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Generominos: Ideation Cards for Interactive Generativity

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Abstract

We present Generominos, a set of design cards to model interactive generative systems. While many ideation cards exist, Generominos attempts to model the constraints of making a transformative pipeline of data in the constraints of the cards themselves. For this paper, we contribute the design of the Generominos cards and a preliminary evaluation of perceived usefulness in an undergraduate alternative controller class.

Introduction

Decks of cards are common ideation tools. There is something about being able to physically manipulate cards, turning or stacking them, shuffling them and watching for accidental juxtapositions, that inspires a playful sense of creativity and exploration. When decks of cards encode a system of rules, physically manipulating the cards gives us a way to manipulate a system which may not be itself physical.

> "[B]y breaking text into smaller chunks by printing it on physical cards, we can more easily violate the categories of information, while not breaking the rules of language or intelligible thought. This allows our brains' creativity to come in and repair the categories in an ad hoc manner, or manipulate them according to predetermined rules." (MethodKit October 2012)

Ideation cards have been created to help reframe questions in game design (Schell 2014), and provide insight and creativity when designing ambient music (Eno and Schmidt 1975). Others, like Plex(Lucero and Arrasvuori 2012) have been used as sources of inspiration for interaction or playfulness design.

For most of these cards, like Schell's Lenses, the Plex, and Oblique Strategies decks, each card is a stand-alone provocation. Users can make use of the affordances of physical cards (moving cards physically, the serendipity of drawing a card from a deck, the juxtaposition of placing two cards together). But in these decks, the cards lack structured ways of relating to each other. More rarely, some decks do contain additional structure, such as the suits of the Ideation Decks from Golembewski and Selby (Golembewski and Selby 2010), who propose a pattern of three-suited decks, a 3x3 grid can be dealt to compare how three concepts interrelated. In this system, any 3 cards from different suits can be set together. However, it is very rare for these card decks to model constrained systems with constraints *in* the cards (Rothstein October 2012), and even more rare for decks to have layout rules, especially constrained layouts.

The design of real interactive systems is constrained by how data can move from one subsystem to another. These constraints are often invisible to novice system designers, who may not understand why it is difficult to map the data produced by an input into the format needed by an output. However, it is possible to model generative interactive systems as a pipeline of data transformations, which merge and split, moving from sources of data (inputs) to data sinks (output), and for this approach, we have proposed a Generative Framework for Generativity (GFG) (Compton and Mateas 2017). The Generominos project takes the concrete constraints of the GFG and embodies them in a dominos-like deck of cards. In these cards, connecting two cards requires a compatible data type, just as actual implemented interactive systems would. Thus the pipelines that can be designed with Generominos are likely to be specific and concretely implementable, in a way that the outputs of other ideation decks are not.

In the Generominos project[1], we attempt to model the constraints of interactive generative systems (such as generative art, computational creativity, and user-guided PCG). Interactive generative works often involve using interfaces and sensors to generate a data feed, performing a sequence of transformations on this data feed, and displaying the transformed feed on output devices (including, but going beyond screens). Thus, with Generominos, we focus on modeling the flow of data through an interactive, generative system, where data flows through the following steps:

1. An input (or many) produces some kind of data.
2. The data is manipulated, recombined, extrapolated, or compressed into new data.
3. New generated data is sent to some visualizer (or other form of output to be experienced by the user).

In this way, data cannot be created from nothingness or spontaneously change form, and data that does not reach

[1] www.galaxykate.com/generominos

Figure 1: A random selection from the current 170+ card set

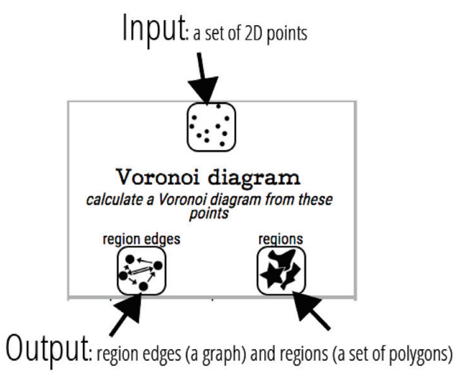

Figure 2: The structure of a Generominos card

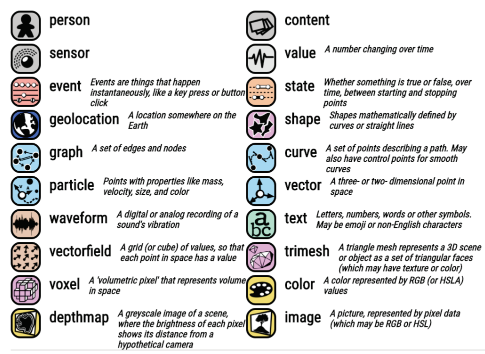

Figure 3: The datatypes available. Datatypes must be matched as cards are connected, providing the designer with data transformation constraints as they use the cards to design generative systems.

an output doesn't matter. The Generominos cards are a constructive model of how pipelines transform the datastreams generated from inputs into the type of data needed by outputs, through a series of compatible transformations.

Design of the cards

Generominos, like dominos, have two sides, only in this case, there is an *input* side and an *output* side. Each side has a number of sockets. In Fig. 2, the cards for a Voronoi diagram has one input (2D points) and two outputs (the points-and-edges of the region, and the shapes of the regions). There are currently over 180 cards (Fig.1) and 17 datatypes (Fig.3), but the cards are made with a Javascript auto-layout utility, so we frequently add more as they are suggested.

Two cards can be socketed together if the input from one matches the output of another, as in Fig. 4. In that example, the stock market produces a numerical value, which can be used to control the amount of propane being fed to a fire. One can imagine this artwork in a corporate lobby, as the stockmarket crashes and the fire dims or jets upward.

Input mods and output mods

From analyzing many interactive art pieces with this framework, we noticed that a substantial numberamount have unusual ways of using sensors and agents for input. In some pieces, the sensor is used by a non-typical lone user, like a family, a couple, or a group of strangers. In others, the "player" may be a non-human animal, or a non-biological natural force. Similarly, a common kind of output can be

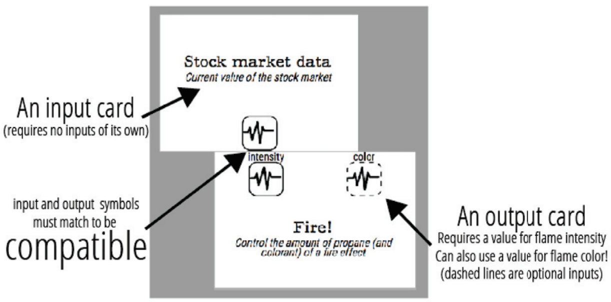

Figure 4: Matching the inputs and outputs on a card (example is a design provided by the student testers)

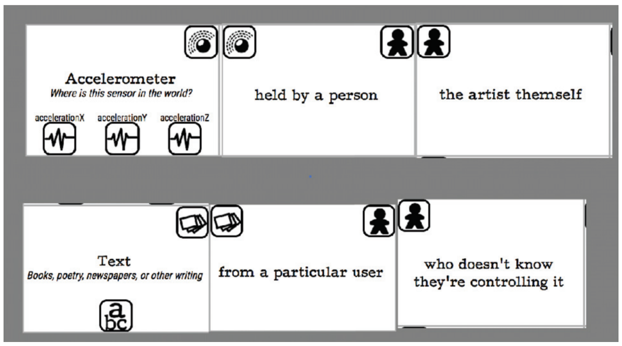

Figure 5: Input mods are stacked to the right of inputs. Icons show whether the input is an agent, a sensor, or content

made interesting or uncommon through its context–e.g., in a public space, on someone's body, or being very very large. To better capture this novelty in existing designs and allow for more generative as well as creative expressivity, we constructed input/output modifier cards that can designate unusual modifications to the agents, sensors, or context of an interactive generative system (see Fig. 5 for examples).

Scenario cards

Often users are unsure how to start designing with the cards, so we provide a number of **scenario** cards with rewards ("grants") that players can earn by designing an outdoor installation game, a game for cats, an art toy for a senior center, etc. Each card also has a listing of the design constraints that are important for that challenge. One issue with the Generominos is that they do not model the affect created by the pipeline or the context where it will be used. Will this pipeline feel "generative or "creative? Would these inputs and outputs be suitable for a particular use case, such as outdoors, or for use by the elderly or children? These are important questions for system designers to consider, so the scenario cards encourage users to consider context and design constraints in addition to the implementation constraints embedded in the regular Generominos cards.

Ambiguity

Generominos is a system-style deck of cards representing a real world set of constraints. We wanted to have cards that

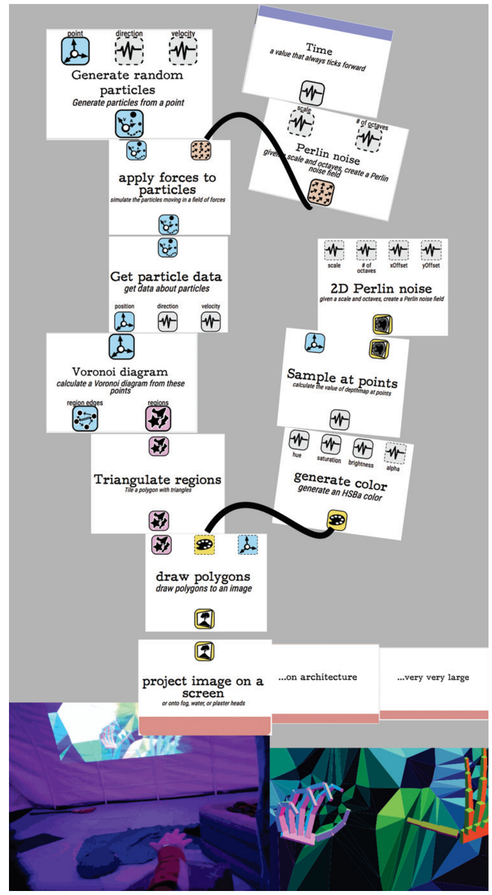

Figure 6: Idlehands, a game designed with the Generominos. Unlike many other LeapMotion games, this does not use gesture detection to compress the graph of joint positions to events and states. Rather, it uses them as the site of a Voronoi diagram, a transformation that takes advantage of that data type naturally.

clearly represented the actual constraints of a pipeline theory of generativity, but still allow for some flexibility when players can *see* how two data types would interact, even if there's not a card for it. Therefore, players are provided with additional blank cards and encouraged to write their own, or instead match similar-colored icons which are *mostly* compatible (like particles and vectors, or waveforms and values. Likewise, to avoid making hundred of cards, some cards can be used in many different ways, representing a class of algorithms rather than a single algorithm.

Use cases

Designing Idle Hands

We were looking for an installation design for an arts festival that could attract many people, engage them briefly, and ideally, use a generative pipeline with rich input. The Generominos made this quite simple to design, and because the data was compatible, it was also extremely straightforward

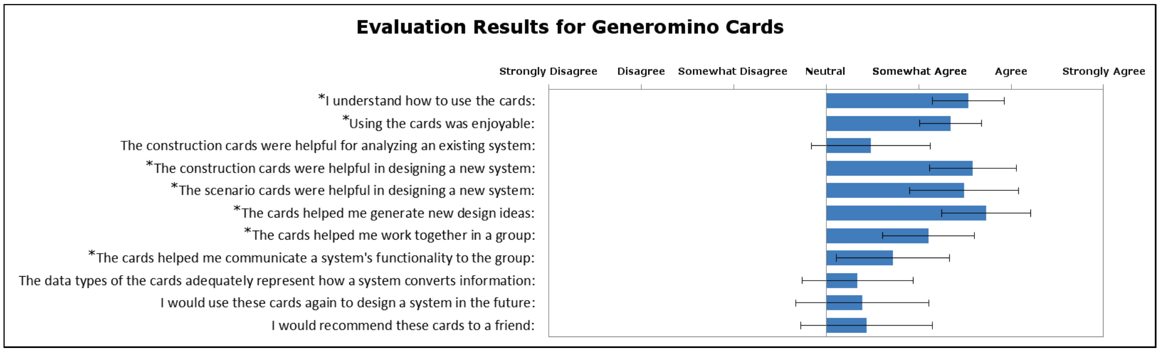

Figure 7: Promising results from the first classroom study of the Generominos

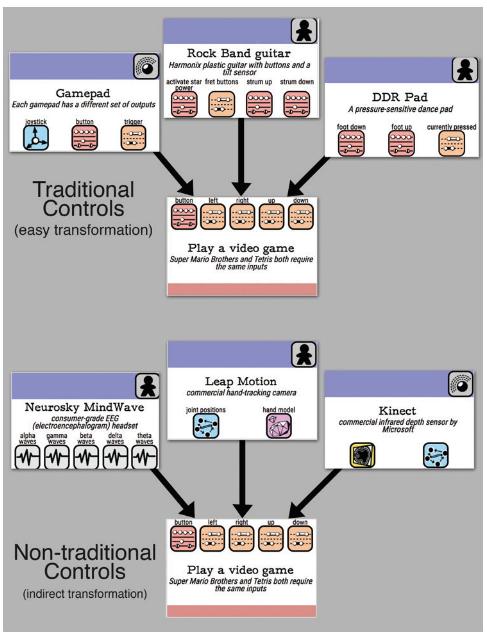

Figure 8: Why do so many alternative controllers fail to catch on in games? This figure compares the inputs of gamepads, plastic guitars, and dance mats used as game input, with Kinects, LeapMotions, and the Neurosky. While the first three all produce events, the latter can only produce events through an indirect translation of the original output.

to build. Idle Hands [2], in Fig. 6, uses a LeapMotion to track the joint positions of a player's hands. Some randomly generated particles are floating past in the background (drifting in a Perlin noise force-field to add interest). The screen positions of the joints are concatenated with the particle positions, and used to calculate a Voronoi diagram. That diagram is then triangulated, colored (with hues controlled by more Perlin noise) and drawn to a buffer that is then projected onto the side of a wall. The players seemed very engaged, especially children.

[2]www.galaxykate.com/idlehands

Why didn't the Kinect become a popular gaming input?

These cards can be used to diagram an analysis of why alternate controllers that sense continuous data, such as joint positions (like the LeapMotion and Kinect), face an uphill battle in a marketplace of games based on previous genres and design patterns, while alternative controllers that focus on discrete event measurement (such as dance pads) are more easily assimilated in this marketplace. LeapMotion and Kinect) never become successful, but other alternative controllers such as dance pads do (illustrated in Fig. 8).

Why do so many alternative controllers fail to catch on in games? For 30 years, many games have been designed for a paradigm of event- and state-based inputs, as those inputs were the first to be produced by button-based game controllers (and keyboards). Novel controllers that produce events and states, like the DDR pad or the Rock Band guitar, are easy to adapt existing game genres to. Devices which produce other forms of data, like the LeapMotion, Kinect, or Neurosky, can only plug into standard game designs after a lossy or indirect transformation of their output data into events. The indirection required to map continuous input devices to existing game designs, vs. the simplicity of discrete input devices, is illustrated in Fig. 8. The ambiguity of the lossy transforms necessary to turn continuous input into discrete events may often be experienced by players as an unnecessarily complicated and ambiguous way to press a button.

Evaluation

In order to further refine our Generomino cards and better understand how individuals might use them to analyze existing alternative controller systems as well as generate new ones, we conducted a preliminary exploratory activity using the cards with 21 students in an undergraduate alternative controller design class. The activity consisted of three parts:

- Students would familiarize themselves with the construction cards by analyzing an existing system from a selection of interactive installation artworks and alternative-controller games [3]. These example systems were preselected to ensure that they were modellable with the cards.

[3]https://www.pinterest.com/galaxykate/interactive-art/

- Students would generate a new alternative controller system using the construction cards and the scenario cards to motivate/guide their designs in a group.
- Students would fill out a post activity questionnaire qualitatively exploring their experience using the cards (e.g., “What did you like about the cards?”), quantitatively examining the cards effectiveness for generative and analysis tasks using a seven-point likert scale (e.g., “The construction cards were helpful in designing a new system:”), and identifying areas in need of refinement for the cards (e.g., “Are there any data types you feel are missing?”).

Participant feedback for the Generomino cards appears positive overall (see Fig. 7), with significantly positive opinions about the understandability, enjoyableness, collaborative, and generative capabilities of the cards. This suggests that the Generomino cards could be a helpful and enjoyable tool to aid groups in the generation and design of new alternative controller systems. However, students did note difficulty in adequately representing existing systems due to a substantial number of missing construction cards, issues trying to match data types and convert them appropriately, and difficulty finding a suitable card in the large deck (e.g., there are currently over 180 cards in a deck). This appears to have impacted ratings of the cards ability to analyze and represent existing systems. Additionally, diagramming an existing system accurately may simply be a more difficult problem than coming up with a new system, as it often requires the user to make plausible guesses at how a system *might* work, given partial evidence or vague documentation.

Based on this feedback, we have made revisions to the Generomino cards such as creating additional construction cards and adding color coding, which we hope improves noticeability of card types on a crowded table. Easily-converted datatypes are colored the same, such as vectors, particles, graphs and curves, which allows expert users to skip obvious transformation steps (simplifying their diagrams to more interesting transformations), while still communicating constraints to novice users.

Conclusion and future work

In this paper, we presented the design of our Generominos cards and results from a preliminary evaluation. Eagle-eyed readers may notice that the layout of these cards begins to resemble dataflow UIs like MaxMSP. The next technological step for the Generominos will be creating an online editor that can be used to drag-and-drop, search for, and create new cards. Additionally, with several formal and informal tests behind us, it is time to get these cards in the hands of designers and educators, so we will be having a small Kickstarter to print the cards.

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