

# Real-time Simulation and Visualization of Concept Sharing

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## 1 Overview

This project was conceived to support the goals of the “Simulation and Other Re-enactments: Modeling the Unseen” Summit held at the Banff Centre April 29<sup>th</sup>-May 2<sup>nd</sup> 2004. The goal was to simulate the 5-day Simulation Summit and display the result at the end of the summit.

It was an exercise in collaboration, visualization, and rapid prototyping. At the end of the summit we had devised a process to collect real-time data from the participants, and dynamically visualize and simulate the data. The end result was a two-fold visualization/simulation: an abstract concept visualization, and a more concrete agent concept-sharing visualization. The concept visualization showed concept words appearing on screen as they were mentioned in conversation or became meaningful to a participant in some other way. As the words gained in popularity or importance they migrated to the centre of the screen and the other words moved towards the edges. Color and font size were also mapped to different aspects of the concept state. The agent concept-sharing visualization depicted the concepts being shared by participants at particular events and in particular venues. The participants were modeled in various shapes, colours and sizes. They were shown getting together in a venue, sharing concepts, and milling about.

Both visualizations were dynamic and ran over the entire simulation in virtual time. They were shown at the end of the summit and included some surprising results. It was interesting to see the concept popularity evolve over time with some concepts competing head to head. The juxtaposition of the agent simulation with the concept visualization provided a great visual cue to a burst of concept-sharing activity. Figures 1 and 2 show screenshots of the concept and agent visualization respectively.



## 2 In the beginning

We set up a listserv and the participants were asked to discuss what a simulation of the simulation summit meant for them, and in what way we could achieve a meaningful simulation. Several interesting exchanges took place but up to 10 days before the summit we still did not have an agreement on what a realistic process might be. The simulation team had to make some executive decisions to get the ball rolling. We decided to use [Repast](#) as a simulation engine, and to collect data using a 30-question questionnaire. This questionnaire was a collaborative work and included questions to describe the individual and to position them on different key questions related to the summit. The questionnaire is included in Appendix A. Using Repast we scheduled all the summit events to be triggered at the appropriate times, and we created one agent per participant. Graphically the agents were represented as dots, and the venues were mapped evenly onto a grid. As the events were triggered the participants scheduled to be in that events filed into the room. This was the preliminary setup that we had at the beginning of the summit and it formed the working basis for the brainstorming session held on the second day.

## 3 Data Collection

During the brainstorming session it was determined that the simulation should be both beautiful and meaningful. The concept of memes or concept sharing was mentioned with the metaphor of flowers being pollinated. Someone also mentioned the possibility of agents changing shape over the course of the simulation. In the end we decided to go with both of those ideas combined. We devised a data collection form whereby participants could enter what concepts were shared, how they were shared, and how the participant shape, size, or colour changed. This form was both on paper, and on the web. Figure 3 shows a screen capture of the web form. Table 1 lists the attributes that were collected. We also had a large sonotube poster depicting the venues of the summit. Participants were invited to write experiences they had during the summit on post-it notes and stick them on the sonotube. These notes could then be either translated into concept-sharing events or used as markers for future improvements to the simulation/visualization.

Attribute	Notes
Name	Name of participant who recorded this event.
Type of exchange	Fast/Slow, Casual/Serious, One-way/Mutual, Focused/Unfocused, Easy/Awkward
Keywords	Concepts that were prevalent in exchange (up to 5)
Heat of Keyword	Each keyword can be assigned hot/warm/cold based how it felt in the exchange.
With whom the exchange took place	Unlimited comma-separated list of other participants involved in the exchange. The keyword 'all' can also be used.
Colour of avatar	Red, Green, Yellow, Purple, Orange, Black, White, Blue
Size of avatar	Small, Medium, Large

Shape of avatar	Triangle, Circle, Square, Spiky, Moon
Energy of avatar	Low, Medium, High
Location of exchange	List of venues (Rice Studio, Hallway, A.R.T. Lab, etc)

**Table 1** Attributes collected about concept-sharing events

Simulation Entry Form - Microsoft Internet Explorer

Address: http://games.banff.org/Daver/ENTRYFORM.html

I am [text box]

DAY: THURS

START TIME: Hour 1 Min 0

DURATION: 1

It was:

FAST [dropdown]  
CASUAL [dropdown]  
ONEWAY [dropdown]  
FOCUSED [dropdown]  
EASY [dropdown]

KEYWORDS:

HOT:  WARM:  COLD:

HOT:  WARM:  COLD:

HOT:  WARM:  COLD:

HOT:  WARM:  COLD:

WITH WHOM:

ALL

ex = Dave Kretz, Defiante Walters, ...

COLOR:

RED:   
GREEN:   
YELLOW:   
PURPLE:   
ORANGE:   
BLACK:   
WHITE:   
BLUE:

SIZE:

Small:   
Med:   
Large:

SHAPE:

Triangle:   
Circle:   
Square:   
Spiky:   
Moon:

ENERGY:

Low:   
Med:   
High:

LOCATION: ART

Submit

**Figure 3** Web entry form for concept sharing



**Figure 4** Sonotube poster was in the hallway outside the main summit venue.

At the end of the summit we had collected over 130 concept-sharing events.

## 4 Mapping Concept-Sharing Attributes

Over the next 2 days of the summit we redesigned the initial prototype to take into account the new data being collected. The concept word visualization was designed to map the following attributes:

Attribute	Mapping
Number of events with concept	Location (closer to centre means relatively more events have concept)
Number of participants that encountered word	Size of word
Average temperature of word	Colour of word

As the simulation runs, the word locations change. This is because the centre location is always reserved for the words that have appeared in the most events. As this will change over time, words will move away or to the centre dynamically. For example, when the simulation starts all words are initially encountered in only one event so they appear randomly in an ellipse that encompasses the whole window space. As soon as one word occurs in 2 events the elliptical space is divided into two concentric rings with equal width. The words having two occurrences are randomly distributed in the inner space, and the words having one occurrence are randomly distributed in the outer space. As the simulation goes on the ellipse is further subdivided with each of the  $n$  spaces or rings having a radius  $1/n$  of the original radius. Figure 4 illustrates the location map for the concept words.

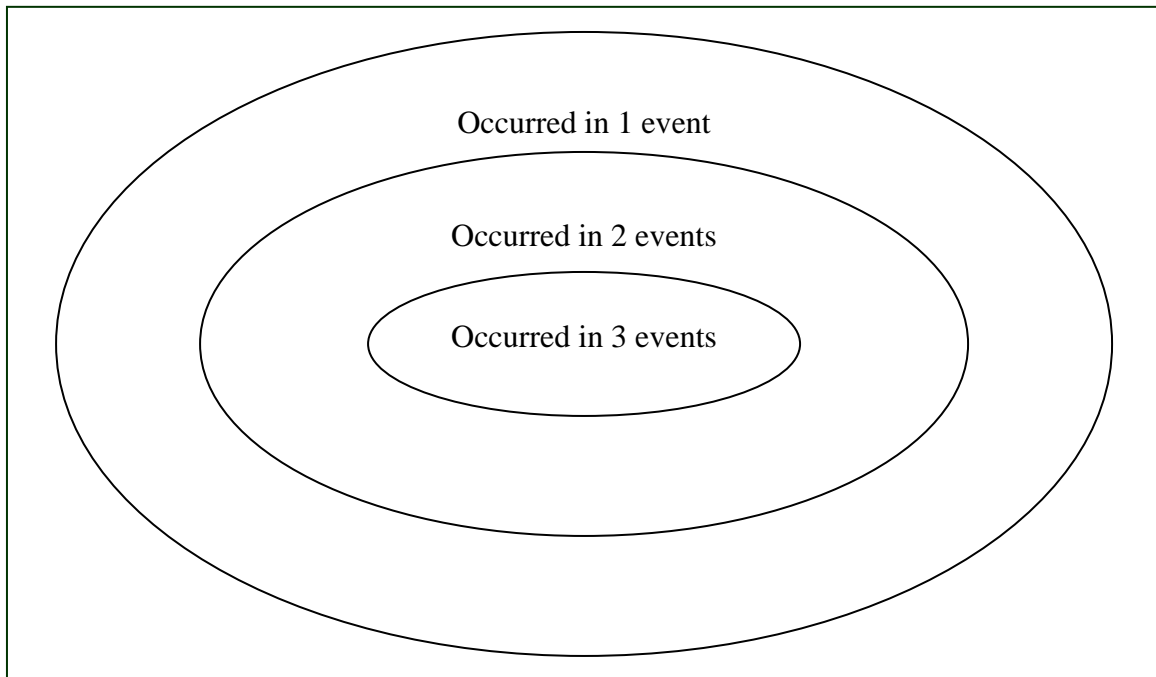


Figure 5 Location map of concept words

Depending on the events this mapping may not lead to an even distribution. For example, a few words might occur in a lot of events with others occurring say once or twice. This would leave a lot of rings empty. We have not experimented with enforcing an even distribution as it seems that the uneven distribution displays valuable information about the concept sharing.

The animation of the agents sharing concepts currently maps the following attributes:

- Location of sharing
- Participants involved
- Participant colour, shape and size
- Number of concepts being shared

As concept sharing events are triggered the agents are shown getting together in the assigned venue. The concepts are shown as little dots going back and forth to the agents. The effect is somewhat like a little explosion of dots surrounded by agent shapes. There are lots of attributes collected in the entry form that are not taken into account in the animation. This is because of the time constraint. We plan to map these attributes in the future.

## 5 Future Work

We plan to use this real-time concept-sharing visualization in other summits and conferences at the Banff Centre. With a process of continuous improvement we hope to make it a delightful, playful, meaningful, and useful tool for participants.

Some of the immediate improvements we plan to make are:

- More diverse shapes for avatars
- Improvement on web interface
- Data collection from PDA (this could also include a PDPal1.0-like visual haiku of the type of concept-sharing exchange that took place.)
- Animation of more attributes of the concept-sharing event.

It would be interesting to make the data available in a form that would invite other types of visualizations. There are privacy issues that would need to be worked out, but perhaps names of participants could be coded to maintain anonymity.

We are also looking at ways to map the data in 3-dimensions for display in an immersive cave environment. Conversely, we would also like a mapping that can be viewed on small devices.

On the simulation side, it would be interesting to add some predictive elements to the concept-sharing. This could be based on previous summit data, personal agent information, general social rules, etc.

## 6 Conclusion

This exercise in rapidly prototyping a simulation and visualization for a summit in progress was exciting and interesting on many different levels. I think we can all be proud to have very effectively collaborated to bring this project to fruition in such a short time. We are looking forward to improving both the process and the final product through future interactions with summit participants.

### Acknowledgements

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And of course, thanks to the Simulation Summit participants for so willingly participating in this whole process.

## Appendix A – Initial participant questionnaire

Answers were required for questions marked with a \*:

What is your usual daily rhythm? (morning person, night person, cyclical, stable)

What is your favourite animal? (cat, dog, bird, monkey, love them all, hate them all, indifferent)

\*List up to 6 words that describe you?

\*List up to 6 words that describe your interests?

What is your eye colour (brown, green, blue, hazel, enhanced, don't know)?

What is your favourite ice cream flavour?

Do you like clowns?

Do you like parties?

\*Who do you know that is coming to the summit (list people that you knew before the listserv)?

Who would you like to debate?

\*Who would you like to meet?

\*What type of simulation are you interested in? (scientific, social, biological, medical, economical, political, historical, ecological, artistic)

[for the questions below please give an answer from 0-10, 0 is no, 10 is yes, 5 is maybe]

Do those who model social interaction have a better time at cocktail parties?

Can simulation drive us to conclusions that are far from where we started?

Do more people than not perceive the world as you do?

Does modeling the world to simulate it beg its own question?

Will we achieve an adequate shared model for the simulation of the summit?

Would you run a simulation to decide on a course of action?

Are simulations of social problems convincing enough to produce policy changes?

Do you have a satisfying notion of what a photon is?

Can you envision a light year?

Is the blend of simulations at different scales the search for the "unifying" equation?

Do highly realistic graphics make the outcome of a simulation more credible?

Can an artistic recreation be used side by side with scientific realism for a combined effect?

Do written words leave more to the imagination than spoken words?

Do you prefer to represent yourself with images?

Do tactile components enhance the appeal of a simulation?

Should a simulated encounter ever take the place of a real encounter?

Is there a place you would rather experience through a simulation than "for real"?

Would access to a simulated human mind or body improve your quality of life?

Can you envision a simulation that can answer the question "what should I do" for everyone individually?

Would you trust a simulation to assess the risk of an impending surgery on your body?

Has your understanding of what is real ever been tenuous?

Can we simulate ourselves out of the "brain in a vat" question?

Would you be willing to undergo a course of study that involved no human contact?

Can you credibly create a simulation that proves any point of view?