



SCL2010
Interdisciplinary Workshop on
Society, Culture and Language



BOOK OF ABSTRACTS

University of Plymouth, 11-13 NOVEMBER 2010

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AGENDA

DAY 1 – THURSDAY 11 NOVEMBER 2010 – *Tamar Room, Babbage Building*

09:15 Arrival

09:20-09:35 **Angelo Cangelosi** (University of Plymouth, UK)
Welcome and workshop introduction

09:35-10:10 **Simon Garrod** (Glasgow University, UK)
Dynamic alignment in groups

10:10-10:45 **Bruno Galantucci** (Yeshiva University, USA)
Social factors in the emergence of human communication systems

10:45 Coffee break

11:15-11:50 **Giorgio Ganis** (Harvard Medical School USA & University of Plymouth UK)
Cognitive neuroscience of deception

11:50-12:25 **Moshe Bar** (Harvard Medical School, USA)
Neuroscience of emotions and cognition

12:25-13:00 **Matt Schlesinger** (Southern Illinois University at Carbondale, USA)
What's the frequency, mama? Socioemotional and cognitive components of early caretaker-infant communication

13:00 Lunch

14:30-15:05 **John Scott** (University of Plymouth, UK)
Social network modelling

15:05-15:40 **David Sallach** (Chicago University, USA)
The dynamics of coercive utopian discourses

15:40-15:50 **Workgroups' Briefing**

15:50 Coffee Break (continues during workgroups)

16:00-17:15 **Workgroups' Meetings I**
Group 1A: New research challenges and priorities – Tamar Room
Group 1B: New research challenges and priorities – Lyner Room

17:15-17:45 **Workgroups' Report I**

19:00 **Dinner**, Ship's Inn, Noss Mayo (shuttle at Jury's Inn backdoor exit, leaving at 19:00)

DAY 2 – FRIDAY 12 NOVEMBER 2010 – *Tamar Room, Babbage Building*

- 09:25 Arrival
- 09:30-10:05 **Joanna Bryson** (Bath University, UK)
The scientific application of agent-based modelling: From biology to anthropology
- 10:05-10:40 **David Traum** (University Southern California, USA)
Models of culture for virtual human conversation
- 10:40 Coffee break
- 11:00-11:35 **J. Fernando Fontanari** (University Sao Paolo at Sao Carlos, Brazil)
Multi-agent modelling of culture and influence on groups
- 11:35-12:10 **Robert Kozma** (Memphis University, USA)
Intermittent synchronization and de-synchronization effects as neural correlates of human cognition and social coordination
- 12:10-12:45 **Leonid Perlovsky** (Harvard University and AFRL Hanscomm, USA)
Emotional Sapir-Whorf Hypothesis: Language, music, emotions, cognition, and cultures
- 12:45 Lunch
- 14:00-15:15 **Workgroups' Meetings II**
Group 2A: Interdisciplinary approaches and methods – Tamar Room
Group 2B: Interdisciplinary approaches and methods – Lyner Room
- 15:15-15:45 **Workgroups' Report II**
- 15:45 Coffee break
- 16:00-16:35 **Istvan Kecskes** (State University New York at Albany, USA)
Context, culture, cognition
- 16:35-17:10 **Claudio Cioffi-Revilla** (George Mason University, USA)
Computational Social modeling: A manifesto
- 17:10-17:45 **Angelo Cangelosi** (University of Plymouth, UK)
Symbol grounding in multi-agent systems and robots
- 19:30 **Dinner:** Barbican Kitchen Brasserie (meet at Jury's Inn at 19:30)

DAY 3 – SATURDAY 13 NOVEMBER 2010 – Tamar Room, Babbage Building

09:00 Arrival

09:15-09:50 **Alessandro Vinciarelli** (Glasgow University, UK)

*Social Signal Processing: understanding nonverbal communication
in social interactions*

09:50-10:25 **Andre Wlodarczyk** (Paris Sorbonne University, France)

Modeling integral linguistic communication as a distributed system

10:25-11:00 **Antonio Sanfilippo** (Pacific Northwest National Laboratory, USA)

Modeling radical rhetoric

11:00 Coffee break

11:30-12:30 **Workgroups' Meetings III**

Group 3A: Research roadmap and milestones – Tamar Room

Group 3B: Research roadmap and milestones – Lyner Room

12:30-13:00 **General Discussion**

13:00 Lunch

14:00 *Workshop ends*

ABSTRACTS OF TALKS

Moshe BAR (Harvard Medical School, USA)

The proactive brain: Predictions in visual cognition

Understanding the visual environment is crucial for our existence. In spite of the considerable complexity of achieving this goal, we are all extremely effective visual creatures. Research in my lab indicates that one of the main sources of this efficiency is the generation and use of predictions. Our proactive minds and brains continuously activate memories of previous experience in order to interpret the present and anticipate the future.

In the domain of visual cognition, these predictions are based on characteristic object appearances, on typical spatial relations, and on statistical regularities of other recurring patterns. They are associative in nature, and are triggered rapidly based on rudimentary, gist information. This principle of predictions that are activated fast to facilitate perception, cognition and action covers an exceptional range of visual (and other) operations: from object to scene recognition, and from person self-impressions to shaping our visual opinions and preferences. The talk is planned to describe the theoretical foundations of this framework and the empirical evidence to support it.

Joanna BRYSON (Bath University, UK)

The scientific application of agent-based modelling: From biology to anthropology

Science is first and foremost a collaborative and evolutionary social process. Science is only successful when the understanding of the world present in our society is increased -- this is measured by our ability to predict and effect changes in our world, including our own cultures and societies. Science therefore like any evolutionary process is highly dependent on communication -- on the ability to retain discovered knowledge in a society. Improving that knowledge requires good mechanisms of variation (discovery) and selection (what gets published? what gets taught? what gets remembered?), but also the guarantee that core understandings are preserved until they are improved.

Agent based modelling holds great promise for accelerating science, but this promise has not yet been fully realised as many models are lost in forgotten backwaters of academia rather than published in journals read by the Sciences the models are claimed to advance. I believe there are a number of causes for this:

- Many models are built by programmers without collaboration with the disciplines they attempt to address. Scientific writing, like all writing, reflects the culture of the writers, and true understanding of that culture comes only by immersion. Modellers who do not attend the meetings and visit the laboratories of the people they are attempting to work with will often misunderstand papers or use inappropriate language in communicating their own result, thus removing themselves from the scientific process.
- Oddly, many scientists do not themselves understand the scientific method so much as practice it by imitation, thus they do not know what to do with a new method. Modellers have not helped with this situation when they claim to have invented a "third way" to do science.

In my own group we take a very simple stance to how ABM fits into science: simulations are scientific hypotheses. This explains why the very fact of building a model can lead to insight: because it requires

specifying a theory or hypothesis so completely that it can run on a computer. This can lead to serendipitous discovery of unintended consequences of the theory, which can then be taken as predictions of the theory and

tested against reality. Unfortunately, in far too many modelling papers this is where the process ends. To really be a part of science, the models / theories should be compared against other theories for best fit to date, extended, corrected, generalised and simplified. This process should be greatly accelerated by simulation, provided that laboratories freely share their theories / models once successfully published.

In this talk I illustrate the above with research from my own group concerning the biological origins of culture, and mechanism for understanding present-day cultural variation including regional variation in apparently maladaptive economic social norms.

Angelo CANGELOSI (University of Plymouth, UK)

Symbol grounding in multi-agent systems and robots

The double function of language, as a social, communicative means, and as an individual, cognitive capability, derives from its fundamental property that allows us to internally re-represent the world we live in. This is possible through the mechanism of symbol grounding, i.e. the ability to associate entities and states in the external and internal world with internal categorical representations. Symbol grounding has fundamental social component, as the learning of a language depends on the collective negotiation for the selection of shared symbols (words) and their grounded meanings. The individual and social components of the symbol grounding have been investigated in evolutionary multi-agent systems and in developmental robot experiments. Simulations of a multi-agent model of the Baldwin effect in language evolution show that when there is a high cost associated with language learning, agents gradually assimilate in their genome some explicit features (e.g. lexical properties) of the specific language they are exposed to. But when the structure of the language is allowed to vary using a process of cultural transmission, Baldwinian processes cause the assimilation of a predisposition to learn, rather than any structural properties associated with a specific language.

In robotics experiments on the acquisition of language, based on the humanoid robot icub, we investigate developmental hypotheses on the interaction between language, social learning and imitation, and sensorimotor knowledge (embodiment). In this talk we will discuss the potential of multi-agent and robotic models of language learning for investigations on the interaction between language, socio-cultural phenomena and embodiment factors.

Claudio CIOFFI-REVILLA (George Mason University, USA)

Computational Social modeling: A manifesto

Computational social science (CSS) has earlier roots in the second half of the 20th century, but a major impetus in recent years has been due to the application of advanced information processing technologies and simulation. Four main thematic areas characterize the emerging field: automated information extraction, social network analysis, complexity theory, and social simulation. This talk will focus on a "Manifesto" for this emerging field, with special emphasis on key concepts, assumptions, principles, and other core features of the CSS paradigm.

Simon GARROD (Glasgow University, UK)

Dynamic alignment in groups

In this talk I will present findings from experiments on how communities of communicators align. First, I consider results from old experiments investigating community-wide alignment on ways of describing positions in a maze game. These compare alignment within isolated pairs of players and that among community players as well as that between equally experienced interacting pairs not drawn from a community. For these linguistic cases the degree of inter-speaker alignment patterns as follows: within community greater than within isolated pairs greater than within non-community pairs (Garrod & Doherty, 1994). Second, I will present results from a non-linguistic graphical communication task with which we can also measure degrees of alignment on graphical symbols. Again, the studies compare alignment within isolated pairs of players and that among community players. The main findings are that communicators converge equally on graphical signs whether they play as isolated pairs or within a larger community (Fay, Garrod, Roberts, Swoboda, 2010). However, in this situation community generated symbols are more effective than those generated by isolated pairs when tested on new participants drawn from the same population (Fay, Garrod & Roberts, 2008). I will conclude by discussing the importance of different kinds of communication network on the process of inter-communicator alignment.

References:

- Fay, N., Garrod, S., & Roberts, L. (2008) Fitness and functionality of culturally evolved communication systems. *Trans. Roy. Soc. London.* 363, 3553-3561.
- Fay, N, Garrod, S., Roberts, L., & Swoboda, N. (2010) The interactive evolution of human communication systems. *Cognitive Science*, 32, 351-386.
- Garrod, S., & Doherty, G. (1994). Conversation, Coordination and Convention - an Empirical-Investigation of How Groups Establish Linguistic Conventions. *Cognition*, 53(3), 181-215.

J. Fernando FONTANARI (University Sao Paolo at Sao Carlos, Brazil)

How not to influence people: A multi-agent model

Understanding how opinions and, more generally, cultural traits disseminate through a population is crucial to fully comprehend the patterns of human culture. Of particular interest is the understanding of the mechanisms that lead to the appearance of stable domains characterized by distinct cultural traits, given that people's beliefs have a tendency to become more similar to each other's as people interact repeatedly. Here we consider a popular agent-based model of opinion dissemination – Axelrod's model – and show that, most surprisingly, the introduction of a global external influence (the mass media) on the population of agents leads to the increase on the number of opinion domains (i.e., increases the polarization) rather than to the expected homogenization of the population to conform with the media opinion. This finding illustrates the difficulty of predicting the effects of perturbations on a system of locally interacting agents whose equilibrium properties is a collective phenomenon.

Bruno GALANTUCCI (Yeshiva University and Haskins Laboratories, USA)

Social factors in the emergence of human communication systems

The emergence of human communication systems is typically investigated via either field studies or simulations with artificial agents. The former option captures the full complexity of human behavior, the latter offers robust experimental control. In this talk I present a method that combines the two options. Pairs of participants are invited to play a coordination game with interconnected computers. The game requires players to communicate, but players cannot see, hear, or touch each other. The only means of contact between them is a device that supports the exchange of visual signals but prevents the use of standard graphic forms (e.g., letters or numbers). In other words, to communicate, players must craft a visual communication system from its very foundations. Novel communication systems emerge and develop rapidly during the games, integrating the use of explicit signs with information implicitly available to players and silent behavior-coordinating procedures. After presenting the method and the kind of results it provides, I illustrate the key social behaviors which lead to success (or failure) in the game. Then I describe two studies in which basic social variables have been manipulated. The first study focuses on the effect of including a third player in the game. The main result of this study is that the social diffusion of communication systems is not a simple matter. The second study focuses on the roles players assume in the game. The main result of this study is that, once players understand the perspective of their partners, they can easily adapt to different forms of social organization.

Giorgio GANIS (Harvard Medical School USA & Plymouth University, UK)

Cognitive neuroscience of deception

Communication within and among social groups (human or non-human) typically has to deal with the potential of deception, that is the attempt to convince another social agent of something the deceiving agent knows is untrue in order to gain a benefit. Deception in multi-agent systems can have catastrophic consequences, which is why it is critical for societies to understand its dynamics, its evolution over time, key factors upon which it depends, as well as strategies to minimize (or exploit, in case of conflict) its impact. Although some ecological factors that are likely to affect attributes such as deception frequency and type in multi-agent systems have been investigated (for example, distributional properties of critical resources and available information about them), other factors have been relatively unexplored. Among such factors are the effect of details of the postulated neurocognitive architecture of agents (for example, how accurately their brains can represent other agents' intentions) and the effect of culture (for example, the dimension of individualism versus collectivism). Within this context, the focus of this talk will be on recent data on the neurocognitive bases of deception production processes in human agents as well as on evidence of effects of culture on several types of neurocognitive processes. The key issue of whether neurocognitive evidence can provide useful information and constraints for social modelling of deception dynamics in multi-agent systems will also be touched upon.

Istvan KECSKES (State University New York at Albany, USA)

Context, culture, cognition

This paper argues that context is a dynamic construct that appears in language use both as a repository and/or trigger of knowledge. It has both a selective and a constitutive role. Several current theories of meaning (e.g. Coulson, 2000; Croft, 2000; Evans, 2006) claim that meaning is primarily dependent on actual situational contexts. This paper, however, claims that the meaning values of linguistic expressions, encapsulating prior contexts of socio-cultural experience, play as important a role in meaning construction and comprehension as actual situational context. Context represents two sides of world knowledge: one that is in our mind (prior context) and the other (actual situational context) that is out there in the world. These two sides are interwoven and inseparable. Actual situational context is viewed through prior context, and their encounter creates a third space. According to this approach, meaning is the result of the interplay of prior experience and current experience, which are both socio-cultural in nature. Prior experience is tied to the meaning values of lexical units constituting utterances produced by interlocutors, while current experience is represented in the actual situational context in which communication takes place, and which is interpreted (often differently) by interlocutors.

Robert KOZMA (Memphis University, USA)

Intermittent synchronization and de-synchronization effects as neural correlates of human cognition and social coordination

Experimental studies indicate that human cognition evolves through intermittent synchronization-desynchronization cycles across large-scale brain areas. Periods of hemisphere-wide synchrony are interrupted by episodes of desynchronization, when phase gradients propagate in local cortical populations. The experimental findings can be interpreted using the dynamic theory of brains. Accordingly, brains are dynamical systems with trajectories evolving through high-dimensional attractor landscapes that are determined by the subject's previous experiences, its present state, and its intended future goals. The brain's state space is essentially infinite, owing to the complexities of the environment, of individual experiences, and of the brain itself. This infinite space is periodically projected to a low-dimensional subspace of attractors, which intermittently demarcate the possible onset of conscious experience and decision making. In the talk, we describe the relevant EEG experiments and outline the dynamic brain theory of intermittent synchronizations and its cognitive relevance. We employ a dynamical model of the brain with hierarchical populations with increasing complexity of structure and functions. We elaborate on recent work on neural correlates of social coordination. The introduced framework of coordination dynamics identifies neural signatures of effective, real-time coordination between people. Human-human interaction is considered as a metastable phenomenon in a non-equilibrium system, when the coordination in the population may briefly break down, or be absent for some extended time period. Consequences of the given approach to efficient communication and the emergence of social bonding are elaborated.

Leonid PERLOVSKY (Harvard University and AFRL Hanscomm, USA)

Emotional Sapir-Whorf Hypothesis: Language, music, emotions, cognition, and cultures

In the 1930s, Whorf and Sapir researched an idea that the way people think is influenced by the language they speak. There was a long predating linguistic and philosophical tradition, (Bhartrihari, IVCE/1971; Humboldt, 1836/1967; Nietzsche, 1876/1983), yet this idea is often referenced as Sapir-Whorf hypothesis (SWH). Linguistic arguments concentrated on conceptual contents of languages. For example, words for colors influence color perception. The idea of language influencing cognition and culture has been criticized and "fell out of favor" in the 1960s due to a prevalent influence of Chomsky's ideas emphasizing language and cognition to be separate abilities of the mind. Recently SWH again attracted much academic attention, including experimental confirmations and publications in NYTimes and WSJournal. This presentation summarizes a novel idea, emotional SWH (ESWH): effects of emotions could be no less important than semantics. Emotionality of connections between sounds and meanings is connected to grammars of languages. ESWH is theoretically connected to mechanisms of interaction between language and cognition. The second part of the talk discusses connections between language emotions, musical emotions, and cultures. Musical emotions, their affects on human, their cognitive functions, evolutionary origin, and evolution from pre-human condition to the current state are unknown and considered a most mysterious of human abilities. The proposed hypothesis relates musical emotions to contradictions in knowledge, which quickly evolved due to language. Musical emotions are related to language emotions, and to emotions of cognitive dissonances. This hypothesis is developed to explain the previously mysterious properties of music mentioned above. The role of musical emotions in evolution of cultures is traced throughout history. Theoretical and experimental research programs further developing and testing the proposed hypotheses are outlined.

David SALLACH (Chicago University and Argonne National Laboratory, USA)

The dynamics of coercive utopian discourses

The emergence of modernity has been accompanied by the idea of societal engineering and the perfectibility of the species. Sometimes the concept has assumed a gradual, evolutionary strategy, but the more disruptive form might be called coercive utopianism. From the Jacobin movement during the French revolution, to communism and fascism, to the emergence of Islamism and a nascent ecological terrorism, coercive utopianism has drawn upon human hope and idealism, using them to justify militantly coercive strategies. However, while the violence and coercion of these movements provide a natural focus of scholarly and practical attention, their forms of linguistic communication are no less relevant. Such movements are highly reliant on their need to communicate, motivate, mobilize and focus their movements. Because they do not want to prepare their adversaries, the idealism must serve as a mask as well as a motive. However, it cannot mask the intent of the movement to the point that mobilization strategies are moot or muted. At one level, this is a product of all mobilizing movements, but coercive utopianism contains a deep contradiction that casts such tensions into bold relief. Moreover, there is a fierce dynamic both within and among coercive utopian movements. The earlier ones serve as an inspiration to the later, at the same time that their demises, when they occur, serve as a warning to their successors. All levels and types of communication, from emotion, to conceptual frameworks to cultural coherence, are involved. The use of subtle or indirect communication, such as irony, answerability and other tropes, have provided important means for deflecting movement tensions. All such dynamics suggest that coercive utopian movements provide an important domain in which to advance and apply models of discourse research.

Antonio SANFILIPPO (Pacific Northwest National Laboratory, USA)

Modeling radical rhetoric

The history of social movements is ripe with examples of radical groups that share the same ideology and yet adopt opposite practices towards the use of violence. For example, both al-Gama'a al-Islamiyya and the Muslim Brotherhood advocated the establishment of a theocratic state ruled by Shariah law in Egypt during the 1990s. Yet, while the Muslim Brotherhood have not pursued terrorism as a means to attain their political and religious goals, al-Gama'a al-Islamiyya chose the opposite mode of action. The question that I explore in this talk is how to detect when messages expressing equivalent radical ideologies originate from a terrorist source and what a temporal analysis of such messages can tell us about the impending occurrence of a terrorist attack. We leverage the co-expression of rhetoric and action features in discourse to build computational models that identify messages from terrorist sources and estimate their proximity to an attack. The emerging approach combines insights from Frame Analysis and theories that explain the emergence of violence with reference to factors such as moral disengagement, the violation of sacred values and social isolation in order to developed a predictive computational approach to radical rhetoric. Frame Analysis has had an increasingly strong impact on the study of social movements since its inception in the mid 70s. Its objective is to understand the communicative and mental processes that explain how groups, individuals and the media try to influence their target audiences, and how target audiences respond. We provide a computational implementation of Frame Analysis that is based on the integration of text mining techniques from computational linguistics and content analysis methods from sociology and political science. The same approach is used to integrate the import of other factors contributing to the detection of violent intent such as moral disengagement, the perceived violation of sacred values and social isolation, using additional theoretical insights from anthropology and psychology. We discuss a specific application of this approach to a body of documents from radical groups in the Middle East and discuss the relevance of the results achieved.

Matt SCHLESINGER (Southern Illinois University at Carbondale, USA)

What's the frequency, mama? Socioemotional and cognitive components of early caretaker-infant communication

Within the first three months of life, a number of prelinguistic skills begin to emerge in the human infant. These skills establish an important foundation that opens multiple channels of communication between infant and caretaker. In this talk, I describe some of the key socioemotional and cognitive skills that are essential to communicating, as well as how they develop in early infancy. I then highlight recent examples of how researchers in developmental robotics have investigated the early development of communication and social interaction, including both normal and pathological development.

John SCOTT (University of Plymouth, UK)

Social network modelling

This paper introduces the background and themes of social network analysis from its diverse origins in social psychology and anthropology. The paper examines the ways in which formal techniques have developed from substantive applications to small groups, communities, and cultural processes. The paper will illustrate applications through material drawn from communication and diffusion studies in small and large social groups and from investigations of citation and co-authorship patterns in scientific discourse. It will conclude with an examination of the ways in which the area has been affected by new trends from within physics that are pointing the way towards more dynamic and longitudinal models of network structure.

David TRAUM (University Southern California, USA)

Models of culture for virtual human conversation

Virtual humans are artificial agents that include both a visual human-like body and intelligent cognition driving action of the body, including engaging in face to face conversation. Culture covers a wide range of common knowledge of behavior and communication that can be used in a number of ways including interpreting the meaning of action, establishing identity, expressing meaning, and inference about the performer. Virtual human behavior will always be interpreted by people from a culture-specific vantage point and viewers will make inferences about cultural aspects of the virtual humans, so whether or not an explicit model of culture is used in the design and behavior of the virtual humans, one will be attributed to them. In this talk, we will present a taxonomy of types of culture models for virtual humans and look at several examples of existing cultural models that have been used, focusing primarily on those we have developed at the Institute for Creative Technologies at University of Southern California, and point out remaining steps for a more full model of culture.

Alessandro VINCIARELLI (Glasgow University, UK)

Social Signal Processing: understanding nonverbal communication in social interactions

There is more than words in linguistic communication. Whenever involved in social interactions, people display a wide number of nonverbal behavioural cues (facial expressions, vocalisations, gestures, postures, etc.) that add entirely new layers of meaning to the words being uttered. Social Signal Processing is the new, emerging domain aimed at conceptual modelling, automatic analysis and machine synthesis of nonverbal cues used as social signals, i.e. signals conveying information about social actions, social relations, social emotions and social attitudes. The goal of this talk is to illustrate the general aspects of the domain, present some examples of SSP works, and show how SSP can be helpful to make computers more adept and robust to realistic socio-cultural phenomena.

Andre WLODARCZYK (Paris Sorbonne University, France)

Modeling integral linguistic communication as a distributed system

The classical generative “in-depth”, tree-like representation structuring of linguistic communication needs to be enhanced with multi-dimensional (“many depths”) web-like representations, more suitable for building meaning within intelligent distributed (multi-processor) systems.

On top of logical inference (reason), such psychological factors as attention, intention and emotion interplay as much in the processes of meaning creation as in that of communication. To conceive this interplay as a formal model of communication, it may be fruitful to start with the framework of Meta-Informative Centering (MIC) theory which focuses on how attention structures predication.

Distributed Grammar is designed as a multi-dimensional approach to the understanding of natural language. Such an analytical view emerged as the result of an investigation into syntactic structures and especially when it became clear that the sequential nature of language reflects both the semantic and pragmatic components of the meaning of utterances. Distributed Grammar is an integrated framework for Associative Semantics (AS) and Meta-Informative Centering (MIC) theory. This integration can be achieved using two kinds of precision (expansion or development) of meaning : (1) external precision - grounding which is applied in order to determine the informative truth value and (2) internal precision - refinement which in some cases is necessary for determining the meta-informative predication status of utterances. Since, in Distributed Grammar, refinement also crosses some other spaces of discourse analysis such as the communicative space (backward/forward looking centered units or, in other words, "anaphors/cataphors") and the epistemic space ("known/unknown" and other kinds of meta-informative modalities such as belief, possibility etc.), it can be considered therefore that both grounding and refinement play the role of liaison (glue) between the pragmatic and semantic components of grammar.

The theory envisages at one and the same time, expression (communication in all its aspects: verbal, visual but also using other channels and supports) and perception (cognitive experiencing of states and actions) which are simply extreme examples of using ingredients from a rich realm of meaningful elements of the world, starting with symbols, going through all kinds of other signs (indexes, icons, signals etc.) and ending with things (objects and facts). 'Symbols' stands for linguistic signs and 'things' covers everything possible (no matter whether it is real or imaginary).