Why Players use Pings and Annotations in Dota 2

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Why Players use Pings and Annotations in Dota 2

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ABSTRACT
Groupware research has long focused on representing gestures as a means to facilitate collaboration. However, this work has not led to wide support of gesturing in commercial groupware systems. In contrast, Dota 2, a popular MOBA game, provides two frequently-used gesturing tools: *annotations* – freely drawn lines on top of the gamespace – and *pings* – a combination of animation and sound indicating a point of interest. While gesturing tools are important for quickly coordinating with teammates in Dota 2, there is little information about how and why people use them. To gather this information, we performed two complementary studies: an interaction analysis of eight game replays, and a survey of 167 experienced players. Our findings include: six distinct motivations for the use of gesturing tools; when and how frequently gesture motivations occur during games; and, that players find pings an essential tool for winning, but not annotations. Our findings provide new directions for the design of gesturing tools in groupware and online games.

Author Keywords
Dota 2; Pings; Annotations; motivation; gestures; MOBAs; online games; groupware; communication tools.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Groupware research has long focused on how to best design tools that facilitate collaboration. One important focus has been on the best way to support gestures – pointing or motioning with the body to communicate – because it is an easy yet effective way to rapidly share information, often used in face-to-face collaboration [12]. While many types of groupware do not natively support gesturing (e.g., Skype or Google Docs), recent online multiplayer games (notably Multiplayer Online Battle Arenas, called *MOBAs*) provide rich support for gestures. MOBAs, such as *Dota 2*, often provide two gesturing tools frequently seen in past groupware research (e.g., [2,3,4,5,11,13,14,15]): *annotations* – freely drawn lines on top of the gamespace that last a few seconds – and *pings* – a combination of animation and sound that indicates a single point of interest.

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While MOBA players learn about pings and annotations early on, and use them frequently, no work has yet looked at *why and how people use gesturing tools in a MOBA*, and to what degree they view them as important for coordinating with teammates to win matches. This information is important for groupware and game designers to understand when gestures are needed. Dota 2 provides a concrete context where such gestures are used today.

We conducted two studies to provide this basic understanding. First, we conducted an interaction analysis of eight Dota 2 game replays, identifying why gestures were created. We found six distinct motivations for gesturing: *planning, warning, resource, conflict, help,* and *emoting*. By examining production time, we found that the motivations for gestures change as a match progresses – from primarily warnings early in matches to primarily planning later on. We also observed that pings are used heavily, but annotations were used much less often. Second, to confirm our identified motivations, and to understand the perceived utility and importance of gesturing tools, we conducted an online survey of 167 experienced players. Players reported that pings are a critical tool for winning matches, while annotations are the least important among surveyed tools. The survey also supported and clarified the motivations identified in the first study.

The results of our studies provide new information about why people use gestures in a popular MOBA, along with new findings about when, how often they are used and their subjective importance. Our work provides new directions for the design of gesturing tools; highlighting that although pings are used frequently, they can be improved by allowing them to convey intent, minimizing ambiguity.

BACKGROUND: MOBAS AND DOTA 2
Dota 2, like other MOBAs, is played on a static map by two teams of five. Each team battles for control over resources in order to advance towards and destroy the other team's base. Each player controls one of 112 possible characters, each with unique abilities and strengths. To increase the odds of success, players must master the nuanced game-mechanics and synergize with their teammates playstyles.

In most MOBAs, players can only see a region of the map in detail at any given time, depending on where their camera is

Figure 1. Communication tools in Dota 2: (left) caution pings; (center) an annotation on the minimap; (right) the chat wheel.

currently set. This means that many actions occur around the map at any given time that are not directly visible, increasing the need for information sharing. Dota 2's interface also provides a *minimap* that displays the entire map in low detail, but makes important information salient (e.g., the location of players and other enemies on the map); see Figure 1, center.

MOBAs provide an array of communication tools that attempt to facilitate and streamline team communications. For the purpose of this note, we select several representative examples from different MOBAs; however, this is not an exhaustive list of all communication tools in the genre.

Text chat – text chat is universally available in MOBAs. Text chat allows players to send free text messages.

Chat wheel – some games (e.g., Dota 2, Strife) allow preset text phrases to be entered with shortcut keys and/or using the mouse to select phrases from a pie menu (see Figure 1, right).

Pings - a combination of animation and sound that indicates a single point of interest. Dota 2, has two ping types created by holding a shortcut key and clicking on an open position on the map: exclamation pings (alt + left clicking) appear as an exclamation mark; and, caution pings (ctrl + alt + left clicking) appear as an 'X' (see Figure 1, left). While the meaning of pings is not specific, exclamation pings are context sensitive, with different effects depending on the object that was clicked. For example, an exclamation ping over an enemy tower produces a unique sound and a sword icon. Pings appear on both the gamespace and the minimap.

Annotations – players can create free hand annotations on the minimap, which allows the creation of more detailed gestures to teammates (ctrl + click and drag on the minimap). Annotations and drawings only last for a few seconds and can only be seen on the minimap. See Figure 1, center.

RELATED WORK GESTURES IN GROUPWARE & GAMES

The more relevant information a team shares, the more likely it is to succeed [16]. Hence, groupware research has focused on providing tools that facilitate communication and increase group awareness [4]. Such tools include gesturing support, which has been shown to facilitate shared work [1,2,5,7]. Gestures can be represented in a variety of ways, including telepointers [4,5], push-pins [3], freely drawn annotations [6, 11] or representations of collaborators' arms [11,13]. Toups et al. studied communication mechanics in games, and identified several ways that games support gestures (including pings) and ways that players approximate gestures when they are not supported by a gesturing tool [14].

Recent work has found that League of Legends (LoL) players want and need to collaborate in "every aspect of the game" to have fun and to be successful [9]. Similarly, a recent study of Portal 2, a game with a rich set of gesturing tools, found that the tools were critical to coordinating actions [15]. Work has also recognized the importance of gestures in MOBAs; a large-scale analysis found that using pings correlated with several metrics of player performance [10]. While research has recognized the importance of gesturing tools to support teamwork in games, no work has yet examined why, when and how gesturing tools are used.

STUDIES OF GESTURING IN DOTA 2

Study 1: Analysis of Game Replays

Our first study focused on identifying the communicative intent behind gesture tool use in Dota 2.

Data and Analysis

Public Dota 2 game replays can be downloaded and replayed in the game's client, allowing full exploration of the entire game state at any time during a match. Eight replays were selected from recent amateur matches to cover a range of match lengths and skill levels (5 normal skill matches; 3 high skill matches). Normal matches covers 75% of players (see: http://de.dota2.com/2013/12/ matchmaking-2/).

We used the iterative nature of Interaction Analysis to create content codes for labeling gesture events [8]. Events (annotations or pings) were identified and recorded with contextual details (e.g. creation time, a communicative intent category, map location, etc.). A new category was created when an event did not fit an existing category. Often this would include discussion and re-watching the event multiple times to ensure accuracy and minimize redundant categories.

Overall Results

Our analysis resulted in 756 gesture events in total (mean: 94.5 events/match; sd. 37.6; min: 31; max: 159). Overall, we found that pings were used extremely frequently, accounting for 729 of the events, while annotations accounted for just 27 events over 8 matches. Matches varied in length between 23 and 56 mins. (mean: 35.3 mins/match; sd: 9.4). Because of this we present data related to time as a normalized value (the percentage of time passed to the end of the match). Based on normalized time, the majority of gestures occur just after the midpoint of matches (after 52.33% of the match has elapsed).

Results: Communicative Intents (Gesturing Motivations)

Our analysis resulted in the six communicative intents (referred to as *motivations*) listed below (with the percentage of total events observed). 751 of the 756 events were categorized into the six motivations. Five events were initially omitted, but categorized later (see Discussion).

Planning (37.2%): Indicates a goal, path or objective that the player plans on pursuing or wants others to achieve or perform. For example, a player pings an enemy tower to tell teammates to attack it.

Warning (37%): When players notice that a teammate is in that an enemy is unaccounted for (i.e., missing), that an area of the map is unsafe, or that an enemy is searching for engagement they may produce warning events.

Resource (8.0%): Makes teammates aware of a resources that are available, such as wards, neutral stacks or runes.

Conflict (8.7%): Draws attention to areas of conflict. For example, a player is ambushed by enemies so they notify their teammates of the ensuing conflict.

Help (1.0%): Sometimes players know that they will require help to complete a task (such as safely farming in a lane), they will request help from other teammates. For example, if a player knows they will need healing from a teammate in the future, they may request help from a healer.

Frustration (*Emoting*) (8.1%): Players often experience frustration, as a result of their own mistakes, the mistakes of teammates, or due to conflict with teammates or enemies. We also observed ignoring warnings and reckless playstyle as causes for frustration in players. Frustration is commonly expressed by creating (spamming) pings in rapid succession. *Note*: Study 1 only uncovered Frustration as a motivation. However, the results of Study 2, caused us to broaden Frustration to *Emoting*. See Discussion for a description.

Results Based on Analysis of Motivations

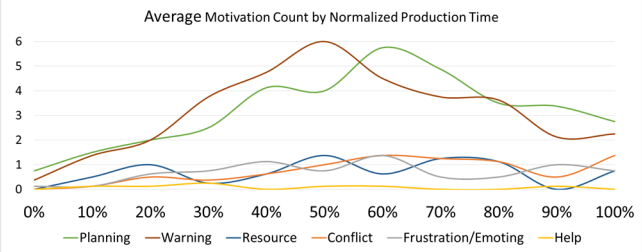

Figure 2. Average Motivation Count by Normalized Production Time

Overall, we observed relatively few uses of the annotation tool; 27 events overall, with coverage in only three of six categories: planning (21 events), warning (4), emoting (2). Figure 2 shows the average count of each motivation type by normalized production time in the match. We can see that most motivations remain relatively stable throughout the match averaging between 0-1.5 uses. However, both warning and planning rise sharply mid-match, with warnings peaking just before the midpoint and planning just after.

Study 2: Survey

Design and Participants

Our online survey collected player's perceived importance of gesturing tools to winning as compared to other available communication tools, the utility of annotation and pings for expressing our six identified motivations from Study 1, and to identify any other motivations for ping and annotations together. To simplify the survey, all of our questions asked participants to consider pings and annotations together.

We advertised our survey on the online forums r/dota2 (reddit) and the LiquidDota forum, in addition to the authors' Twitter accounts. 179 respondents could optionally be entered into a draw for one of five 20USD Steam gift cards.

Participants were from 40 different countries – the top 3 countries were US (47), UK (28), Canada (16) – 63% spoke English as a first language, had an average age of 20.5 (sd. 4.9, min. 14, max. 39), and were predominantly male (175 male; 4 female). Participants were very experienced, the average number of time in game was 2406 hours (s.d. 1757, min. 227, max. 11,050); only 22 participants reported playing fewer than 10 hours/week.

Data and Analysis

Our survey asked a series of Likert-style (on a 5-point scale). Response data was analyzed using a Friedman test and pairwise comparisons were conducted using Wilcoxan, with Bonferonni adjustments. Participant responses to optional free-text questions are used selectively to support findings.

Results

There was an effect of communication tool type on participants rating of the tool helping them win (see Figure 3); $\chi^2(3) = 62.734$, $p < .001$. Overall, participants rated pings, text chat and the chat wheel significantly more helpful for winning than annotations (all $p < .001$), but there were no other differences between the communication tools.

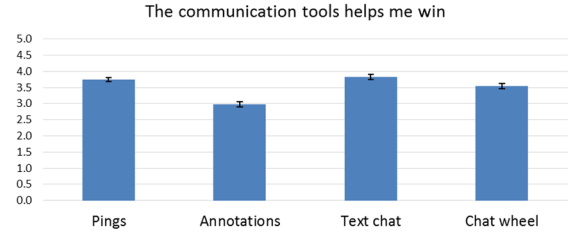

Figure 3. Agreement ratings for the utility of different communications for winning matches.

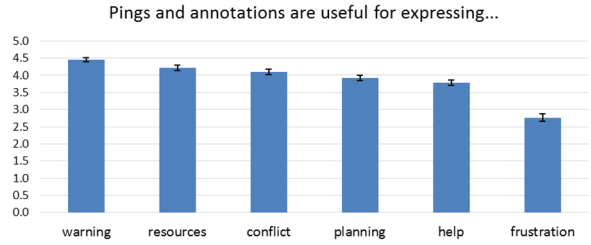

Figure 4. Agreement with the usefulness of tools for expressing six different motivations identified in Study 1.

There was a significant difference between the usefulness of gesturing tools for communicative intents (see Figure 4); $\chi^2(6) = 185.934$, $p < .001$). Overall, there was a difference between all motivation types ($p<.001$) with the exception of there being no difference between danger and resources, and planning and conflicts. This means that participants felt that pings and annotations are most useful for communicating warnings and resources, followed by planning and conflicts. They were rated least useful for expressing frustration.

We also asked participants to describe why they use pings and annotations. Of the 179 participants, 44 described uses. Two authors looked at these individually and agreed that most mapped to our categories; for example, "Notify a teammate of who to target" maps to 'planning'. However, 10 uses did not fit in our motivation. For example, one participant would cheer for teammates using pings: "Awe at execution of skill or luck in an event." Participants also described using pings and annotations for "flaming" and for "comedic value". These comments led us to broaden Frustration to Emoting (see Discussion).

DISCUSSION

Frustration becomes Emoting

Study 1 originally uncovered only 'Frustration' as a motivation. However, after Study 2, we broadened this category to include other types of 'Emoting' including the expression of joy, praise, pride, playfulness or to flame. This resulted in the only 5 (0.6%) events for which we could not find a category in Study 1, to be recoded as Emoting. For example, these five events included two instances of players expressing pride in making big plays by pinging rapidly, and two instances of a player drawing penises on the minimap; a relatively common act that is meant to be playful.

Why Are Pings More Popular than Annotations?

We were surprised that annotations were not used more frequently; however, we can speculate about two possible reasons for their lack of use, which should be investigated in future work. First, pings are likely enough in many situations. Although, pings carry low information content, drawing attention to a single point only [14], the addition of contextual use (e.g., different behavior for pings when clicking objects like towers) and player's deep knowledge and experience with the game might allow pings to carry much more information that can be inferred rapidly by players. Second, annotations take more time and effort to create. Annotations must be created on the minimap; targeting, clicking and dragging the mouse on this small area can be challenging and might take too much time in the heat of a battle. Further, unlike pings (which appear on the gamespace), annotations only appear on the minimap; meaning they are much less visible.

To address these limitations, we believe that annotations might be used more often if they were more salient and more easily created. For example, annotations could be created and viewed directly on the gamespace rather than the minimap. There is some evidence that such a change could work, as Dota 2 provides exactly this in widely used tools for commentators and casters to describe matches to spectators.

Why Do Motivations Occur at Different Times?

The results relating to production time for the different motivations provide valuable new information regarding the dynamics and different stages of matches. During the early stages of a Dota 2 match players actively engage in well understood activities (e.g., laning, jungling, etc.); however, in the middle of the match players start to form a game plan to try and gain the upper hand. Initially, teammates try to jockey for an advantage (e.g., by pushing lanes, trying to gank enemies), which results in warning pings being created. As this is happening, teams start to plan offensive and defensive tactics, leading to planning pings. This opens up interesting direction for work that looks at how communications can help explain game behavior and dynamics in MOBAs and other games.

Enriching Gestures with More Information

Games like Smite and LoL have recognized that providing a pre-defined type with pings can make them more effective; via an interface similar to the chat wheel, called the ping wheel. Four ping types are provided: danger, enemy missing, on my way, and assistance. At least two of these, map clearly to our motivations (danger & missing >warning, assistance > help). The other messages are available in Dota 2 through the chat wheel, which allows reports of "missing" with a general location (e.g., "top" or "bottom"), and on my way. However, we have identified six motivations and each of these motivations might warrant its own ping wheel (e.g., the planning chat wheel could have pings for "attack", "push", "gank", "hide"). We will explore this in our future work.

Deictic references (the combination of speech and gestures to communicate detail quickly) are common in collaboration [12]. Ping wheels enable a form of deixis; however, it is also likely that voice and pings are often used together in Dota 2. Studying voice chat and their use in combination with pings and annotations was not possible through our study methodology, and would be a complex undertaking. Therefore, our work focused exclusively on non-verbal tools. Future work should start to examine the use of voice in MOBAs and how it is combined with gesturing and other communication tools.

CONCLUSIONS

Our two studies were the first to identify six distinct communicative intents for the use of gesturing tools (planning, warning, resource, conflict, help, and emoting). We found that use of pings for most motivation types are fairly stable throughout matches, with the exception of warning and planning gestures, which peak around the middle of matches. We also found that players clearly view pings as an important tool; players used them extremely frequently and rated them as important to winning. However, annotations were neither used frequently nor felt to be particularly helpful for winning.

Based on these results we have suggested several promising directions for the improvement and future study of gesturing tools in Dota 2 and MOBAs. Given the success and importance of gesturing tools in MOBAs, other genres, such as MMOs and FPSs, might consider them as new ways to support collaboration. Further, we believe that groupware research more generally might learn from some of the communication tools that have successfully been employed in MOBAs (and other games), and provide designers with new directions to support collaborative work tasks.

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