios so that using magic (and thus signing Sigils) was a required step. Further, you can design the shortcuts and exploits (even if you do not explicitly tell the players about these 'strategies') so that players who game the system still learn what you want them to—or possibly even learn more. For example, in *Handwavey* players could watch what gestures other players were using to get an advantage on coming up with ways to communicate Sigils to those players.

Lesson/Play Alignment

We could design the game context so that what the players were asked to do and learn made sense within the narrative,

logically, and even kinesthetically. We were able to avoid an awkward shoehorned experience by designing the game around and explicitly for the lesson in mind. In contrast, our initial plan of trying to fit the Sigil system within an existing game was jarring and the many features of a game not designed for the system were constantly distracting and detracting from the intended focus.

Designing Failure

This was perhaps even more important than designing success. Success, especially socially visible success, is intrinsically easy to make rewarding and compelling. Failure, on the other hand, is naturally unpleasant and reduces people's willingness to risk it again. However, by intentionally and explicitly designing the experience of failure, the edge can be taken off. *Handwavey* controls the experience of failure by establishing clear expectations that failure will occur, use of humor to soften the frustration, presenting an opportunity to learn something new (new spell patterns) from failures, and making sure failure never eliminates the possibility of overall success.

Limitations of the Sigil Designs

There remain issues in the design of the Sigils themselves. Even with a mixture of linear and solid features, the Sigils are still too easy to 'trace'—that is, the image is insufficiently complex to inhibit mimetic drawing in the air. In the next iteration, we are hoping to bring in an artist to create more involved Sigils that are distinctive, but harder to universally reduce to simple shapes would allow more ways to interpret a particular Sigil gesturally.

On the other hand, there is a problem of replayability— which would be important for either longitudinal expansion of the research or adaptation for mainstream play. Once a group has played through and figured out gestures they can use to communicate each Sigil accurately, future play with the same Sigils and player loses the aesthetics (and research value!) of experimentation and failure that the game is designed around.

These two design issues are in competition because resolving the first issue (simplicity) involves putting more resources into each Sigil and the second issue (replayability) requires substantially more Sigils. Theoretically, we could identify the aspects of a 'good' Sigil and develop a program to procedurally generate Sigils, but that is currently outside the scope of this game's design.

PLAYER REACTIONS TO THE GAME

Players eagerly engaged with the Sigil system in the game, took pleasure when they successfully communicated three Sigils in a row (to successfully cast a spell), and winced when they failed. The game proved successful in providing a situated context where the players were motivated to get better at communicating the Sigils, while the puzzle solving, task oriented nature of the game itself kept the players explicitly focused on the game, leaving mastery of the Sigil system as a strategy they employed rather than their objective itself. One player compared the game to 'creating a new language' and that the Sigils themselves were now like 'meanings' that they had appropriated and would associate with certain hand motions. They had adopted a new mode, shared among themselves as part of the discourse of the game. From their perspective, where the interpreter arguably had more control than the communicator over what spell was cast, is emblematic of Todorov's (1984) description of the recipient's active role in communication.

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