"Take that!": Evaluating Game Systems as Communicative Media

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Abstract
In this paper, I introduce a method of analysis for evaluating the communicative aspects of game systems. This method is offered as an artifact analysis and design lens based on Clark and Brennan's theory of communicative grounding. These dimensions for game design are explained. An analysis of Pictochat on the Nintendo DS is conducted.

Keywords
Game Design, Artifact Analysis, Grounding in Communication

ACM Classification Keywords
H.5.2 Information Interfaces and Presentation: User interfaces – Evaluation/ methodology

Introduction
Player communication intertwines deeply with in-game actions [3, 6], undergirds the negotiations for changing rules[4], and channels socialization[7]. For evaluating player communication, can a conceptual tool prove useful early in the design process when major design decisions are being made and before a system can be play-tested? Here, I present an evaluative method based on the theory of grounding in communication[2]. This evaluation is demonstrated with an artifact analysis of the Pictochat software on the Nintendo DS. The connection between analysis and design is highlighted.

Table 1: Grounding Dimensions of Communicative Media.

Dimension	Description
Copresence	A & B share the same physical environment.
Visibility	A & B share visual information (e.g. Cameras, gestures, shared game screens)
Audibility	A & B can hear each other and take note of timing and intonation. (e.g. VoIP [3, 6])
Cotemporality	B receives at roughly the same time as A produces.
Simultaneity	A & B can send and receive at once and simultaneously.
Sequentiality	A's & B's turns cannot get out of sequence.
Reviewability	B can review A's messages.
Revisability	A can revise messages for B.

Grounding in Communications

The theory of Grounding in Communications[2] provides a foundation for understanding communications and the medium over which it happens. It offers us concrete ways to explain how a medium supports collaborative play in a game. At its core, it identifies 'common ground' as an essential element of communication in general: speakers establish mutual agreement about assumptions, perspectives, and knowledge. A principle of 'least collaborative effort' dictates how communicators select the least costly way to establish common ground (e.g. when it easier to point than to speak). When describing different media, Clark and Brennan identify eight "constraints". I have adapted these into dimensions for evaluation and design work. The summarized table is included in the sidebar (Table 1).

Dimensions and Activities for conducting Artifact Analysis

The use of these constraints as dimensions is inspired by a model of dimensional analysis elsewhere in the field of HCI[1]. Pairing a set of dimensions with a list of activities allows us to perform a dimensional analysis of an artifact. From Clark and Brennan[2], we have ten activities: *Formulation, Production, Reception, Understanding, Start-up, Delay, Timing, Changing Speakers, Display, Repair*. With this generic list, game systems can be assessed by how well their communicative dimensions facilitate common ground. As evaluators grow familiar with the context of a game, an activity list specific to the game system may be added to the generic one. Since game moves can be seen as conversational turns [5], we should anticipate a common grounding of a playing 'vocabulary' to stabilize between players. In turn-based games such as chess, the strong parallels between games' move-making and communicative turn-taking can be leveraged to great effect. In summary, (a) start with a game artifact (or even a provisional design) which may be multimodal (see the example analysis below) and (b) cross the generic activity list against the dimensional list for a matrix of evaluative considerations. Also, (c), likely, the communicative acts are an *accompaniment* a main game activity. Evaluators ought to consider the locale of the **attentive focus** of the players.

[1] Designing programming languages or 'notations' [1]

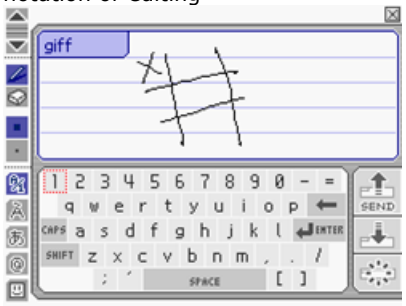
Example Evaluation of Tic-tac-toe and Pictochat

Pictochat is a chat program for the Nintendo Dual-Screen (DS) handheld device. The software is often used to play simple pen and paper games. This evaluation demonstrates a communicative dimensional analysis of a game of tic-tac-toe, also known as noughts-and-crosses, played over Pictochat.

Step A. Game Artifact and its modalities: Two modes can be evaluated, over the Pictochat connection and in person (Figures 1 and 2). Pictochat allows DS owners to converse over a wireless connection. Users compose messages on the lower touchscreen by tapping a keyboard, dragging symbols from the keyboard to the composition area, or by drawing. They click on a button to send their message to the upper screen which displays all messages for the chatroom. Users can review prior messages by scrolling upwards through the upper screen. They can copy any prior message into their composition area by scrolling to the message and clicking a "recall" button (located below the "send" button). Players are in close proximity to each other, usually in the same room due to the 10-30m range of the wireless technology that the DS uses (802.11b, ad-hoc networking). Players face their handhelds during most of the activity, but they have the option of looking up at each other.

Figure 1: Pictochat's upper display collects messages with a scrollable history of messages.

Figure 2: Pictochat's lower display is a composition area. Note that below the Send button is a Recall button for pulling down a prior message verbatim for annotation or editing



Step B. A complete generic walkthrough addresses 8 dimensions x 10 generic actions x 2 modalities. Communications accompany a main game activity (*Consideration (C)*), tic-tac-toe. A game might proceed as follows. Player 1 draws a grid and puts an 'X' in the upper left corner. He clicks "send". Player 2, receiving the message in her upper screen, clicks "recall". A copy of the board with its X appears in her composition screen. She draws an 'O' in the middle of the board and clicks "send". The "recall" function plays a major function in facilitating this game. Instead of listing all 160 permutations, select insights are described below.

Visibility. To date, there are four models of the Nintendo DS with PictoChat (DS, DS Lite, DSi, DSi XL), the visibility dimension is constrained by screen-size (3" to 3.5" and 4.2" for the XL). In Pictochat, transmitted messages appear in boxes ranging from full height (approximately ½ of the screen) to a single line of text (⅛ of the screen). The composition area fills the entire bottom screen. Visual information includes a history of messages, messages that permit text and drawing, "recalled" messages, and a chatroom roster (the top line of the composing screen). The small size of the Nintendo DS screens may lead to visibility limitations. Because the game activity occupies the same space as the messaging activity (see Figure 1), display space is limited. This raises the cost for any Pictochat message (utterance, repair, backchannel, display). In the copresent mode (players in the same room), all the benefits of visibility are available, but due to the game, attentive focus primarily centers on the Pictochat screens.

The "recall" feature is especially promising in situations of display (e.g. showing objects or pointing at them). Where grounding requires clarity in what is being referenced – if the object of reference is in the Pictochat message itself, the "recall" message allows users to annotate another's utterance.

Due to the game, the primary visual focus will be on the Pictochat screen. For face-to-face benefits of visibility (seeing one's reactions, etc…), this suggests that there are costs in negotiating when players will look at the screen and when they will raise their heads to see one another. This will affect the production and reception of visual gestures and other visual actions.

Audibility. Pictochat does not transmit audio. The ease of speaking implies that co-location will be a rich audio channel.

Cotemporality Once a player clicks "send", the transmission is immediate, but visual co-temporality depends on the other player's attentiveness. The nature of the game encourages attentiveness to the screen. Visual messages are immediately received via Pictochat; verbal utterances are immediately received when there is co-presence. Visual cues in co-presence could be missed if the player was looking at the screen at the time of production.

Simultaneity. Messages are composed separately appear only after the user clicks "send". Communicators may abandon Pictochat and resort to pure in-person communication when simultaneity is desired. For example, at the end of a game, both players may look up and at each other – favoring the immediate, simultaneous conversation to express emotion, see physical reactions, and so forth.

Sequentiality. Messages are interwoven with game moves, thus both the game and the messaging can disrupt the sequence of messages. However, the order is never lost. Face-to-face conversation is sequential and familiar. If there are too many conversational messages in Pictochat, there is a risk of losing one's sense of place in the game. One would have to scroll back and figure out which message was the last move in the game. This risk may lead players to limit

their extraneous conversation during game-play so as not to disrupt the game.

Reviewability. Past messages are reviewable by scrolling through the top screen. Face-to-face conversation is not reviewable. Reviewability introduces a display cost. Drawing on these dimensions, new designs are possible. Consider ephemeral messages. If some messages were unrecorded, players could move part of their utterances out of the historical record, saving space and promoting sequentiality for the messages they want to keep. Allow players to scribble real-time and have it fade away in seconds. This might raise questions about reception (was she watching when you wrote a fading scribble?), but the new channel solves problems.

Summary

This analysis shows interactions between modes as players play and chat. These result in the interleaving of extraneous conversation and game moves. Analysis anticipates the likelihood for communicative threads to jump from mode to mode. Considering the principle of least collaborative effort, some predictions can be made in finding the locale of the game and extraneous conversation. The constraints of the medium (display costs) and its strengths (recalling messages verbatim, reviewability) also affect the kind and expected amount of visual communication. One design suggestion is for ephemeral messaging to ease the display costs and support simultaneity.

In closing, the theory of grounding in communication describes cognitive principles, media-centric dimensions, and communicative activities useful for a dimensional analysis of communication over game systems and is suggestive of new designs. Gameplay dominates the player's attention; evaluators should identify the expected attentive focus. This method can be used early in and throughout the design process.

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