Andreas van Cranenburgh & Kaspar de Geus
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Contents

1 Communicative Interaction

1.1 Introduction

This paper will try to explain the term communicative interaction, by explaining a number of concepts and then finally relating them to communicative interaction. Our ideas are based upon information presented in class and on the first two chapters of the book "Principles of Interactive Media"[1] and on the first chapter of "Introduction to Knowledge Systems"[2].

1.2 Medium, channel, modalities

Let's first define these three terms. They are important in describing the different aspects of communication and hence communicative interaction.

Modality :

The modality is the sensory system through which the communication occurs. This is either visual, auditory, tactile, olfactory or gustatory. It should be noted that mostly the first two modalities are used in computing, and the tactile modality is also sometimes used. It has small applications in computer games and mobile phones (vibration). It is hard to digitize olfactory and gustatory sensations so there are not much practical applications yet. As a means of communication they are not that important either way.

Channel :

A channel is a certain kind of encoding within a modality. Speech and music are examples of channels in the auditory modality, for instance. A channel exists within a single modality but a modality can have several if not many channels of communication. One requirement which is introduced by the notion of channels is that there needs to be both an encoder and decoder for the specific channel for communication to happen.

Medium :

A medium is a collection of channels spanning one or more modalities which has become recognized as being one by convention. There has to be a so-called "cross-channel language of interpretation", that is, the channels have to relate to each other and give meaning to each other. A TV is a good example of a medium. Here the sound fits with the images shown and thus forms the cross-channel language. It is important to note that something only becomes a

[1] Elsom-Cook, McGrawHill, 2001
[2] Stefik, Morgan Kaufmann, 1995

medium because of convention, one can invent all sorts of combinations of channels but only when people are used to something it will be called a medium.

1.3 Different types of interaction

Two types of interaction are physical and communicative interaction. The meaning of this might seem obvious, the first relating to actions and the second to words, but it's not that simple.

Physical interaction is any kind of interaction which results in changes in the physical world. This might be throwing a stone, but also pressing "back" in your browser is an example of this. In fact, everything the average computer user does is physical interaction.

Communicative interaction on the other hand, requires agents, entities which have intentions and an internal state. They communicate and bring about a certain mental change. The communication happens over one or more channels, so it could be words but also someone waving his hand. Obviously, communicative interaction is much more complicated than physical interaction. There is much room for misinterpretation, like in all communication.

1.4 Autonomous agents, internal state and goals

The concept of agents was just touched upon, let's look into this in more depth.An agent is typically either a user or a computer program, although some animals also pass the requirements. These are the requirements for something to be an agent:

communication :
It can communicate and interact across one or more channels. This is important for agents to connect with each other or, in the case of computers, with the outside world in general.

internal state :
It has an internal state, where knowledge can be kept.

intentions :
An agent also has intentions, certain goals it wants to achieve. The agent can alter its own intentions based on new information. Intentions are necessary because they drive the agent, there's no action without it.

Agents are the basic building blocks of communicative interaction. Now let's see how they interact.

1.5 The Shannon and Weaver model

The Shannon and Weaver model for communication states that when one agent wants to communicate with another it is done in the following way:

Agent 1 has an idea in his "head", this is encoded in some way, then it is transmitted (in this transmission there could occur some loss due to noise) and receive and decoded for agent 2.

In human interaction one can see this as human 1 wants that human 2 knows something, human 1 knows so he formulates the words he wants to use, speaks those words (in a language he thinks human 2 can understand), background noise (like traffic) can cause loss in transmission, human 2 hears this noise and tries to define what words were spoken and what they mean.

Keep in mind that noise in computer communication isn't really an issue anymore seeing that we now have found quite a few ways to make this problem almost non existent. This is done with for example checksums.

1.6 Information versus knowledge

To understand the difference between information and knowledge one has to know what each one specifically means in the context of communicative interaction. Information is made of words, pictures and data. Knowledge is what is in our head.

The things we know are not transferable without it first being transformed (encoded) into something which we can both understand. We often use language to do this. When things are, for

example, written down it becomes information which then can be read again and interpreted in the readers mind and it becomes knowledge again, but it's always different from the first knowledge possessed by the writer.

1.7 (Multimedia) assets, knowledge and user information

First we will give a definition of multimedia, for it is not used here the way it is used in common language. Multimedia uses different channels of communication to transmit information from one agent to the next, but in a way that isn't a convention yet. When it becomes a convention it usually gets a name and it is just a medium that uses more than one channel.

The assets one has with multimedia is that each channel that is used should complement the others and thus making the chance of near perfect communication (a.k.a. knowledge transfer) greater.

For this to work best one also needs user information to make the channels used even more effective for this specific agent and when updated frequently one can try to understand which information has been successfully received and which parts need more clarification.

1.8 Communication as a constructive process

When communication is seen in a way that one agent wants another agent to know something the first agent knows, then it isn't hard to come to see that in getting to know something new one expands ones knowledge base and so builds a larger library of information in ones head.

For example if human 1 tells human 2 that a ball is a round object then human 2 can store this in his head. If human 3 then tells human 2 that human 1 has a ball then human 2 can combine this with older information an then conclude that human 1 has a round object which is called a ball, thus expanding his knowledge base.

1.9 Symbols, symbol systems

Symbols are central the central element of language, mathematics and formal systems in general. A symbol is an intentional marking which represents something. By intentional we mean that it was made for a purpose, not just some footsteps. Furthermore, it has to be a representation of something, or it doesn't mean anything and it can't be a symbol. We can now identify two requirements for something to be a symbol:

recognizer :
Someone or something has to be able to make and read the symbols.

observer :
Someone or something has to attach meaning to the symbol. Note that this happens outside of the recognizer, since the observer must be able to look at the situation and tell what the symbol corresponds with. This process is called *designation*.

A symbol system is a system in which symbols are read, written and modified. It can form sentences and react to input. According to a theory by Newell and Simon these symbol systems possess the potential for general intelligent action, where general intelligent action means intelligence similar to that of humans.

The authors of this paper have different views on this matter.

van Cranenburgh: I find that very hard to believe, I do not feel myself to be a symbol manipulating device. I do not think thoughts are made of symbols, but something else which is more elusive. Only when people articulate their thoughts it becomes necessary to resort to symbols.

de Geus: I think more along the lines of Newell and Simon, for I belief that my thoughts are completely controlled by language. The best example I can find for this is in my dreams which where always in Dutch (which is my native language) until I moved to Spain and started to learn Spanish. After a couple of months when I used Spanish more than Dutch I also started to dream in Spanish. I can only conclude from this that even my thought are constructed with language.

1.10 The role of language

Without some sort of language the previous model is of no use. There are formal and natural languages. Formal languages can be divided into two categories:

procedural :
: Most of the languages understood by a computer include procedural languages. It's essentially a list of instructions to the computer. These languages come in different levels. The lower level is closer to the hardware and contains a set of primitive instructions, higher level languages are consequentially made with lower level languages.

declarative :
: Declarative languages describe things. An example is HTML, the language of the world wide web. The browser can interpret a page how it wants to, it only contains a description.

Formal languages follow specific rules and have no ambiguities. This means that we can expect to make a computer program understand a formal language without too much trouble. Natural languages however are very hard to deal with. The grammar might follow rules but there are too many exceptions. Words have too many meanings and the right one can't always be inferred from the context using rules.

1.11 'perfect knowledge' vs. mutually shared believes

"Perfect knowledge" is more an idea than a real concept. It would be the knowledge that something is perfectly described in your head. Flawless and without own perceptions or ideas that alter it in any way. As this is impossible in my concept of things it is easy to differentiate it from mutually shared believes. One of the most obvious examples to illustrate mutually shared believes is a god. Which some people have ideas about and which churches try to guide to be the same. If we had perfect knowledge that a god would exist and knew what it was there would not be a need for churches or wars because not just everybody would believe the same, everybody would **know** the same, no debate possible! But of course what one would do with this knowledge is a very different discussion altogether.

1.12 Conclusion

Let's review our knowledge until now. We've seen the difference between physical and communicative interaction. Agents with an internal state and their own intentions have to be interacting, for something to be called 'communicative'. This interaction occurs by sending information over one or more channels, in one or more modalities. The information has to be encoded before it can be send along the channel, and the other agent will decode it. The encoding and decoding happens with symbols, and in a certain language. Formal languages are well suited for computer programs because they are easy to implement, but using natural language can make it easier for humans to interact with the computer.

Important is not to forget that information is never perfectly absorbed, but always interpreted by the receiver and "tainted" with previous beliefs. To try and come as close as possible to transmit knowledge flawlessly multimedia are implemented. It is important to get user information at frequent intervals to see what information has been received, otherwise information can be lost and can be corrupted beyond use. When information transfer is close to perfect it becomes easier to create a similar background for thought, and thus easier ways of communication.

As can be seen, the field of communicative interaction is only beginning to be explored. Let's see what the future will bring.