



## **Language, Vision & Music: Workshop Report on The Eighth International Workshop on the Cognitive Science of Natural Language Processing (CSNLP-8)**

*National University of Ireland, Galway (NUI Galway), Galway, Ireland, Monday 9th–Wednesday 11th August, 1999*

PAUL MC KEVITT<sup>1</sup>, CONN MULVIHILL<sup>2</sup> & SEÁN Ó NUALLÁIN<sup>3</sup>

<sup>1</sup>*University of Ulster, Northern Ireland (E-mail: p.mckevitt@ulst.ac.uk);* <sup>2</sup>*National University of Ireland, Galway (NUI Galway), Ireland;* <sup>3</sup>*Nous Research & CSSI, Ireland*

### **1. Introduction**

“Occurring during the solar eclipse of 1999,” the Eighth International Workshop on the Cognitive Science of Natural Language Processing (CSNLP-8) has been a success. The delegates enjoyed themselves, and particularly not only the academic content but also the surplus of social events, and expressed their congratulations on the programme and organisation. CSNLP attracted for the first time a large number of delegates and papers from abroad including many from Britain, Europe, the USA and Asia.

CSNLP-8 was hosted by the Information Technology (IT) Centre at NUI Galway, Ireland, The Cognitive Science Society Of Ireland (CSSI), and the Artificial Intelligence Association of Ireland (AI)<sup>2</sup>, in cooperation with IntelliMedia 2000+, Aalborg University, Denmark. It was run just before “MIND-IV: Two Sciences of Mind”, The Annual Conference of the Cognitive Science Society of Ireland (CSSI), at Dublin City University, Dublin, Ireland (August 15th–18th).

CSNLP-8 was advertised internationally to mailgroups and on usenet as well as by placing information at the Information Technology (IT) Centre, NUI Galway on WWW Paul Mc Kevitt was Programme chair for CSNLP-8 with Conn Mulvihill and Micheal Colhoun as Local Organisation Chairs and Seán Ó Nualláin is the General Chair for CSNLP. More details on the Workshop are available on <http://www.it.ucg.ie/csnlp8>.

## 2. Venue

Galway, Ireland with a population of around 80,000 is the Capital of the West of Ireland and is situated on the Northeastern edge of Galway Bay with Connemara to the West and agricultural regions to the East and South. It is the third largest city in the Republic of Ireland after Dublin and Cork. Galway has experienced phenomenal growth in recent years and has a lively vibrant City Centre with traditional medieval streets, extensive shopping and business facilities, a youthful population and its living culture of music, theatre and language makes it for many the Cultural Capital of Ireland. With relevance to the organisation of this meeting Galway is a twin-city of Aalborg, Denmark.

We find the following quote on Galway from <http://www.galway.local.ie>: “CITY OF THE TRIBES “To hell or to Connaught” ordered Cromwell as the dispossessed flocked west in their droves. The land may still be poor but no-one these days would equate Connaught with hell. As anyone who ever watched the sun go down on the famously beautiful Galway bay will tell you, it’s definitely more on the heavenly end of the spectrum. A friendly sprawling city, Galway has all the amenities of a much larger place yet maintains its laid-back vibe. As a University town, it is incredibly youthful, culturally vibrant and undeniably cosmopolitan. You can lose your shirt at the races or your inhibitions at the oyster festival. A light mist will enhance your complexion as you cycle over the salmon weir, along by the cathedral. Bring your umbrella and prepare to have lots of fun ...” More details about Galway are available on “The complete guide to Galway” (<http://www.galway.net>), “Local Ireland”, Galway (<http://www.galway.local.ie>), “Galway On-line” (<http://www.galwayonline.ie>), and “Galway Bay FM” (<http://gbfm.galway.net/gbfmnew/>) (radio).

The Information Technology (IT) Centre at NUI, Galway has a research focus on Cognitive Science and Artificial Intelligence with research on topics such as Creativity, Natural Language Processing, Robotics and Embedded Systems, Information Filtering and Retrieval, Image processing and Human Computer Interaction. The workshop was held in the lecture room (oratory) of the St. Anthony’s College building (see Figure 1), used as a seminary in previous years and appropriate for this meeting which had numerous religious leanings.

## 3. The Programme

The Programme Committee for CSNLP-8 consisted of around eighty members from Ireland and abroad including a large number of internationally renowned researchers. The programme contained a balanced set of papers



Figure 1. St. Anthony's College building.

from both Humanities and Engineering in response to the following Call for Papers:

*Language, vision and music*

What common cognitive patterns underlie our competence in these disparate modes of thought? Language (natural and formal), vision and music seem to share at least the following attributes: a hierarchical organisation of constituents, recursivity, metaphor, the possibility of self-reference, ambiguity, and systematicity. Can we propose the existence of a general symbol system with

instantiations in these three modes or is the only commonality to be found at the level of such entities as cerebral columnar automata? Also, we invite papers which examine cross-cultural experience of these modalities.

What can Engineering of software platforms for integrated Intelligent MultiModal and MultiMedia processing of language/vision/music/etc. tell us?

Topics include:

- combinations: language and music; language and vision; music and vision.
- What can Engineering of software platforms (e.g. AAU CHAMELEON; cf. <http://www.cpk.auc.dk/imm>) for integrated Intelligent MultiMedia processing of language/vision/etc. tell us?
- Metaphor: For example: the use of terms like “interval” and “range” in music.
- Rhythm: How is Rhythm important for language, vision and music?
- Acoustics: What role does it play in the three modalities?
- The roles of embodiment and culture in the formation of symbolic apparatus; For example: the use of gesture in face-to-face communication.
- Emotions: what role do they play in the three modalities?
- Synesthesia
- What the visual, musical and linguistic arts can tell us.
- What is the developmental relationship between prosody and music? What is the cognitive evidence for the dependence of music on language?
- Can we speak meaningfully about a semantics of music?
- Architectures for integration of language, vision and music; what aspects are conscious and what automatic? What aspects are common and what are specific to each?
- What is the role of modelling creativity? Are the creative processes similar or in what way are they different?

Special session on creativity:

In AI we have failed to get much handle on creativity.

Conn Mulvihill will Chair a special session on creativity looking at writing, poetry, painting, and music composition.

Irish Nobel Prize Laureate Seamus Heaney is composing a translation of Beowulf at present with special attention to the sound – reminiscent of movement in a longship type craft and there are those that claim that music is central to any hope of understanding

Joyce. We think also of the likes of Kandinsky here.  
 Is Joyce prose or music? Is Kandinsky art or music?  
 What is Picasso? What are the links between language, vision and music?  
 Is creativity the same for each? and by the way, What is creativity?  
 It is intended to involve Writers-in-Residence at NUI, Galway.  
 Pat McCabe (“The Butcher Boy”) and Paula Meehan (Poet).

- Are recent trends towards integrating ideas in the Arts/Humanities and Sciences/Engineering important here?  
 (cf. <http://www.futurehum.uib.no/>  
 & <http://tn-speech.essex.ac.uk/tn-speech/>  
 & <http://www.cpk.auc.dk/imm>)
- Why are there many arts and not just one?

CSNLP-8 had four invited speakers with 30 papers split into nine oral sessions (multimodal communication interfaces, multimodal communication and music, multimodal system formalisms and architectures, language and vision, language and music, language and music (semantics), synaesthesia, creativity I and II), panel session (on creativity), and five posters.

### 3.1. *Invited papers*

We had a distinguished group of invited speakers from both Europe and the US: Sheldon Klein (Computer Sciences Department and Linguistics Department, University of Wisconsin, Madison, USA; see <http://www.cs.wisc.edu/~sklein/sklein.html>), Stephen Nachmanovitch (Free Play Productions, Los Angeles, USA; see <http://www.freeplay.com>), Gérard Sabah (LIMSI-CNRS, Orsay, France; see <http://www.limsi.fr/Individu/gS/>), and Ipke Wachsmuth (Faculty of Technology, University of Bielefeld, Germany; <http://www.techfak.uni-bielefeld.de/~ipke/>).

Sheldon Klein currently teaches courses on “Natural Language and Multimedia” and “Analogy in Language, Culture and Cognition” and his paper entitled “The analogical foundations of creativity in language, culture and the arts: the Upper Paleolithic to 2100CE” proposed that real-world knowledge systems may have evolved in forms that make combinatoric processing problems linear coming from the combinatoric problems associated with unrestricted models of human language processing. Sheldon’s presentation was during a creativity session from 10.50 AM until 11.40 AM on Wednesday, August 11th, at the maximum of a solar eclipse, which was 90% in Galway, occurring at 11.10 AM during his presentation. Paul Mc Kevitt asked him if it was the first time he had spoken during the max. of a solar eclipse and he said yes it was!

Stephen Nachmanovitch (see Figure 2) is an author, musician, computer artist, and educator. Stephen gave three presentations entitled “The computer



Figure 2. Stephen Nachmanovitch.

and the violin”, “Visual Music Tone Painter (synesthesia software)” and “Creativity: stone and lava”.

“The computer and the violin” focussed on the range of experiences that are captured in analog and digital media in musical, visual and verbal art forms. Stephen noted that with each kind of coding, and each kind of practice we gain something and lose something. He points out that this explains why there are so many arts and not just one, many sciences, many religions, many languages and cultures. He asks the question: “How does the medium you choose affect your thoughts and feelings?” With “Visual Music Tone Painter (synesthesia software)” Stephen demonstrated Visual Music Tone Painter(tm) a new art form which merges sound, light, and touch. The user uses the program to paint with sound. The visual forms respond not only to pitch but also to finger pressure and musical dynamics are reflected through visual transformations in size, movement, hue, saturation and value. The work taps into a tradition dating back to Pythagoras where the inter-relations of sound, colour, and form are reflections of archetypal number patterns – giving us a feel for the underlying spiritual unity of our universe.

“Creativity: stone and lava” focussed on creativity which Stephen said like life itself is a balancing act. We melt down structures that are too settled or habitual and solidify intuitions that are too loose and incoherent – a flux of give-and-take between lava and stone. Stephen points out that this is why the archetype of the creative personality is often portrayed as a blacksmith

or alchemist: heating, reshaping, hammering, cooling molten metal. Being too rigid makes us tyrants wrapped up in conformity and fear, and being too loose our dreams remain unrealized. Stephen draws on material from William Blake, Buddhism, Taoism, the history of Western music, and other traditions. Stephen jumped on the point of STAMPING OUT NOUNS and that we must become detached from symbols and Paul Mc Kevitt asked if this is what Joyce did in *Ulysses* and *Finnegans Wake* and Stephen said yes it was! This third presentation of Stephen's was during a creativity session from 9.30 AM until 10.30 AM on Wednesday, August 11th, where the solar eclipse was already ongoing and he made reference to the eclipse a number of times showing pictures of lions eating the sun which heralded "a new beginning". During this, Paul Mc Kevitt noted that on EuroNews TV in the morning it showed Celtic Druids dancing in Cornwall, England doing the sundance and they pointed out that the significance of the solar eclipse was that it heralded "a new beginning".

Paul went further to say: "When I read *Ulysses* and *Finnegans Wake* it feels like I am eating the sun" and Stephen said this was a Haiku, an Irish Haiku! Stephen stressed again, a point that he had made in his previous presentations, the need for us to become detached from symbols, our beliefs about perceptions and perceive the world as it really is in its analogue form. Paul pointed out that in his research field some people had developed formalisms for representing knowledge of the world, etc. and that they had become attached more to the formalisms than what they were being used for. Paul asked if it were true that peoples' beliefs and intentions cloud out their perceptions and Stephen said it was. Paul said at this point that it was well documented that in a number of court cases that witnesses thought that they had perceived something and it was proven later they hadn't. Stephen agreed and recounted the experiment by Harvard psychologist Gordon Allport where subjects were shown slide projections of a scene where a well dressed black man on a subway was attacked by a shabbily dressed white man – however, a statistically significant percentage of the subjects when asked said they saw the reverse – a well dressed white man being attacked by a shabbily dressed black man. Nachmanovitch's presentations brought a lot of life to the Workshop and his style of presentation was lively showing mainly pictures through slide presentation to make his points. His book "Free Play" (see Nachmanovitch 1991) gives more details on the ideas on which his presentations were based.

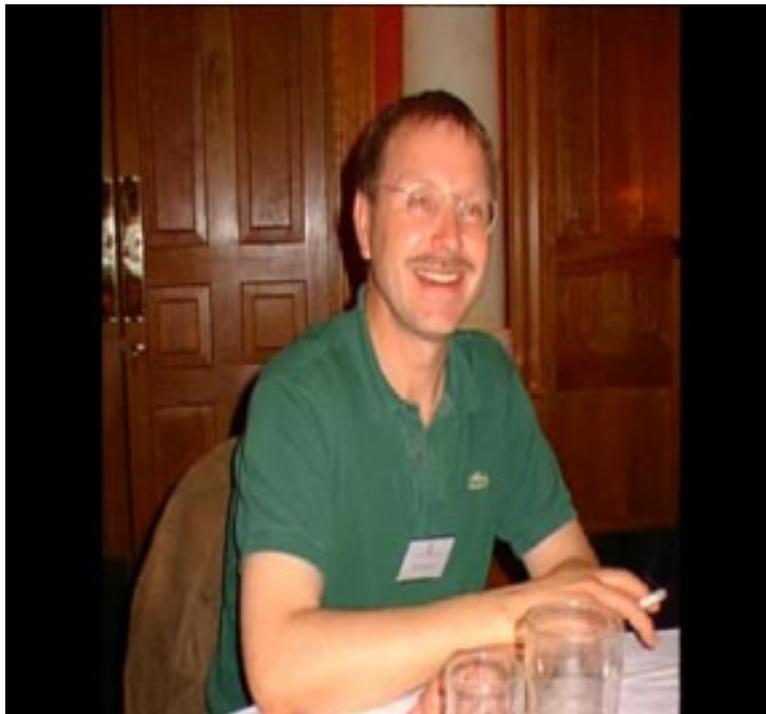
Gérard Sabah's presentation on "The respective role of consciousness and subconscious processes for interpreting language and music" focussed on the Caramel architecture which has been developed to account for three aspects of natural language understanding: 1. dealing on the fly with unpredictable

situations, 2. simulation of unconscious (automatic) processes, 3. dealing with true semantics (not only formal): consciousness being a bridge between the preceding aspects. He summarised the architecture, provided neurological and computational evidence for its validity and pointed out the commonalities between language, vision and music. He took the example of a musician, showing how Caramel can mimic some of the underlying processes where the example involves interpretation AND production as well as vision, hearing and gesture. Caramel has a new data structure, the Sketchboard, an extension of blackboards, allowing different modules to collaborate while solving a problem which allows feedback from higher levels to lower ones without requiring any explicit control.

Ipke Wachsmuth's (see Figure 3) presentation on "Communicative rhythm in gesture and speech" focussed on the fundamental role that rhythms apparently play in speech and gestural communication among humans. Ipke focussed on how multimodal interfaces are conceptualised on the basis of timed agent systems and how multiple agents are used to poll presemantic information from different sensory channels (speech and hand gestures) and integrated into multimodal data structures that can be processed by application systems. Ipke motivated and presented work which exploits rhythmic patterns in the development of biologically and cognitively motivated mediator systems between humans and machines. Ipke covered a number of projects carried out and ongoing at his laboratory in Bielefeld and also the large SFB-360 project "Situating Artificial Communicators" (see Rickheit and Wachsmuth 1996) focussing on the integration of speech, vision and robotics, demonstrating the importance of rhythm in systems. Paul Mc Kevitt pointed out whilst introducing Ipke that SFB-360 focussing on Intelligent MultiMedia which Ipke is co-directing, is one of the largest projects in this area in Europe, if not in the world. Ipke gave an exciting presentation bringing in examples of music from the Irish Rock musician Rory Gallagher and an example video of Marvin Minsky gesturing fervently to demonstrate rhythm and finished with a picture of "two druids" John McCarthy and Paul Mc Kevitt standing at Grianan of Aileach, Co. Donegal, Ireland (see Figure 4) and having a dialogue through bubbles ending with Paul saying, "rhythm is the key". Ipke mentioned that he had just been to Ireland with his family for a holiday, returned to Germany, and came back again for the workshop.

### 3.2. *Submitted papers*

On "multimodal communication interfaces" Isabella Poggi presented work on the meaning of gaze in animated faces. She analyses gaze from both a signal side (physiological state and muscular actions of eye region) and on the meaning side (type of information conveyed) and a formal representation

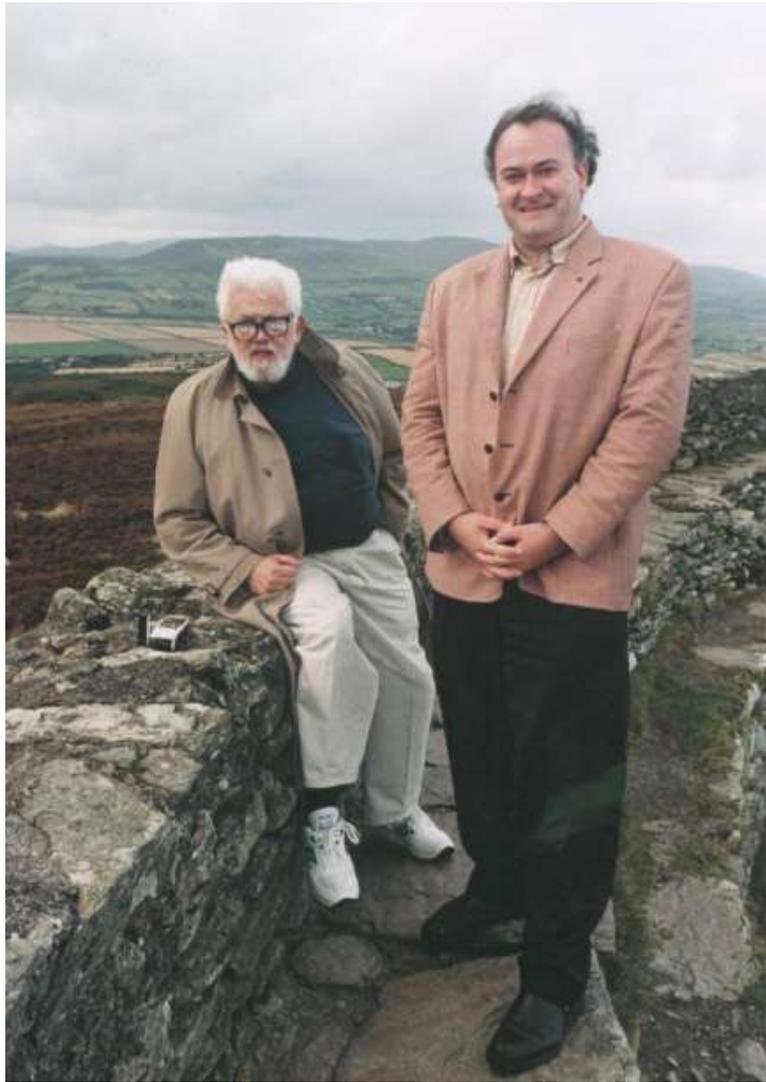


*Figure 3.* Ipke Wachsmuth.

is proposed for each possible meaning. John Gurney described a software agent that uses simulated perception to perform spoken language navigation in a natural language and virtual reality project (NLVR) where the user interface simulates the look and flow of movement through terrain and sky operating in real-time presenting a detailed, photographic quality landscape. Paul Nemirovsky from the MIT Media Laboratory presented GuideShoes, a wearable system which assists the user in navigating an open space such as streets, by sequencing emons (musical patterns) as navigational cues.

In the session “multimodal communication and music” Poggi described work on studying the communicative facial behaviour of an orchestra conductor in order to produce a lexicon of the signals produced in conducting by gaze, head movements and facial expression. Alain Bonardi showed a new genre of interactive operas implemented on personal computers which differ from traditional operas because they offer new perspectives of combinations between music, text and visual spaces.

On “multimodal system formalisms and architectures” Riccardo Antonini presented the Amusement project where one of the goals is the integration between different aspects of interaction at distance through Virtual Worlds



*Figure 4.* John McCarthy and Paul Mc Kevitt at Grianan of Aileach.

and where language, vision and music is integrated in a multiuser distributed virtual environment. John Connolly focussed on the application of some fundamental principles of General System Theory (GST) to multimedia integration.

In the session entitled “language and vision” Julie Carson-Berndsen showed how prosodic representations for speech applications can be visualised. Francisco Pereira presented Dr. Divago, which is a system that aims at

getting musical and drawing ideas by solutions in a multi-domain knowledge base where the goal is to achieve transfer of ideas between different domains. Thomas Dorf Nielsen and Sergio Ortega from IntelliMedia 2000+, Aalborg University, Denmark discussed the exchange of affect/emotions in human-computer interaction and classify a user's input based on basic emotional attitudes from traditional media (eye-tracker, gesture recognition, speech-to-text recognition) and also signals communicated through extra-linguistic features (prosodic mode). The user interacts with an autonomous dog-like 3D agent called Bouncy. Paul Mc Kevitt presented the CHAMELEON system from Aalborg University, Denmark which is a general platform for performing the integration of speech and image processing with an application where people can ask questions like "Whose office is this?" about 2D building plans. Paul introduced his presentation by showing a postcard from his mother which had a picture of the "Brian Boru" harp, a 15th or 16th century harp which is the oldest surviving Irish harp and on which the national government seal of Ireland (the harp) is based, and noted that many countries have birds or animals rather as their government seals. He also showed a picture of the Irish 10 pounds note on which there is a picture of James Joyce (1882–1941). Finally, Paul blessed the workshop proceedings with some sprinklings of Irish whiskey.

In "language and music" Kai Karma discussed a study where the aim was to clarify the roles of auditory structuring and auditory/visual matching in dyslexia. The test is one where the subject reads abstract, non-verbal visual patterns when corresponding sound patterns are played by the computer. Seán Ó Nualláin (see Figure 5) presented "Tonality in Irish traditional music" arguing that Irish music is modal and instead of having a triad of 1-3-5, i.e. a major and minor chord, it relates to a single note, a centre of tonality. He hastened to add that none of the music associated with the Riverdance dance show is Irish traditional music!

Barbara Tillman looked at priming effects in language and music and reviewed a set of semantic and harmonic priming experiments and concluded that an integrative stage of processing seems not to be indispensable to account for global relatedness effects in harmonic priming.

In the session on "language and music (semantics)" Jean Callaghan and Edward McDonald discussed expression, content and meaning in language and music and came up with an integrated semiotic framework which recognises three types of meaning: ideational (world of experience), interpersonal (relationships between enactants), and textual (creating relevance to context). Niall Griffith discussed the idea that it is the functional as well as the structural similarities between language and music that are important and in



*Figure 5.* Seán Ó Nualláin.

particular the idea that their similarity arises because they are articulations of a single perceptual/cognitive system.

In the session on synaesthesia John Gammack (see Figure 6) discussed “synaesthesia and knowing” and noted that recent years have seen a resurgence of interest in synaesthesia where, for example, we have people hearing colours or tasting shapes. John focussed in particular on the integration of colour imagery with language or musical notes and points to an explanation suggested by an esoteric understanding of mental phenomena with linkages to the nature of human knowing. Sean Day, a synaesthete himself, presented an overview of current scientific views of synaesthesia

attempting to correct misunderstandings and answer common questions. Sean proposed that research on synaesthesia will give useful insights into brain and language evolution and functions can be a useful tool towards exploring new artistic media. Sean also presented two papers from Russia by Bulat Galejev and Ileana Vanechkina who could not attend CSNLP-8. In one paper, “‘Prometheus’ (Scriabin+Kandinsky)” they analysed all noted attempts of ‘Prometheus’ performed throughout the world through many years of research and experiments with the “light symphony” idea of Scriabin. Their own experiment on the original solution of the problem of light-music synthesis is described where the music of ‘Prometheus’ was accompanied by the pictorial images of W. Kandinsky who dreamt of the synthesis of musical and visual impressions. The other paper by Galejev considers synaesthesia as one of the forms of interaction in polysensorial perception where normal synaesthesia is considered to be “intersensational association” with manifestation of non-verbal thinking connected with intersensational comparison and hence synaesthesia is not a psychic anomaly but a form of non-verbal thinking.

In the first creativity session Paul Hodgson presented ideas on “Modelling creative cognition through evolution” aiming at a more accurate cognitive model of the mental processes involved in the generation of creative content with the aim of developing a general theory of creative cognition. Paul noted that evolution allows for emergence of adaptable structures which is in direct opposition to the explicit representation of data structures to represent different modalities and his answer to this is to outline a methodology which looks at ways in which structure and process can emerge within the system. Paul played the sax during his presentation and he and Seán Ó Nualláin did a duo with Seán on guitar. Another paper was not presented at the meeting due to the authors not being able to attend – “h2g2: the hitch hiker’s guide to the Galaxy” by Soeren Christensen and Adam Cohen from IntelliMedia 2000+, Aalborg University, Denmark discusses a system called h2g2 which answers natural language queries about places to eat and drink with relevant stories generated by storytelling agents from a knowledge base containing previously written reviews and places and the food and drink they serve. h2g2 is based on the electronic guide to Life, the Universe and Everything in Douglas Adams’ “Hitch Hikers Guide to the Galaxy” science fiction story (see Adams 1979) and is now the basis of a product from Adams’ company, The Digital Village (TDV). Jens Allwood presented “Intermodal translation?” asking the philosophical question of whether it is possible to fully translate between different modalities such as text, speech and vision. His conclusion was that it is not, and that is why we have these different modalities in the first place.



*Figure 6.* John Gammack.

In the second creativity session Julia Lonergan presented a study of humour inherent in the language content of the Tarahumara Indians of northern Mexico. Their linguistic mode builds support for the hypothesis that they see in opposites and the duality in their belief system provides a binary semantic framework necessary for spontaneous humour. The linguistic attributes of proverb and metaphor are correlated with the ancient Tarahumara superstitions of sorcery as the origin of all misfortune and death. Another paper on creativity was not presented at CSNLP-8 as the author, Tudor Rickards, could not attend. Tudor's paper focussed on creativity from

within the Economic world where it has attracted attention as a contribution towards achieving individual and organisational innovations. Tudor examines the economic perspective in the context of current research into the nature of work teams and this is then extended to considerations of the nature of discovery processes in various domains of arts, science and everyday life.

### 3.3. *Poster papers*

Due to the intensive programme for CSNLP-8 some papers could only be accepted as posters due to limitations of space in the oral programme. Patrick Fourcade presented a poster on his work on ACROE a language to simulate virtual musical instruments by physical models. He makes a connection between unvoiced plosive consonants and a model of a musical percussion attempting to generate /p/, /t/, /k/, consonants by a percussion model. Harriet Read and Rosemary Varley report on a detailed study of a dissociation between language and music in a pre-morbidly musical patient who has severe language difficulties (global aphasia) due to extensive left-hemisphere damage. The findings suggest that complex musical processing is being undertaken by the right hemisphere due to left hemisphere damage contradicting claims of left hemisphere dominance for music in musically sophisticated subjects. Elisabeth Ahlsén also discussed speech, vision and aphasic communication. Dilys Treharne looks at the relationship between the imitation and recognition of non-verbal rhythms, sequential processing and language comprehension. Her present study is exploring the relationship between rhythmic ability and language development in two ways: by studying the difficulties in rhythm displayed by children with language difficulties and the effect of training in rhythmic awareness, and by re-examining sequencing, rhythmic ability and inferred meaning in children developing language normally. Antonio Romano investigates if there is any correspondence between the general rising-falling contour in spoken sentences and the classical subdivision of melody in European music into two parts: a 'proposal' generally ending on a fifth, and a 'response' following a resolute pattern towards the tonic. Empirical studies are carried out through field studies in Aosta Valley, Apulia Region Sudtirolo, and Abruzzi Region in Italy and a pilot study on other European languages.

### 3.4. *Plenary panel session: what is creativity?*

The panel session on creativity was held in the afternoon (4.00 PM) of the solar eclipse on Inis Mor (Big Island), the largest of the Aran Islands. Members of the panel are as shown in Figure 7.



*Figure 7.* “What is creativity?”; Back row (left to right): Sean Day, Gérard Sabah, Ipke Wachsmuth, Paul Hodgson, Julia Lonergan, Stephen Nachmanovitch, Paul Mc Kevitt, Sheldon Klein; Front row (left to right): Riccardo Antonini, Francisco Camara Pereira, Micheal Colhoun, and Conn Mulvihill.

Conn Mulvihill asked a number of questions on creativity in the call for papers as shown above the central one being, what is creativity? He also contributed a paper on creativity and asked the question, is creativity algorithmic? Conn also used these two questions to kick off the panel discussion as well as singing the song “Raglan Road” the words of which were written by the poet Patrick Kavanagh and the tune of which is “The dawning of the Day”. Conn’s paper points out that any language is taken to be characterisable through form and content and creativity activity occurs where form and content mix. Paradoxes mix form and content in a special way and ambiguity and diagonalisation appear where form and content mix whereas algorithmic studies are mainly concerned with space/time metrics and not with form/content interplay. It is posited in the paper that any language supporting creativity should mix form and content and be marked by ambiguity and reflective arguments and hypertext might be an example.

Riccardo Antonini said creativity is, in his view, a form, a very special one indeed, of mastering a given language. Triviality is on the contrary the common use of such a language. For example, in his game “Let’s compose together” there is a language whose lexicon is the set of all the possible objects (and their attributes: colours, sound etc.). The syntax, that in Greek means “putting things together”, is very loose there, but still there is one,

since there are only some ways to compose the objects together, while some others are not possible. For example, we cannot overlap objects one inside the other (we may of course, but we do not allow the people to do it). With such a lexicon and syntax, a trivial game is putting objects together at random. A creative way of putting them together is, on the contrary, for example, creating an alley, in which while you walk you listen to music, and watch the pictures and animations associated. The syntax is a constraint, the lexicon is the raw material, and the creativity is the capability of building non trivial phrases in this (or any other) language.

Sean Day said: as to whether an algorithm could be written for “creativity”, I would have to say “No”. It is possible to write algorithms that produce creative things – this is done all the time. Likewise, it is possible to be creative via algorithms – such is virtually a basic requirement of being creative. However, “creativity” in of itself is, by definition, unbounded, infinite. “Creativity” is the essence of Gödel’s Theorem - there will always be something, undefined and perhaps eternally undefinable, beyond the realm, transcending it. Thus: It is possible to shape algorithms for a computer/robot/android who could become highly creative, and quite probably could eventually (self?)-evolve creativity in wholly non-human forms. However, neither this nor any other entity nor algorithm can encompass the whole of “creativity”, which is infinite.

Sheldon Klein commented: I think of creativity in the context of the cognitive worlds created collectively by groups of humans some 40,000 years ago, at the onset of the Upper Paleolithic, when, after an archaeological record of more than a 150,000 years of unchanging technology, humanity embarked upon the exponential growth of creativity in the arts, technology and social organization that continues to the present day. I suggest that the source was in the invention of global classification schemes, in combination with analogical modes of reasoning. Semantic features may be viewed as an alternate notation for class or category memberships. If complex set memberships are represented by boolean feature vectors, the vectors may also be interpreted as binary integers, and the minimum number of features needed appears as the number required to give a unique identifier to every element in the cognitive universe. If a ‘hashing collision’ occurs when a new entity is encountered, then adding a single new feature to the category system system can remove the ambiguity. But this addition doubles the size of the potential universe, and creates a vast domain of potential concepts that may be explored, at low cost, by analogy. The process can accelerate the discovery of new phenomena and the need for more features, with the result that exponential growth of the cognitive universe becomes a self-sustaining process.

Julia Lonergan said that Creativity and Natural Language Processing (NLP) have an objective in common, both seek for ways to represent meaning outside of natural language. Machine Translation has as its aim the representation of the meaning in natural language in an alternative form, usually called an interlingua. This form consists of defining the computational elements of language with a system of language independent symbols. In the case of famous literary works, such as *Finnegans Wake*, James Joyce relied on metaphorical extensions of meaning, idiomatic comparisons, and phonetic similarities to create riddles that also encode meaning in language. In both cases, the meaning is hidden in the deep structure and relies on the background knowledge of the recipient to decode the content. Theatrical compositions function similarly. In dance, for example, mime, gesture, music, and movement convey a story independent of language. Thus, as a lexicographer, who has been trained to transfer the English language into its interlingual symbols NLP, and as an artist, writer, and dancer, who has given language related realities a form of expression outside the use of natural language, she finds that NLP and creativity converge at the point that both seek to capture and represent human expression in alternate ways.

Paul Mc Kevitt said that Conn asked two questions and with respect to the first one (what is creativity?) Geraint is right (Geraint Wiggins, a workshop attendee had made a point about creativity and the unexpected), in that the unexpected or surprise is interesting and hence creativity is surprise and in particular creativity is an emergent property of Free Play; Paul then played "The dawning of the day" on Ipke's tin whistle.

Stephen Nachmanovitch responded: Can creativity be taught? Are there algorithms for creativity? This is a very important question, but it is important to turn it upside down. What one can teach is not creativity but the disinhibition of creativity. Every human being is born creative, is potentially creative all the time. Every one of us has created several billion cells just today. We are talking together in this room thanks to the creativity of the settlers of this island, of the people who built this building, of the people who evolved our languages. We exist in an environment of overwhelming, continuous, all-around creativity. Creativity is never a problem. The problem is the inhibition of creativity, which usually comes about through fear. Fear of embarrassment, fear of not being in control, etc. The algorithm that most affects my creativity is other people. That's why it's great to be speaking together today. I think that the formula for changing one's creativity is inviting another human being, with a somewhat different mind, into your creative space, and – boom! something will happen. If beings are brought into apposition with other beings, who have other operating systems and other biases, and if you cross the biases, bringing together what James Joyce called their

intermisunderstanding minds, then powerful combinatorial and synergistic effects take place. This can be done with ideas, even machines. My preference is to do it with other human beings. They're the most fun.

Francisco Camara Pereira pointed out that there are two issues upon which he'd like to state some comments. Sometimes, he sees much confusion among them: Creativity with Computers and Computational Creativity. The first one, very common, is mainly Human Creativity - one uses a program to create and develop his/her ideas. The major parts of the process are controlled by the Human (specially, the evaluation). The second issue, to which he (and others) call Computational Creativity, is indeed a very interesting subject of study. It centers mainly in the quest for methods/frameworks that accomplish in some way the task of automatic resolution of problems in a creative fashion. He sees this "creative fashion" as the way we tend to solve problems when common or routine solutions don't work. Although vague this may seem (isn't any definition of creativity?), he believes we can (and will eventually) develop models that can be considered creative in that sense. Such a system would be able to generate its ideas and be able to evaluate them at some degree of complexity. He believes this can be a very important path in AI, and we still have much to learn from Psychology and Philosophy.

Inspired by the place, Ipke Wachsmuth, from Bielefeld University, took a creative approach to express his sentiment about ingredients of creativity. He took: 'C' for Compassion, to say that it needs a sympathetic attitude for creativity, that feels for a matter in devotion; 'R' for Rhythm, to say that creativity often leaps in alternating periods of tension and relaxation; 'E' for Exposure, since he thinks a system can only be creative when opening up to, and interchanging with, its environment; 'A' for Art, to say that as much as art is an expression of creativity, enjoying art fosters creativity; 'T' for Travel, to say that it needs to go and see persons and places to enrich your creative pool; 'I' for Impulsiveness, to say that a creative act often springs from the minute idea; 'V' for Vitality, saying that as much as a vital system is necessary for a creative act, vitality also grounds on creativity; 'I' for Imagery, to make the point that, more than reasoning, it needs imagery to conceive the new; 'T' for Tree, to refer to the impact of a creative idea that has the potential to have many branches, like a tree; 'Y' for Yi-jing, leaving it to the audience to understand in which way this should be relevant.

### 3.5. *Local organisation*

Local organisation was coordinated by Conn Mulvihill and Micheal Colhoun who together with Josephine Griffith and Colm O'Riordan comprised the Local organising committee. Conn and Micheal took responsibility for social events whilst Micheal also focussed on equipment and web pages and Conn

on accounts. Josephine dealt with registrations and accommodation and Colm worked on the proceedings and the participants list. They all did an excellent job. The Registrar and Deputy President (now the President), Iognáid Ó Muircheartaigh started off the workshop by welcoming all delegates in both Irish and English with a light hearted introduction.

The extensive social programme for CSNLP-8 organised by Conn and Colm was a great success and it's well known that having a good social programme is always necessary, especially where creativity is concerned! The call for papers invited participants to bring along their musical instruments for informal ceili jam sessions and they did: Stephen Nachmanovitch brought his violin, Seán Ó Nualláin his guitar, Paul Hodgson his sax, and Ipke Wachsmuth his tin whistle and Seán and Paul did a number of duos. On the weekend days preceding the start of CSNLP-8 there were informal gatherings of people for drinks at the Westwood Hotel and Conference Centre. Riccardo Antonini showed up in formal dress since it turned out that his secretary had translated "informal" as "formal"! The Registration Reception was held on the first evening (Monday) of CSNLP-8 at the students' centre and a local group played Irish music for two hours. Also, Stephen Nachmanovitch played an excellent violin solo for 10 minutes which left everyone speechless. Ipke Wachsmuth and Paul Mc Kevitt played tunes on the tin whistle. The Workshop banquet was held at the WestWood Hotel and many commented on the quality of the food which was an excellent beef and fish choice during which we had a string quartet and then later with Seán Ó Nualláin on guitar in a duo with Paul Hodgson on sax (see Figure 8).

During the banquet, Paul Mc Kevitt, Programme Chair on behalf of Seán Ó Nualláin (CSNLP Chair) and himself thanked Conn Mulvihill and Micheal Colhoun for their excellent work on Local Organisation and also each of the invited speakers in turn for coming and said "This has really been one of the best conferences we have organised PAUSE" APPLAUSE "in Europe!" and Stephen Nachmanovitch added "... in the world!". Ipke Wachsmuth thanked Paul Mc Kevitt for being such a wonderful Programme Chair for CSNLP-8 for one of the best meetings in Europe if not in the world! Seán Ó Nualláin, Chair of CSNLP thanked everyone for coming, and especially so many from abroad, and making this such a successful meeting. And, Glorianna Davenport from the MIT Media Lab. captured all of this on her camcorder!

On the Wednesday many people took the opportunity to view the eclipse of the sun during the morning refreshments break and it was visible behind while the clouds cleared (see <http://sunearth.gsfc.nasa.gov/eclipse/TSE1999/TSE1999.html>). The conference tour began at 12.00 noon on the Wednesday and we had a bus trip through the beautiful scenery of Galway and Connemara to the coast town of Rossaveal and then a ferry boat trip



Figure 8. Seán on guitar and Paul on sax.

(1.30 PM) to the town Kilronan (2.15 PM) on the Aran Islands, Inis Mor (Big Island). Next, at 2.45 PM we had the Ragus Irish dancing and music until 3.45 (see Figure 9), then a break and the creativity session at 4.00 PM until 4.50 PM. Next, delegates had the following options: (1) bus or bike to the 2000 year old Dún Aonghasa fort, (2) visit Aran's Heritage centre showing the classic film: 'The man of Aran', (3) do your own thing. Paul Mc Kevitt and Ipke Wachsmuth went walkabout and visited the Heritage centre (see Figure 10). Finally, we had to be back on the boat by 7.30 PM for arrival in Rossaveal and back in Galway around 9.30 PM. We had good weather and a calm sea, most delegates went on the trip and they enjoyed it thoroughly. Some met later informally for drinks at the Westwood Hotel bar.

Unlike previous CSNLP meetings, this workshop was much more international with many coming from Britain, Europe, the USA and Asia. We hope that this trend will continue so that CSNLP remains an international meeting. We had around 50 delegates for CSNLP-8, a large number for a focussed workshop, which has made this the largest CSNLP meeting ever. We were glad that delegates such as Glorianna Davenport, Paul Nemirovsky, and Kris Thórisson from the MIT Media Lab. who are leaders in Intelligent MultiMedia were able to come and now with the new news that MIT MediaLabEurope is established in Dublin, Ireland with first students due to start in September 2000 and funded initially with IR 28 million by the Irish government (see <http://www.mle.ie>). A full picture gallery for the workshop is



*Figure 9.* Ragus Irish dancing on Inis Mor (Big Island).



*Figure 10.* Ipke Wachsmuth and Paul Mc Kevitt going walkabout on Inis Mor (Big Island).

available at <http://www.itucg.ie/csnp8> and clips from Glorianna's camcorder are on: [http://wwwic.media.mit.edu/About\\_IC/GID-Iceland/](http://wwwic.media.mit.edu/About_IC/GID-Iceland/) and reviewable with a Real G2 Player which can be downloaded from <http://www.real.com>.

#### 4. Other related Irish Meetings During 1999 and 2000

“Mind-IV: Two sciences of mind”, the Fourth Annual Meeting of the Cognitive Science Society of Ireland was held at Dublin City University (August 15–18) and had a focus on (1) outer and inner empiricism in consciousness research and (2) foundations of cognitive with speakers Bernard Baars, David Galin, Stuart Hameroff, Katie McGovern, Stephen Nachmanovitch and Karl Pribram and the meeting was very successful (see <http://www.compapp.dcu.ie/~tdoris/mind4.html>). The Tenth Irish Conference on Artificial Intelligence and Cognitive Science (AICS-99) was held at University College Cork (September 1–3) with Barbara Hayes-Roth from Stanford University and Alexis Drogoul from Paris 6 as invited speakers (see <http://www.cs.ucc.ie/aics99>). AICS-00 will be held at NUI Galway (see <http://www.it.nuigalway.ie/aics>). The Irish Machine Vision and Image Processing Conference (IMVIP-99) was held at Dublin City University (September 8–9) with Matti Pietikainen from Oulu, Finland and Don Braggins from Machine Vision Systems Consultancy, England as invited speakers (see <http://www.eeng.dcu.ie/~imvip99/imvip99.html>) and held this year at Queen's University, Belfast, Northern Ireland (see <http://www.qub.ac.uk/ivs/imvip2000/>).

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