Master in Comunicazione della Scienza

della SISSA di Trieste

SEARCHING FOR CONNECTIONS:

COMUNICARE L'INTERDISCIPLINARIETÀ.

La riprogettazione del sito dell'Istituto di Scienze e Tecnologie della Cognizione del CNR

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A Cristiano Castelfranchi, "contrabbandiere" della scienza

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INTRODUZIONE

Le connessioni ci sono sempre, basta volerle trovare.

Umberto Eco, *Il pendolo di Foucault*

L'interdisciplinarietà è oggi un concetto che va di moda nella scienza. Sovrapporre saperi, unire competenze, trovare connessioni: è opinione sempre più diffusa che i maggiori progressi scientifici contemporanei provengano da ricerche a carattere interdisciplinare.

Le scienze cognitive lo dimostrano in modo emblematico: nate proprio per essere interdisciplinari, sono in grado di far dialogare aree di ricerca un tempo lontane come la politica, l'etica e l'economia. Se da un lato questa versatilità favorisce il confronto fra settori diversi, dall'altro porta con sé il rischio di vaghezza.

Di che cosa si occupano *veramente* gli scienziati cognitivi?

L'Istituto di Scienze e Tecnologie della Cognizione del Consiglio Nazionale delle Ricerche (ISTC-CNR) è partito proprio da questa domanda per riprogettare il nuovo sito web istituzionale.

Questo lavoro intende esporre i risultati e le difficoltà emersi dal tentativo di sviluppare una strategia efficace per comunicare l'interdisciplinarietà delle scienze cognitive, caratteristica che l'ISTC rispecchia pienamente. Al suo interno infatti circa 120 ricercatori lavorano sui temi più diversi, dalla psicologia cognitiva alla biologia evoluzionistica, dalla robotica alle scienze sociali.

La soluzione proposta è stata quella di puntare sulla complementarietà di queste discipline, rispettando le peculiarità di ciascuna ma cercando di mettere in evidenza i tanti punti di contatto. Ribaltando la concezione del vecchio sito d'Istituto, che presentava in modo tradizionale e molto tecnico i vari gruppi di ricerca, abbiamo provato a individuare le tematiche fondamentali a prescindere dalla loro appartenenza

disciplinare. Tutto è stato pensato attorno alla metafora della connessione: la sfida è stata tradurre questo concetto in un linguaggio comprensibile e visivamente efficace.

Dopo una breve descrizione del contesto in cui un'operazione comunicativa di questo genere si inserisce, verranno presentate le varie fasi di realizzazione del nuovo sito dell'ISTC-CNR e i principali problemi affrontati. Con un occhio rivolto sempre alla questione dell'interdisciplinarietà e al modo migliore per comunicarla: *Searching for connections*, lo slogan su cui si basa l'intera strategia di comunicazione del sito web, si è rivelata una delle chiavi possibili.

1. UNO SGUARDO ALLE SCIENZE COGNITIVE

Google, Search, "cognitive science": 13.700.000 results (0,24 seconds)

Il numero dei risultati cambia a seconda della velocità della ricerca, ma nelle prime pagine l'ordine dei siti è sempre lo stesso. Al primo posto, l'immancabile Wikipedia: "Cognitive science is the interdisciplinary scientific study of mind and its processes"[1]. Ma prima di approdare nell'enciclopedia libera, nei siti Internet e nei blog, le scienze cognitive hanno subito un'affascinante, rapidissima evoluzione. Da settore scientifico ibrido e confuso sono diventate una vera e propria materia di studio, che in pochi anni ha guadagnato corsi universitari, scuole di specializzazione, convegni, istituti dedicati.

Eppure la figura dello scienziato cognitivo non ha nell'immaginario collettivo un posto chiaro come quello occupato da medici, fisici, biologi. Questo avviene perché probabilmente un profilo univoco per gli scienziati cognitivi non esiste: lo "studio interdisciplinare della mente e dei suoi processi" può essere affrontato da moltissime prospettive, con altrettante diverse competenze. Da un punto di vista comunicativo, questo si traduce nella difficoltà di fornire un'immagine chiara degli oggetti di ricerca delle scienze cognitive, restituendone al tempo stesso la complessità. Di che cosa si occupa uno scienziato cognitivo? E un istituto di scienze cognitive?

La comunicazione istituzionale, nel tentare di rispondere a questa domanda, raccoglie una duplice sfida. Da un lato quella di trovare un messaggio univoco, in grado di semplificare una rete di attività spesso molto lontane tra loro; dall'altro quella di avvicinare il pubblico a una scienza che sotto alcuni punti di vista appare ancora lontana dalla vita quotidiana. La prima sfida può far arrabbiare gli scienziati, la seconda può disinteressare il pubblico: due rischi da evitare se l'obiettivo è dare visibilità a un istituto.

Questo lavoro prende in considerazione uno dei tanti strumenti della comunicazione istituzionale: il sito web. Interfaccia ufficiale tra un istituto e la società, il sito istituzionale è il veicolo migliore per creare e raccontare un'identità. Ma come

[1] http://en.wikipedia.org/wiki/Cognitive_science

comunicare un'identità che non è una, ma sono molte? Il sito d'istituto può essere lo strumento giusto per comunicare l'interdisciplinarietà?

I paragrafi successivi, che non hanno alcuna ambizione di esaustività, cercheranno di tracciare i contorni del contesto scientifico e sociale in cui si sono inserite le scienze cognitive, perché è da qui che deve partire qualunque riflessione su come comunicare la loro interdisciplinarietà.

1.1. Nascita di una disciplina nuova

"I neuroscienziati hanno un grande vantaggio su noi scienziati cognitivi: hanno sempre delle impressionanti immagini colorate di PET o fMRI, che mostrano la localizzazione esatta di qualunque cosa si stia discutendo. Noi invece studiamo quello che c'è nella mente, senza chiederci dove si trova."[2] Così nel 1999 lo scienziato cognitivo canadese Zenon Pylyshyn definisce il raggio di azione della sua disciplina. Oggi, dopo oltre dieci anni, molti suoi colleghi potrebbero non essere più d'accordo con quest'affermazione, dal momento che le scienze cognitive e le neuroscienze viaggiano su binari sempre più vicini. Eppure un aspetto di quel discorso resta attuale: lo studio della mente e di ciò che essa contiene, dei suoi processi e delle sue trasformazioni continua a essere l'oggetto di ricerca di una disciplina tanto vasta quanto complessa.

Nate intorno agli anni '50, le scienze cognitive sono il prodotto di un tempo in cui discipline storiche come l'antropologia e la psicologia si stanno profondamente trasformando. Lentamente si inaugura la grande epoca della contaminazione: i nuovi strumenti dell'informatica cominciano a trovare applicazioni in ogni campo di ricerca e le neuroscienze fanno capolino nel panorama scientifico, permettendo ai settori disciplinari più distanti di dialogare tra loro.

Lo psicologo George Miller identifica l'avvenimento di questa "fusione disciplinare" con una data precisa: l'11 settembre 1956, il secondo giorno di un Simposio all'MIT sulla teoria dell'informazione. In quell'occasione, l'informatico Allen Newell,

[2] Pylyshyn, Z. (1999) *What is Cognitive Science?* Ciclo di conferenze tenuto al Centro di Scienze Cognitive di Rutgers, New Jersey e trasformato in seguito nel saggio Physhyn, Z. (1999) What's in your mind? In Lepore, E., Physhyn, Z. (Eds.), *What is Cognitive Science?* Oxford: Blackwell, 1999, p.1.

l'economista Herbert Simon, il linguista Noam Chomsky e Miller stesso presentano un lavoro che tende a unificare i rispettivi campi di ricerca, spingendoli tutti verso una direzione "più cognitiva". Miller lascia il Simposio "con una forte convinzione, più intuitiva che razionale, che la psicologia sperimentale, la linguistica teorica e le simulazioni informatiche dei processi cognitivi siano tutti pezzi di un tutto più grande, e che in futuro ci sarebbe stata una progressiva elaborazione e coordinazione dei loro concetti condivisi."[3]

Miller aveva visto giusto. Nel giro di pochi anni la "rivoluzione cognitiva"[4] investe i settori scientifici più diversi, dando vita a una nuova scienza. Almeno sei sono le discipline che si fondono tra loro: psicologia, linguistica, neuroscienze, informatica, antropologia e filosofia. Ciascuna di loro aveva ereditato dalla sua tradizione un modo diverso di concepire la mente e la cognizione: ecco che questi modi si sovrappongono, si fondono tra loro, creano la base interdisciplinare su cui costruire una disciplina nuova.

Secondo Miller[5], le sei discipline madri si organizzano tra loro in un esagono:

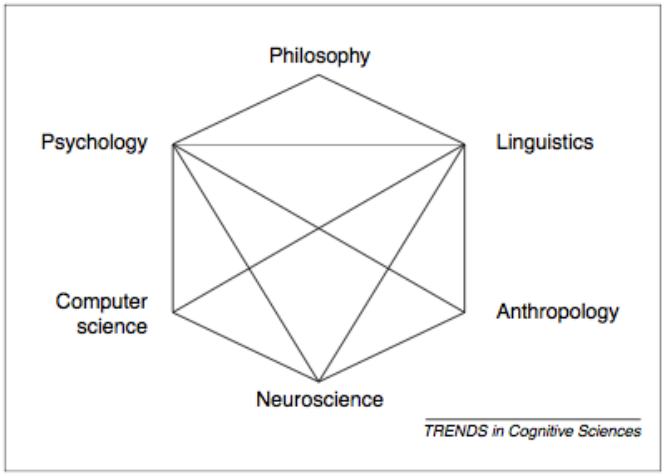


Figura 1 Le sei discipline che danno vita alle scienze cognitive secondo Miller[6]

[3] Miller, G. (1979) A Very Personal History (Occasional Paper n. 1), Center for Cognitive Science, Cambridge, p. 2.
[4] Miller, G. (2003) The Cognitive Revolution: A Historical Perspective. *Trends in Cognitive Sciences*, 7(3), p. 141.
[5] *Ivi*, pp. 142-143.
[6] *Ivi*, p. 143. La figura è ripresa da un documento mai pubblicato scritto nel 1978: Keyser, S.J., Miller, G.A., W. Walker, E., Cognitive Science in 1978. *An unpublished report sub- mitted to the Alfred P. Sloan Foundation*, New York.

Le linee che uniscono i vertici dell'esagono rappresentano i collegamenti interdisciplinari tra le diverse aree (Figura 1). Oggi si potrebbero aggiungere altri vertici e tracciare altre linee: è così che le scienze cognitive si sono ampliate fino a diventare un settore autonomo, ma sempre aperto a ulteriori integrazioni.

1.2. Verso l'istituzionalizzazione

Intorno alla metà degli anni '70, le scienze cognitive hanno sviluppato una loro identità; ciò che ancora manca è un profilo istituzionale ben definito.[7] Il primo grande passo in avanti viene fatto da quella che oggi occupa la seconda posizione tra i risultati Google nella famosa ricerca "Cognitive Science": la *Cognitive Science Society.*[8] Si tratta di un'associazione no-profit nata nel 1979 con lo scopo di promuovere la ricerca nelle scienze cognitive. Il suo grande contributo è stato quello di conferire autorità alla nuova disciplina, attraverso due operazioni fondamentali:

- La pubblicazione del giornale *Cognitive Science*. Nato nel 1976, è stata la prima cassa di risonanza ufficiale per far circolare quelle idee che "intersecassero due o più discipline"[9]. Oggi è tra i primi giornali di scienze cognitive, e le sue pubblicazioni ricevono un alto numero di citazioni. Tra gli addetti ai lavori, quindi, è una delle fonti di informazione più influenti.
- L'organizzazione del Convegno di Scienze Cognitive. Istituito nel 1979 con la conferenza di La Jolla, California, da allora si è tenuto ogni anno in diverse città. Ospita i migliori scienziati cognitivi del mondo per presentare le più recenti teorie della mente e i principali risultati della ricerca applicata.

Giornale e Convegno sono due traguardi fondamentali per la legittimazione delle scienze cognitive, che ricevono così una veste ufficiale[10]. Da questo momento diventano una disciplina riconosciuta, e lentamente entrano nel mondo accademico: corsi universitari, seminari, conferenze, workshop. Fino ad arrivare alla costruzione dei

[7] Bechtel, W., Abrahamsen, A., Graham, G. (2001). Cognitive Science, History. *International Encyclopedia of the Social and Behavioural Sciences*. Oxford: Elsevier Science, p. 2154.
[8] http://cognitivesciencesociety.org
[9] Dal Manifesto del Journal *Cognitive Science*, http://cognitivesciencesociety.org/journal_csj.html
[10] Schunn, C. D., Crowley, K., Okada, T. (2005) Cognitive Science: Interdisciplinarity now and then, p 3. In S. J. Derry, C. D. Schunn, & M. A. Gernsbacher (Eds.), *Problems and promises of interdisciplinary collaboration: Perspectives from cognitive science*. Mahwah: NJ, Erlbaum, 2005.

primi istituti tematici. In che modo queste nuove istituzioni si interfacciano con il pubblico?

1.3. La comunicazione istituzionale delle scienze cognitive

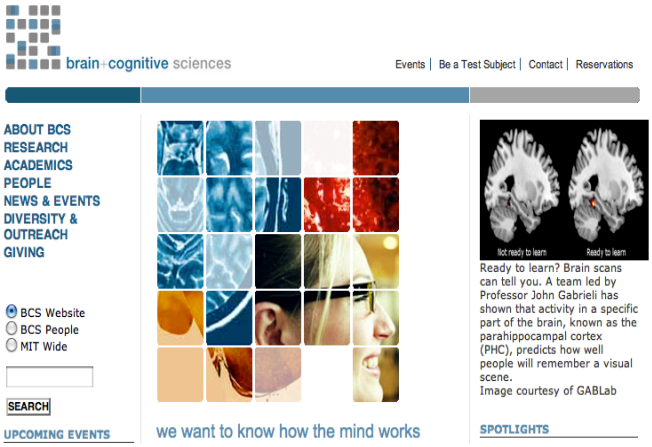
Da un punto di vista mediatico le scienze cognitive trovano fin da subito una facile cassa di risonanza: spesso accomunate alle neuroscienze, si affermano nell'immaginario comune come la chiave per capire il funzionamento del cervello. "Trovato il gene dell'aggressività", "L'area del cervello che regola l'altruismo", "I neuroni dell'estro musicale": titoli di questo genere esplodono sui giornali, guidati da quella nuova tendenza che qualcuno inizia a chiamare "neuromania"[11]. Non è facile analizzare le cause e le conseguenze di questo processo di comunicazione, che coinvolge un gran numero di attori sociali, dagli scienziati ai giornalisti, dal pubblico alle comunità online, ciascuno con un ruolo importante nella costruzione e nella trasmissione delle informazioni. Paradossalmente, il ruolo minore è svolto proprio dagli enti che hanno conferito legittimità a questa nuova disciplina: gli istituti di scienze cognitive. Se da un lato l'attività accademica fiorisce di anno in anno, dall'altro lato questo non corrisponde a un'apertura verso il pubblico. Ancora oggi quasi nessun istituto di scienze cognitive, ad esclusione delle Università, è dotato di un ufficio stampa; così molto spesso l'unico canale di comunicazione con i non esperti è il sito web istituzionale. Canale che però la maggior parte delle volte, soprattutto in Italia, non viene sfruttato, e rimane uno strumento a uso quasi esclusivamente interno.

Proprio questo è il caso dell'istituzione di riferimento per le scienze cognitive nel panorama italiano: l'Istituto di Scienze e Tecnologie della Cognizione del Consiglio Nazionale delle Ricerche (ISTC-CNR). Il sito dell'ISTC, antiquato e poco navigabile, è stato concepito per essere provvisorio e poi per oltre dieci anni non è mai stato cambiato. Fino al 2010, quando l'allora Direttore Cristiano Castelfranchi ha deciso di puntare su un profondo, radicale rinnovamento. Realizzando così il primo tentativo da parte di un istituto di scienze cognitive italiano di parlare a un pubblico più ampio.

[11] Legrenzi, P., Umiltà, C. (2009) *Neuromania. Il cervello non spiega chi siamo.* Il Mulino, Bologna.

Prima di presentare l'ISTC-CNR, analizzeremo brevemente la comunicazione su web di tre importanti Istituti di scienze cognitive americani, i cui punti di forza possono essere utili per capire ciò che il nuovo sito istituzionale dell'ISTC desiderava ottenere con la sua nuova strategia di comunicazione.

MIT, Department of Brain and Cognitive Sciences[12]



Il sito web ruota attorno a una fotografia "a scacchiera", che cambia ogni pochi secondi e mostra immagini che richiamano lo studio del cervello. Sulla destra un riquadro *Spotlights* presenta ricerche specifiche.

Primo impatto comunicativo: trasmette l'idea di un ambiente di ricerca fecondo e dinamico.

Primo impatto grafico: le foto sono molto efficaci e catturano subito l'attenzione.

Struttura: a sinistra compare una barra di navigazione standard (*About*, *Research*, *People*, ecc.) mentre a destra gli utenti possono approfondire temi di ricerca specifici (riquadro *Spotlights*), che rimandano a brevi articoli scritti in modo semplice ed efficace.

Navigabilità: molto buona. I diversi percorsi di navigazione sono chiari, ed è facile reperire informazioni.

Punti di forza: Fotografie, news in evidenza, grafica molto curata. Lo slogan *We want to know how the mind works* è semplice e d'impatto, ed è fortemente collegato alle immagini.

[12] http://bcs.mit.edu/

Punti di debolezza: La sezione *News &Events*, raggiungibile dalla barra di navigazione, rimanda a un lungo elenco privo di figure; le singole news non sono raggiungibili in altro modo.

Beckman Institute for Advanced Science and Technology, University of Illinois[13]

Il sito web ha in Homepage un testo di presentazione dell'Istituto, mentre sulla sinistra compare una colonna con le principali tematiche di ricerca. Un'immagine centrale e una sullo sfondo completano la pagina iniziale.

Primo impatto comunicativo: trasmette l'idea di un grande Istituto dove si raccolgono diverse linee di ricerca (impressione data anche dalla foto sullo sfondo, che mostra scorci del *campus* universitario).

Primo impatto grafico: l'Homepage è un po' troppo affollata, le immagini non sono molto evocative.

Struttura: la barra laterale di sinistra presenta, dopo la pagina *About*, i vari gruppi dell'Istituto a partire dalle loro tematiche di ricerca (ad esempio, *Human-Computer Intelligent Interaction*)

Navigabilità: abbastanza buona, le informazioni sono facili da reperire e l'utente sa sempre in che punto del sito si trova. Però non sono molto chiari i diversi percorsi di navigazione: la barra laterale comprende sia le pagine istituzionali sia quelle rivolte a un pubblico più ampio.

Punti di forza: Collegamento ai principali social networks, Feed RSS, possibilità di iscriversi alla newsletter.

[13] http://www.beckman.illinois.edu/biointel/cs.aspx

Punti di debolezza: Il testo in Homepage è troppo lungo e la presentazione delle varie tematiche di ricerca poteva essere valorizzata di più.

Rensselaer Polytechnic Institute, Cognitive Science Department[14]

Il sito web ha la parte alta completamente occupata da immagini che cambiano a rotazione.
Nella seconda metà della pagina compare l'offerta didattica (dottorati e master) e un riquadro con le news più recenti.

Primo impatto comunicativo: trasmette l'idea di un ambiente ricco e stimolante (impressione data soprattutto dalle foto, che sono molto artistiche).

Primo impatto grafico: la pagina è molto ordinata e le immagini sono d'impatto.

Struttura: la barra di navigazione fornisce soprattutto informazioni sull'offerta didattica (sezioni *Undergraduate*, *Graduate*, *Faculty*, ecc.). Le news invece rimandano a ricerche di punta dell'Istituto.

Navigabilità: buona, la grafica è ordinata e aiuta a orientarsi nel sito.

Punti di forza: impatto grafico, informazioni complete e dettagliate per gli studenti.

Punti di debolezza: mancano contenuti dedicati alla spiegazione delle tematiche di ricerca dell'Istituto. Questo tipo di informazioni è dato in parte nelle news, me per un utente esterno non è facile capire esattamente di che cosa si occupa il Dipartimento di Scienze Cognitive dell'RPI.

I tre siti brevemente analizzati mostrano tre buoni esempi di comunicazione istituzionale delle scienze cognitive; si tratta però di eccezioni all'interno del panorama

[14] http://www.cogsci.rpi.edu/

americano, e non esistono corrispettivi dello stesso livello in Europa. L'obiettivo dell'ISTC-CNR era proprio quello di costituire la prima eccezione a questa regola, avvicinandosi agli standard dell'MIT, se non dal punto di vista grafico almeno da quello comunicativo.

2. L'ISTITUTO DI SCIENZE E TECNOLOGIE DELLA COGNIZIONE DEL CNR DI ROMA

Il Consiglio Nazionale delle Ricerche è stato l'incubatore privilegiato per la nascita in Italia di molti nuovi settori scientifici di frontiera. Informatica, astrofisica, ingegneria genetica: queste discipline si sono sviluppate nel nostro Paese a partire da istituti del CNR o da progetti di ricerca targati CNR. Questo è avvenuto per ragioni non casuali, legate al fatto che il CNR, a differenza delle Università, non svolge un ruolo formativo di base, e quindi offre ai suoi ricercatori più spazio per spingersi verso sentieri meno convenzionali.

Per le scienze cognitive, si tratta di una condizione a dir poco necessaria. L'esagono di Miller (cfr. p. 8) avrebbe avuto ben poche speranze di affermarsi in Italia senza la possibilità di uscire dalle rigide divisioni disciplinari delle Università; a questo proposito il CNR è stato il terreno giusto dove poter sperimentare.

Lo dimostra il modo in cui è nato il primo istituto di scienze cognitive nel CNR e in Italia: figlio dell'interdisciplinarietà, l'Istituto di Scienze e Tecnologie della Cognizione è frutto della fusione dell'Istituto di Psicologia, dell'Istituto di Fonetica e Dialettologia e di alcuni gruppi di ricerca di tecnologie biomediche, scienze dei sistemi e di elettronica (Figura 2).

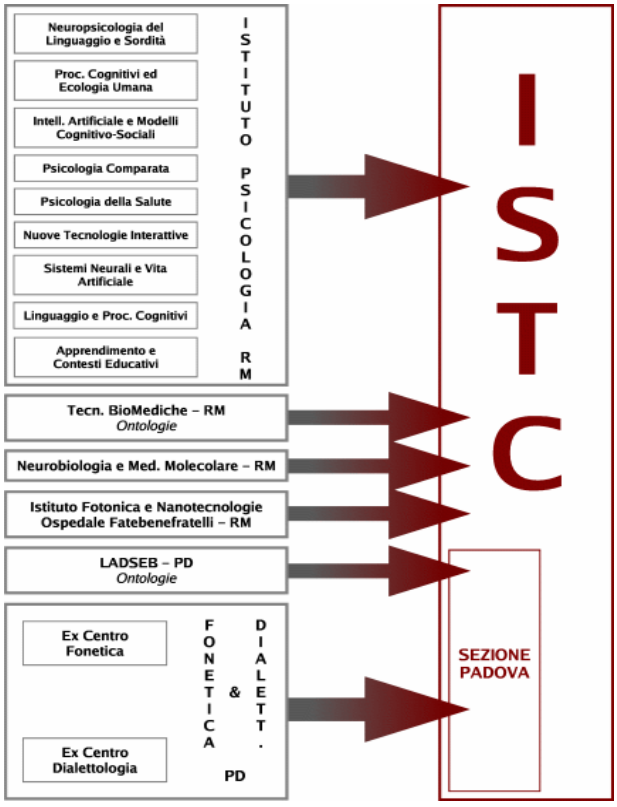


Figura 2 La formazione dell'ISTC-CNR

Come struttura, l'Istituto nasce nell'immediato dopoguerra, attorno al 1947, e diventa la sede dei test attitudinali per i militari. Inizialmente

prende il nome di Centro di Studio per la Psicologia e nel 1950 diventa Istituto Nazionale di Psicologia. Nella fase iniziale e fino alla fine degli anni '60 la maggior parte della ricerca prodotta riguarda i settori della psicologia sperimentale, della psicofisiologia e dei test sulla personalità e sull'intelligenza. È dagli anni '70, sotto la direzione di Raffaello Misiti, che l'Istituto acquista un ruolo di primo piano in due aree: quella dei problemi sociali (educazione, handicap, ambiente, servizi psichiatrici) e quella della relazione tra psicologia, linguistica e intelligenza artificiale, che ha preso il nome di scienza cognitiva.

L'Istituto nel corso degli anni ha condotto ricerche di grande rilievo, che ne hanno fatto una struttura di livello internazionale in numerosi campi di attività.

I ricercatori dell'ISTC hanno svolto un ruolo di pionieri in molti ambiti, dalla fonetica sperimentale alla psicolinguistica, dallo studio del linguaggio dei segni utilizzato dai sordi all'intelligenza artificiale (nel cui ambito rappresenta il più grosso istituto del CNR), dallo studio del rapporto cognitivo ed emotivo con l'ambiente urbano e domestico all'intelligenza delle scimmie comparata con quella dei bambini, dalla simulazione al computer all'ergonomia cognitiva, alla vita artificiale.

Ancora oggi lavorano nell'Istituto ricercatori provenienti da dodici lauree diverse, che si integrano in vari modi anche all'interno degli stessi gruppi di ricerca. Come trasmettere all'esterno questa interdisciplinarietà?

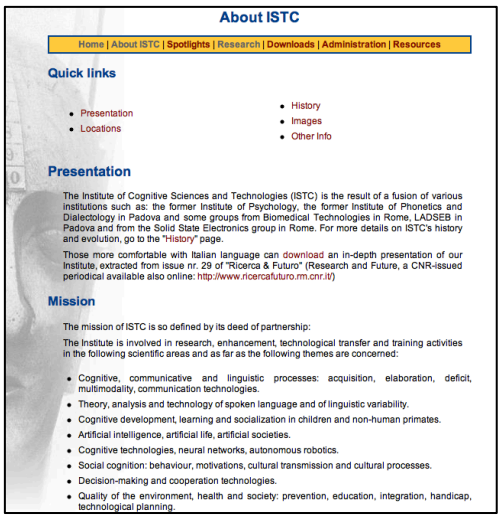
2.1. Analisi del vecchio sito dell'ISTC-CNR e dei suoi limiti

L'immagine restituita dal vecchio sito dell'ISTC non è certo quella di un Istituto dinamico e attivo, e soltanto un esperto può coglierne la forte interdisciplinarietà. Il primo ostacolo è dato dall'impatto grafico: la pagina è divisa perfettamente in due, con la metà destra completamente bianca e la metà sinistra molto affollata. Tutte le pagine del sito sono raggiungibili dall'Homepage, che presenta un menù verticale di sette voci, ciascuna affiancata dalle rispettive sotto-voci.

Questa scelta, fatta probabilmente per facilitare la navigabilità, in realtà dà un effetto complessivo caotico e rende piuttosto difficile orientarsi nel sito.

Figura 3 Homepage del vecchio sito dell'ISTC-CNR

Il sito è interamente in inglese, ma ha alcune sezioni in italiano (ad esempio, le gare e i concorsi).



Addentrandosi nelle varie pagine, si incontrano prima di tutto informazioni sull'Istituto (Sezione *About ISTC*). In un documento piuttosto lungo, chiaramente non pensato per il web, vengono descritte le diverse istituzioni confluite nell'ISTC e viene presentata la missione dell'Istituto, con un elenco puntato che crea un "blocco di scrittura" poco accattivante.

Questa struttura a elenco si ritrova in tutte le altre sezioni: l'area "Research" è una lista verticale di tutti i gruppi di ricerca, la maggior parte dei quali collegato a un link esterno; lo stesso vale per l'elenco dei ricercatori e dei progetti.

Infine, le voci *Map of the Site*, *Webmail* e *Other things* non sono cliccabili; la pagina *News* non è aggiornata, così come quella della bibliografia.

Nel complesso, l'impressione è quella di un sito abbandonato a sé stesso e utilizzato soltanto dai ricercatori. Anche per questi ultimi, però, mancano alcune funzioni fondamentali; lo dimostra il fatto che quasi tutti i gruppi di ricerca hanno costruito un altro sito web separato da quello istituzionale e qui semplicemente linkato.

Per questi motivi, rinnovare il sito web dell'ISTC significava in realtà ripensarlo da zero.

2.2. La riprogettazione del sito: cosa comunicare e come

Rifare il sito web d'Istituto era sulla lista delle cose da fare dell'ISTC-CNR da diversi anni, ma per vari motivi l'obiettivo tardava a realizzarsi. Durante il penultimo anno di direzione di Cristiano Castelfranchi, però, alcuni ricercatori più sensibili alle tematiche di comunicazione suggeriscono di affidare il compito a esperti del settore. È così che vengono contattati Nicola Nosengo e Mauro Scanu, giornalisti scientifici professionisti, a cui viene chiesto di riprogettare completamente il sito web.

Il loro punto di partenza è analizzare le caratteristiche principali dell'ISTC. Come è emerso dalla breve introduzione di questo capitolo, il fattore preponderante viene individuato nell'interdisciplinarietà. La ricchezza di interconnessioni tra le linee e i progetti di ricerca viene vista come un possibile punto di forza nella comunicazione:

per questo si propone valorizzare la rete di connessioni come chiave concettuale della riprogettazione del sito istituzionale dell'ISTC.

Connettere: ecco quindi l'obiettivo primario della nuova strategia di comunicazione, che fa così dell'interdisciplinarietà il concetto principale da trasmettere al pubblico. Concetto reso proprio attraverso la metafora delle connessioni: *Looking for connections* oppure *We look for connections* viene suggerito come slogan da far comparire in Homepage, e da accoppiare sempre al logo d'Istituto come vero e proprio motto distintivo.

Una volta definito l'oggetto della comunicazione, ci si chiede poi *come* comunicarlo. Da qui emerge implicitamente la domanda a cui il progetto – e l'intero sito d'Istituto – avrebbe dovuto rispondere: di che cosa si occupano gli scienziati cognitivi? La soluzione proposta è rispondere con un'immagine grafica. Una rete neurale, strettamente legata alle scienze cognitive nell'immaginario comune, avrebbe rappresentato le interconnessioni come punto di forza della ricerca dell'ISTC. Le varie connessioni neuronali sarebbero state così la metafora delle connessioni interdisciplinari.

L'icona della rete neurale doveva avere una forma poligonale, ai cui vertici dovevano comparire termini cliccabili come *Brain*, *Technology*, *Evolution*, *Society, Language*: i principali oggetti di studio delle scienze cognitive, collegati tra loro lungo la rete di neuroni. Sempre giocando sul piano metaforico nasceva così l'idea delle interconnessioni tra elementi che producono risultati emergenti, in linea con la *mission* dell'ISTC.

Ognuna delle parole avrebbe rimandato a una stringata descrizione del concetto a cui faceva riferimento; ogni connessione tra parole (ad esempio, *Education-Technology*) avrebbe generato invece una pagina dedicata alle applicazioni di quei concetti nella ricerca, in questo caso le tecnologie per l'insegnamento.

Un'ultima importante proposta del progetto è la "Finestra Idea": canale dedicato ad attrarre l'utente curioso, avrebbe raccolto una serie di domande chiave sull'attività dell'Istituto.

La riprogettazione del sito doveva raggiungere tre obiettivi principali:

- Raccontare la struttura e le attività dell'Istituto di Scienze e Tecnologie della Cognizione;
- Accreditare il sito come punto di riferimento delle scienze cognitive sia dal punto di vista della fruizione specialistica che di quella generalista;
- Attirare nuovi fruitori.

Il sito viene infine concepito per funzionare grazie a un Content Management System distribuito sotto licenza GNU GPL come Drupal o Plone, in modo che gli amministratori e i redattori possano gestirne i contenuti senza bisogno di conoscere l'HTML.

2.3. Il target

Un discorso a parte merita la valutazione del tipo di pubblico a cui il nuovo sito doveva rivolgersi. Vengono identificate tre tipologie di fruitori del sito:

- Utenti ISTC: questi utenti hanno la necessità di accedere alle informazioni sull'ISTC con estrema rapidità perché già conoscono i contenuti del sito. Devono inoltre poter usufruire di tutti gli strumenti potenzialmente attivi sul sito.
- Ricercatori esterni: questi utenti sono specialisti del settore delle scienze cognitive e cercano informazioni di alto livello sulle linee di ricerca, sui membri dei vari team, sui progetti europei. Devono essere guidati attraverso percorsi innovativi tra i contenuti del sito.
- Curiosi/giornalisti: questi utenti non hanno le idee chiare su quello che può contenere il sito. Sono alla ricerca di spunti, idee, novità. Devono essere guidati attraverso percorsi divulgativi verso i temi di ricerca dell'ISTC.

L'obiettivo è quindi quello di creare diversi percorsi di navigazione in base alle diverse necessità degli utenti. Si tratta di un punto molto importante, il cui fraintendimento causerà la maggior parte dei problemi durante la realizzazione del progetto.

3. *SEARCHING FOR CONNECTIONS*

A partire dal settembre 2010 è iniziato il periodo di stage all'Istituto di Scienze e Tecnologie della Cognizione che doveva portare alla costruzione del nuovo sito istituzionale. L'obiettivo era realizzare tutti i contenuti in inglese, adattando il progetto originario alle esigenze specifiche dei ricercatori: psicologi, informatici, filosofi, scienziati sociali, ingegneri, biologi, medici, neuroscienziati, per un totale di circa 120 scienziati cognitivi con formazione e interessi scientifici diversi.

I principali interlocutori erano i responsabili dei vari gruppi di ricerca, in modo da restituire un'immagine equilibrata delle diverse aree scientifiche dell'Istituto. Con lo scopo di trovare le connessioni tra queste aree: *Searching for connections*, lo slogan che ha sostituito i simili *Looking*/*We look for connections* originari, non doveva quindi essere solo una strategia di comunicazione ma anche un modo di procedere per realizzarla.

3.1. Lo stage all'ISTC-CNR: dal progetto alla realizzazione

Il progetto di un sito web, per quanto dettagliato e aderente alla realtà, è sempre un documento scritto che va tradotto in immagini e testi adatti al web. Da dove cominciare? Con chi parlare per primo, e di che cosa? Dopo la riunione iniziale all'ISTC è stato fissato un primo punto importante: esiste qualcosa di scientifico anche nel modo in cui parlare di scienza su Internet. Un metodo, insomma, che allontana quasi alla fine la fase della scrittura.

Primo passo: *Conoscere ciò di cui si deve parlare*. Sembra ovvio, ma se si parla dell'Istituto di Scienze e Tecnologie della Cognizione del Cnr non lo è. Luca Tummolini e Fabio Paglieri, ricercatori ISCT e promotori nel nuovo sito web, hanno fornito una panoramica generale piuttosto dettagliata dell'Istituto. A partire da una lista di gruppi di ricerca e di "cani sciolti", come venivano chiamati i ricercatori più autonomi, è stata portata avanti una prima fase di analisi delle tematiche di ricerca principali dell'ISTC.

Acronimo	Nome Lab (o temi di ricerca del singolo)	Referente
ERG	Evaluation Research Group	Antonella Rissotto
GaLL (Nomentana)	Gesture and Language Laboratory	Olga Capirci
GOAL	Goal-Oriented Agents Lab	Cristiano Castelfranchi
LABSS	Laboratory for Agent-Based Social Simulation	Rosaria Conte
LaDD (Nomentana)	Language Development and Disorders Laboratory	Maria Cristina Caselli
LaPLL	Laboratorio sui Processi di Lettura e Lessico	Cristina Burani
LARAL	Laboratory of Autonomous Robotics and Artificial Life	Stefano Nolfi
LET's (Fatebenefratelli)	Laboratory of Electrophysiology for Translational neuroScience	Franca Tecchio
LOA (Trento)	Laboratorio di Ontologia Applicata	Nicola Guarino
LOCEN	Laboratory of Computational Embodied Neuroscience	Gianluca Baldassarre
ISTC Padova	ISTC sede di Padova (ex Ist. Fonetica e Dialettologia)	Dario Salmaso
PPI	Psicologia della Partecipazione Infantile	Antonella Prisco
PRInt	Psicologia delle Relazioni Interpersonali	Rita D'Amico
PST	Planning & Scheduling Team	Amedeo Cesta
SLL (Nomentana)	Sign Language Laboratory	Elena Pizzuto
SMCL Padova	Speech and Multimodal Communication Laboratory	Piero Cosi
STLab	Semantic Technology Laboratory	Aldo Gangemi
SUS	Sviluppo Umano e Società	Tullia Musatti
T3	Trust: Theory & Technology	Rino Falcone
UCP	Unit of Cognitive Primatology & Primate Center	Elisabetta Visalberghi
NAC / UniNa	Natural & Artificial Cognition Laboratory	Orazio Miglino
EMCO / UniBo	EMbodied COgnition lab	Anna Borghi
“cane sciolto”	Scienze fonetiche, fonologia articolatoria, patologia del linguaggio, acquisizione del linguaggio, sviluppo della (co)articolazione	Claudio Zmarich
“cane sciolto”	Emozioni & linguaggio	Emanuela Caldognetto Magno
“cane sciolto”	Performance scolastica e psicologia della personalità, psicologia sociale, percezione del rischio, autostima	Patrizia Vermigli
“cane sciolto”	Etica, psicoanalisi, costumi sessuali, sociologia delle emozioni	Sergio Benvenuto
“cane sciolto”	Psicologia sociale, psicologia di comunità, differenze culturali	Laura Benigni
“cane sciolto”	Rapporti fra uomo e animali, violenza sugli animali, bullismo, diversità e marginalità, immigrazione	Camilla Pagani
“cane sciolto”	Teorie dell'apprendimento, e-learning, apprendimento collaborativo, educazione scientifica	Silvia Caravita
“cane sciolto”	Nuove tecnologie e apprendimento, comunicazione nei musei, psicolinguistica	Francesco Antinucci
“cane sciolto”	Sindrome di Huntington, counselling nella	Gioia Jacopini

	relazione medico-paziente, psicologia e medicina	
“cane sciolto”	Ontologie per la medicina	Domenico Pisanelli
“cane sciolto”	Vita artificiale, simulazioni evolutive	Domenico Parisi
“cane sciolto”	Neuroimmagini, neurofarmacologia, medicina e società	Marco Pagani
“cane sciolto”	Psicologia ambientale	Vittoria Giuliani

Tabella 1 Lista dei gruppi ISTC e dei "cani sciolti"

Da questa prima fase è uscita rafforzata l’idea di utilizzare la metafora delle connessioni. Si è scelto di costruire connessioni non più a due ma a tre nodi, in modo che in ciascuna fosse presente il termine *Cognition*, filo conduttore di tutte le tematiche di ricerca. Oltre a *Cognition*, i termini selezionati erano: *Brain*, *Language*, *Technology*, *Evolution*, *Society*, *Education*, *Health*, *Emotion*. Nove parole chiave per nove connessioni, declinate in questo modo:

- *Brain, Cognition & Language*
- *Technology, Cognition & Language*
- *Brain, Cognition & Technology*
- *Society, Cognition & Technology*
- *Society, Cognition & Education*
- *Brain, Cognition & Evolution*
- *Education, Cognition & Technology*
- *Health, Cognition & Technology*
- *Emotion, Cognition & Technology*

Si trattava di una scelta ancora provvisoria, destinata a cambiare diverse volte nel corso dei lavori.

Il passo successivo è stato studiare il modo in cui una connessione avrebbe generato i contenuti, e la struttura di questi ultimi. Il progetto infatti parlava di una breve descrizione dei singoli nodi e di un testo più lungo per ciascun collegamento tra essi, ma bisognava ancora decidere il tipo di percorso a partire dalla parola chiave, e lo stile del testo. Così è stato fatto un primo tentativo di sviluppare una connessione, e in particolare *Brain, Cognition & Evolution*, che era un buon esempio perché, specchio

dell'interdisciplinarietà dell'Istituto, ospitava temi di ricerca molto diversi tra loro, dalla primatologia alla robotica alle neuroscienze.

In base al progetto, cliccando sui singoli nomi doveva comparire una breve spiegazione del concetto di riferimento, mentre la connessione avrebbe rimandato a un testo più articolato sui vari gruppi che quella connessione coinvolgeva, con le relative tematiche di ricerca. Questo secondo testo era il più complesso da scrivere, perché doveva tracciare un filo conduttore tra argomenti molto diversi tra loro. Dopo vari tentativi e revisioni, ecco quale è stato il risultato.

BRAIN – COGNITION – EVOLUTION

*From primitive **brain** to complex **cognition** through human **evolution**: the steps needed to walk this path are still largely unknown. When and why did typical human behaviours and abilities such as altruism, trust, cultural transmission and language emerge? Are these abilities really unique to humans, or do primates share them to some extent? If so, what kind of evolutionary advantage do they provide? How can we rigorously differentiate goal-oriented human behaviour from instinctive animal behaviour?*

*These questions, as well as they underlying main concepts – brain, cognition and evolution – belong to different research fields, since they involve both biological and social studies. Nevertheless, a **common goal** is implied: to understand how human and nonhuman minds work. This is one of the reasons why ISTC is **searching for connections**.*

*The first link is the one between the structural evolution of the brain and the evolution of cognitive functions. The starting point is the comprehension of the basic neural mechanisms that allow crucial human cognitive abilities such as learning and language acquisition. This is the job of the **Laboratory of Electrophysiology for Translational Neuroscience** (**LET'S**).*

But to understand what happened during evolution, it is crucial to know whether what we consider human trademarks (altruism, reciprocity, symbolic

communication) do appear in some form in primates. Primate studies have a long tradition at ISTC, and the ***Unit of Cognitive Primatology and Primate Center*** *(**UCP**) is one of the leading groups in the world for research on primate cognition.*

Working with concepts related to cognition raises the need of good definitions of the concepts themselves. What is altruism? What is trust and how does is work in a social group? Philosophical and social inquiry is a crucial part of the Institute's work, and the ***Goal-Oriented Agents Laboratory*** *(**GOAL**) studies concepts such as trust and altruism in both real and artificial societies.*

And talking about artificial life, some important connections between brain, cognition and evolution are drawn by the ***Laboratory of Autonomous Robotic and Artificial Life*** *(**LARAL**), together with the* ***Laboratory of Computational Embodied Neuroscience*** *(**LOCEN**). The approach is looking at computational models within the theoretical framework of evolution. In fact whereas primate studies can explain the point of departure of human evolution, robotics and artificial agents offer an alternate route to the study of its point of arrival, a chance to recreate the dynamics that may have led from there to where we are today.*

Non molto convincente. Nonostante i tagli, i ritocchi e le semplificazioni, restava quasi impossibile da eliminare la sensazione generale di forzatura: troppi temi diversi, troppo astratto il modo di associarli tra loro.

Forse quindi non era questa la strada adatta per restituire l'idea di interdisciplinarietà in modo naturale. Quanto sarebbe interessato a un visitatore esterno, estraneo alle dinamiche d'Istituto, leggere un testo che collegava tra loro gruppi di ricerca di cui non aveva mai sentito parlare? Probabilmente poco.

Per questo abbiamo pensato che fosse necessario addentrarsi fin da subito nelle tematiche di ricerca. L'interdisciplinarietà doveva trasformarsi in un messaggio meno esplicito, meno teorico, che non mettesse l'urgenza di comunicare un determinato concetto davanti al concetto stesso. In altre parole: *mostrare* l'interdisciplinarietà dell'ISTC piuttosto che *parlare* di quanto l'ISTC fosse interdisciplinare.

È così che si è deciso di utilizzare per l'Homepage la parte del progetto originario che riguardava la finestra idea (cfr. p. 18). Semplice, e altrettanto efficace: domanda, risposta. Ecco quale poteva essere la chiave per collegare le varie parole chiave: nessuna descrizione del concetto, nessuna meta-descrizione della triade, ma semplicemente una serie di "temi caldi", che incuriosissero il pubblico e al tempo stesso fornissero una panoramica dei principali filoni di ricerca dell'Istituto.

Poteva funzionare: la strada migliore per verificarlo era parlare direttamente con gli scienziati.

3.2. Le interviste ai ricercatori

Gli incontri con i coordinatori dei vari gruppi di ricerca si sono svolti come interviste strutturate[15]: sono state considerate ipotesi di partenza da un lato un insieme di connessioni in cui le tematiche di ricerca di ciascun gruppo potevano inserirsi, dall'altro due o tre tematiche per gruppo estratte dall'analisi preliminare di tutti i filoni di ricerca dell'Istituto.

La prima cosa è stata verificare quanto i ricercatori si "trovassero a proprio agio" nelle connessioni di parole assegnate, raccogliendo anche pareri su eventuali parole chiave da togliere o aggiungere. Con il procedere delle interviste, questo confronto si è rivelato l'aspetto più problematico, come si vedrà nel paragrafo successivo.

Parallelamente, occorreva stabilire il formato delle domande e delle risposte che dovevano essere generate dalle varie connessioni. Dopo aver parlato con i primi ricercatori, si sono proposte tre possibili soluzioni:

- "Lo scienziato risponde": mini-interviste in cui un ricercatore dell'ISTC risponde a una domanda che riguarda le sue tematiche di ricerca;
- "Lo sapevate che…": domande accattivanti a cui dare una risposta generale, che rimandi poi con un link al gruppo dell'ISTC che si occupa di tematiche affini;
- "ISTC highlights": i risultati scientifici più rilevanti dell'Istituto, presentati insieme al gruppo che ha svolto una determinata ricerca.

[15] Tusini, S. (2009) *La ricerca come relazione. L'intervista nelle scienze sociali.* Franco Angeli Editore, Milano.

L'analisi delle proposte e dei relativi testi di prova ha fatto optare per un misto tra la prima e la terza soluzione. L'idea era quella di formulare domande a cui rispondere dal punto di vista non di un singolo ricercatore, ma di un intero gruppo di ricerca. Questo per dare più visibilità ai gruppi, e allo stesso tempo per produrre testi che attraverso singoli spunti presentassero le linee di ricerca più solide dell'Istituto. Si trattava di una scelta dettata da almeno tre ragioni, una comunicativa, una strategica e una istituzionale.

Dal punto di vista comunicativo, l'esigenza era quella di scattare una fotografia realistica delle scienze cognitive come erano vissute all'ISTC, presentando quindi non solo i risultati più recenti ma anche il bagaglio scientifico costruito delle linee di ricerca più radicate nella storia dell'Istituto.

La ragione strategica riguardava invece lo spinoso problema dell'aggiornamento del sito: non era sicura la frequenza con cui si sarebbero potuti produrre nuovi contenuti una volta finita la fase di realizzazione del sito, dunque non era opportuno improntare la comunicazione sulla "news".

Infine, c'era un motivo per così dire istituzionale, che aveva a che fare con la politica interna dell'ISTC: negli ultimi anni c'era stata una spinta per incoraggiare l'aggregazione nei gruppi piuttosto che la ricerca individuale, in modo da favorire e alimentare il clima di collaborazione e interdisciplinarietà. Dare più visibilità ai gruppi rispetto che ai singoli poteva essere un ulteriore incentivo alla costruzione di nuove unità di ricerca formate da più ricercatori. La conseguenza diretta di quest'ultima considerazione è stata ridurre drasticamente il numero di "cani sciolti" a cui affidare una domanda; l'unica eccezione è stata fatta per Domenico Parisi, ex Direttore dell'ISTC e scienziato cognitivo di punta, a cui è stata affidata una domanda della categoria "Lo scienziato risponde" (cfr. p. 59).

Dopo aver stabilito i punti cardine della struttura delle domande, è iniziata la fase di scrittura vera e propria. L'aspetto più delicato era la scelta delle domande, da concordare di volta in volta con i ricercatori; quanto ai testi, avevano una lunghezza di circa 2000 battute l'uno, più un breve cappello introduttivo. Alla fine del periodo di stage sono state realizzati in tutto 47 testi nella forma domanda-risposta.

3.3. La grafica

In parallelo alla produzione dei testi, veniva sviluppata anche la proposta grafica, che è stata affidata a *Sixeleven*[16], un'agenzia di comunicazione di Torino. I grafici hanno lavorato di pari passo con lo sviluppo dei contenuti del sito, in modo da coniugare le esigenze tecniche e quelle comunicative.

La prima proposta di Homepage (Figura 4) è stata una rete neurale stilizzata, in cui le connessioni sinaptiche si illuminavano al passaggio del mouse, evidenziando una determinata triade di parole.

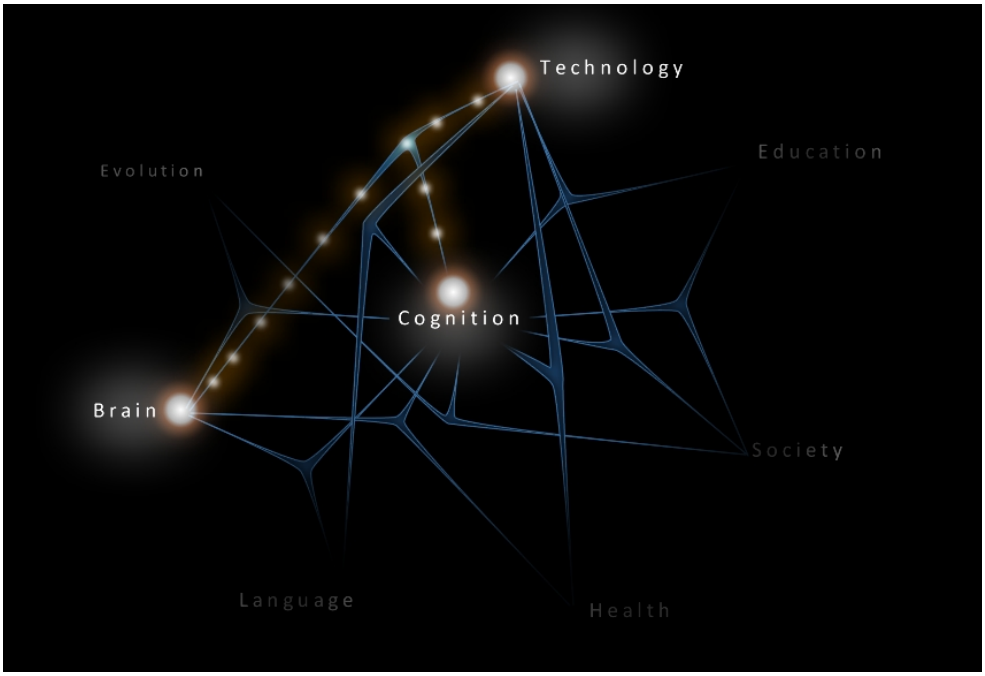


Figura 4 Prima proposta grafica realizzata dalla *Sixeleven*

Il problema di questa soluzione stava nel fatto che non si percepiva la centralità della parola *Cognition*; inoltre le varie parole chiave erano disposte in modo un po' troppo periferico, e le interconnessioni non erano visibili.

Per questo si è pensato di rinunciare alla metafora della rete neurale e optare per un disegno più semplice ma dove le connessioni tra le parole fossero più visibili. È stata

[16] http://blog.sixeleven.it/

proposta come nuova metafora grafica una mappa metropolitana, altra immagine che poteva funzionare per l'ISTC, visto il suo alto livello di interconnessioni sociali.

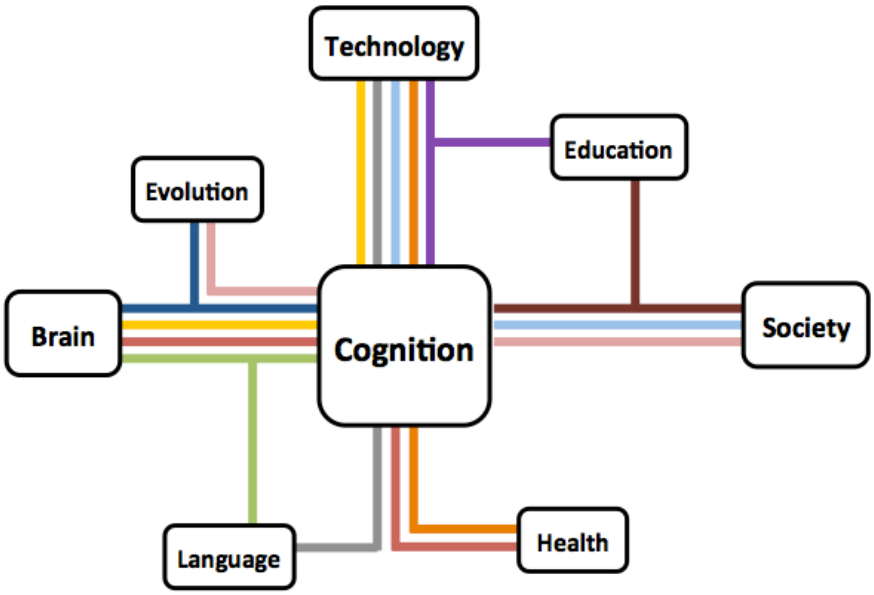


Figura 5 Indicazione grafica data alla *Sixeleven* per lo sviluppo del secondo modello di Homepage

Questa nuova proposta (Figura 5) è stata sviluppata dalla Sixeleven con un sistema di orbite attorno cui ruotavano le varie parole chiave (Figura 6).

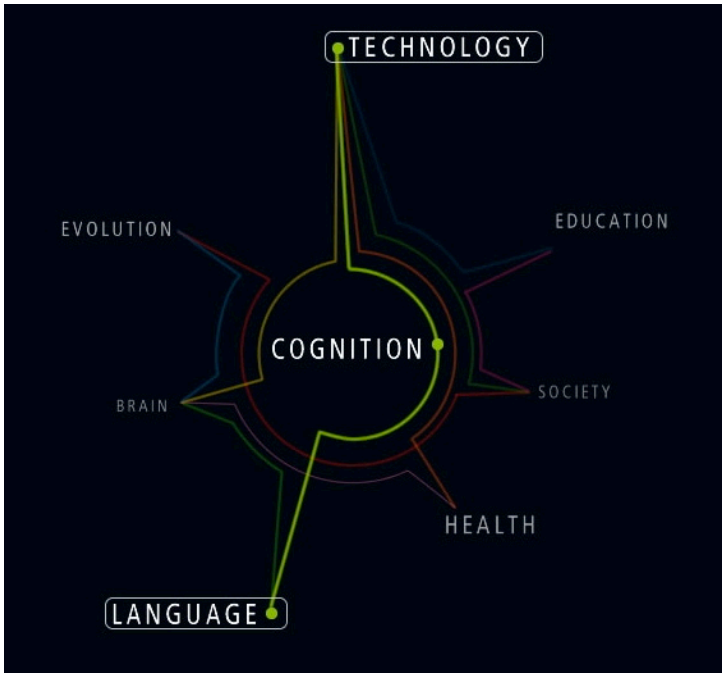


Figura 6 Seconda proposta grafica sviluppata dalla *Sixeleven*

Nei mesi successivi, la seconda proposta grafica è stata sviluppata fino ad arrivare alla versione definitiva, accompagnata dal Logo dell'ISTC-CNR ridisegnato appositamente dalla *Sixeleven* (Figura 7).

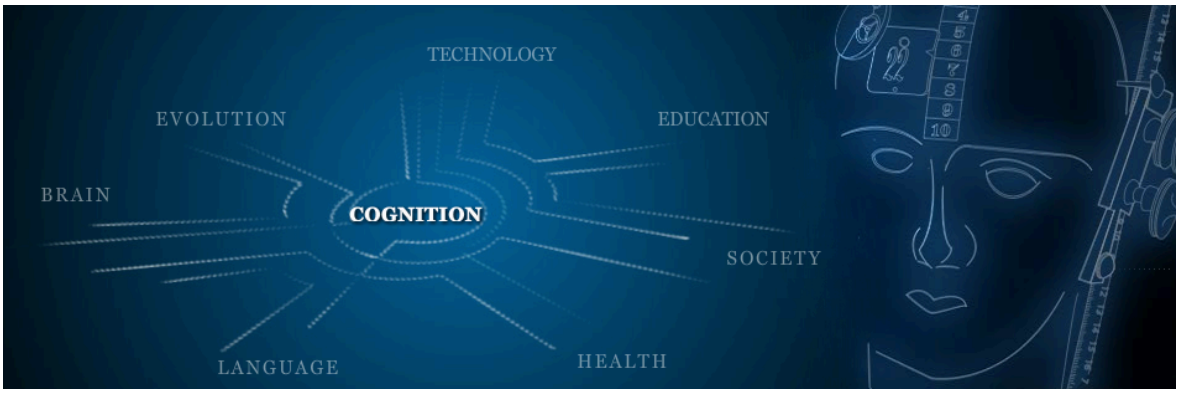


Figura 7 Mappa dell'Homepage definitiva

Effettuato l'accesso al sito web, le connessioni si attivavano autonomamente a rotazione, evidenziando i vari percorsi possibili che a loro volta generavano una serie di domande collegate a ogni connessione. Cliccando su una connessione, comparivano tutte le domande relative seguite dal rispettivo cappello introduttivo (Figura 8); l'utente poteva a quel punto decidere quale domanda approfondire.

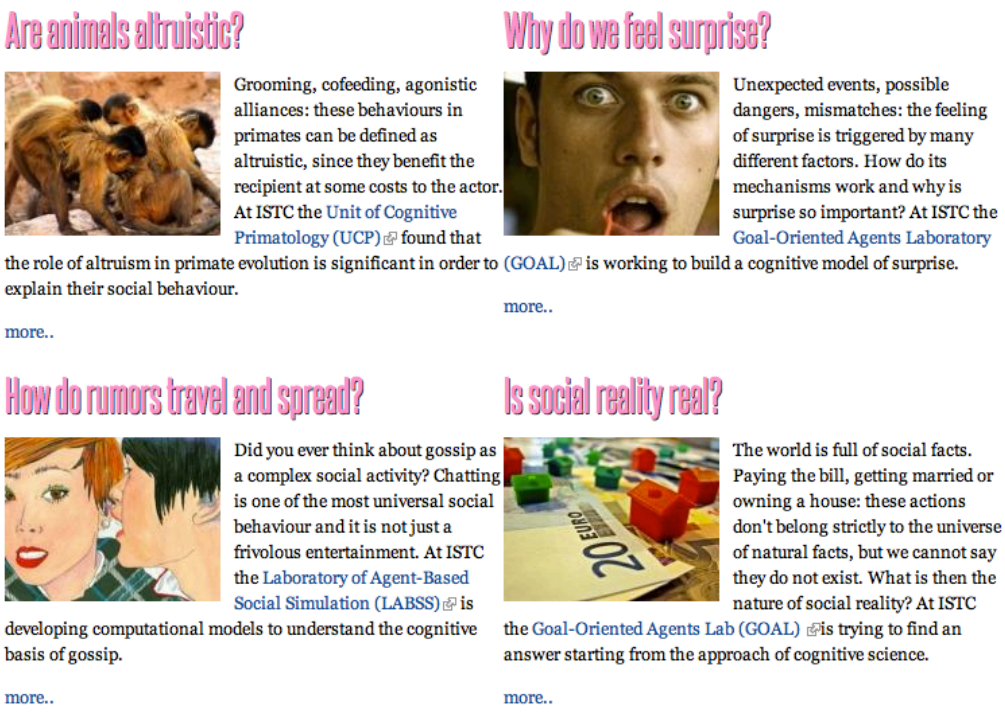


Figura 8 Domande e risposte brevi della connessione *Society, Cognition & Evolution*

Complessivamente, l'Homepage presentava la mappa delle parole con le varie domande che ruotavano insieme alle connessioni, una barra di navigazione con le voci *Institute*, *Research*, *Library*, *Opportunities*, *Events*, *News*, e una scrolling bar che segnalava l'ultima notizia, l'ultimo evento e un *Focus on* su uno dei gruppi di ricerca dell'ISTC (Figura 9).

Lo sviluppo della grafica e l'implementazione del sito web sono stati realizzati in circa un anno di tempo. Attualmente il sito istituzionale dell'ISTC-CNR si trova sul dominio provvisorio http://www2.istc.cnr.it, che presto passerà sul dominio ufficiale http://www.istc.cnr.it, per adesso ancora occupato dal vecchio sito.

Figura 9 Homepage del nuovo sito dell'ISTC-CNR, con un esempio di connessione attiva

Mentre veniva messa a punto la grafica e continuava la produzione dei contenuti, si è consumata lentamente anche una piccola "guerra fredda" interna, che ha sollevato diverse difficoltà e richiesto moltissimo lavoro di mediazione.

3.3. Il dramma delle parole chiave (ovvero: "Se non compare social simulation in Homepage me ne vado per sempre")

Presentarsi a un ricercatore con una mappa concettuale che pretende di riassumere il suo lavoro in dieci parole può essere molto rischioso. Soprattutto se queste parole esprimono concetti semplici e radicati nell'immaginario comune, come "Cervello", "Salute", "Tecnologia", e poco adatti a restituire tutte le sfumature del linguaggio scientifico.

Tutti i ricercatori maneggiano parole chiave quotidianamente: le "keywords" sono gli elementi distintivi di ogni lavoro scientifico, sono le variabili che permettono alle pubblicazioni di essere indicizzate e immediatamente riconoscibili all'interno di un gruppo di esperti. Per questo esiste una sensibilità molto sviluppata per le "etichette", le parole che danno il nome a una determinata ricerca; questo vale a maggior ragione nelle scienze cognitive, dove non ci sono i facili confini tra una disciplina e l'altra.

Ci siamo resi conto di quanto questo tema fosse delicato un po' alla volta, dopo i primi piccoli incidenti di percorso. Alcuni ricercatori hanno preso molto male la proposta di "ridurre" le scienze cognitive a un mucchio di parole ruotanti in Homepage; alcuni addirittura erano disposti a rinunciare alla propria presenza sul sito web se non fosse stata rappresentata la loro area di ricerca con una parola chiave specifica.

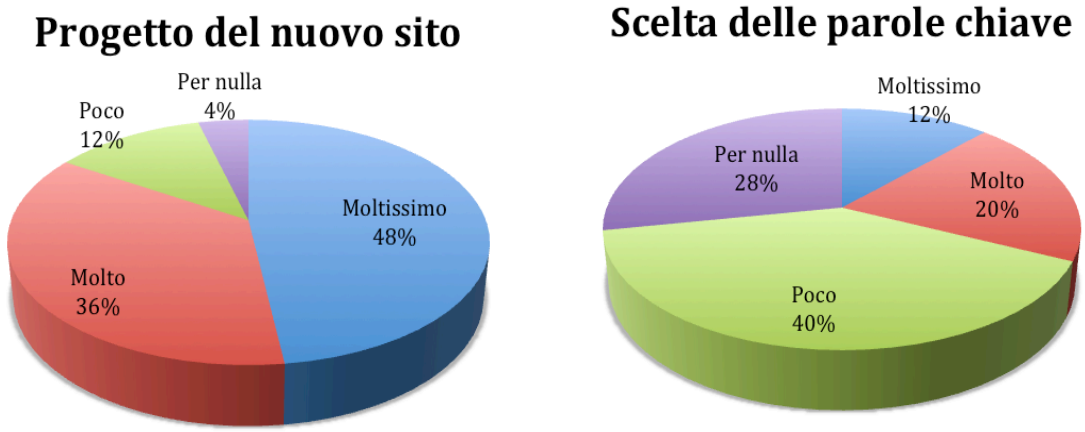


Figura 10 Percentuale di gradimento del progetto del nuovo sito e della scelta delle parole chiave

Come mostrano i grafici della Figura 10, in generale il progetto del sito e i primi tentativi di realizzazione incontravano un parere favorevole; il vero oggetto di critica era proprio la scelta delle parole. Si sono così iniziate a moltiplicare proposte e rivendicazioni, e con esse la richiesta di aggiungere nuove parole, sempre più specifiche e tecniche. Un pendio scivoloso difficile da arginare, che avrebbe portato presto a una selva di termini incomprensibili per la metà dei visitatori, o quanto meno poco evocativi.

Di fronte a queste difficoltà, il Direttore ha deciso di non affrontare il problema a livello di Consiglio di Istituto, temendo che un confronto diretto avrebbe soltanto acuito le contrapposizioni. Per questo si è scelta la strada di una "semi-democrazia": ai coordinatori dei vari gruppi e ad alcuni ricercatori singoli (per un totale di 25 persone, meno di quelle indicate nella Tabella 1, cfr. pp. 22-23) è stato chiesto di esprimere delle preferenze sulle parole e di suggerirne eventuali altre. Come si vede dalla Figura 11, il risultato è stato un massiccio accordo sui primi tre termini, e una grande frammentazione di opinioni su tutti gli altri; la maggior parte delle parole aggiuntive proposte erano talmente specifiche che non hanno ricevuto più di uno o due pareri favorevoli.

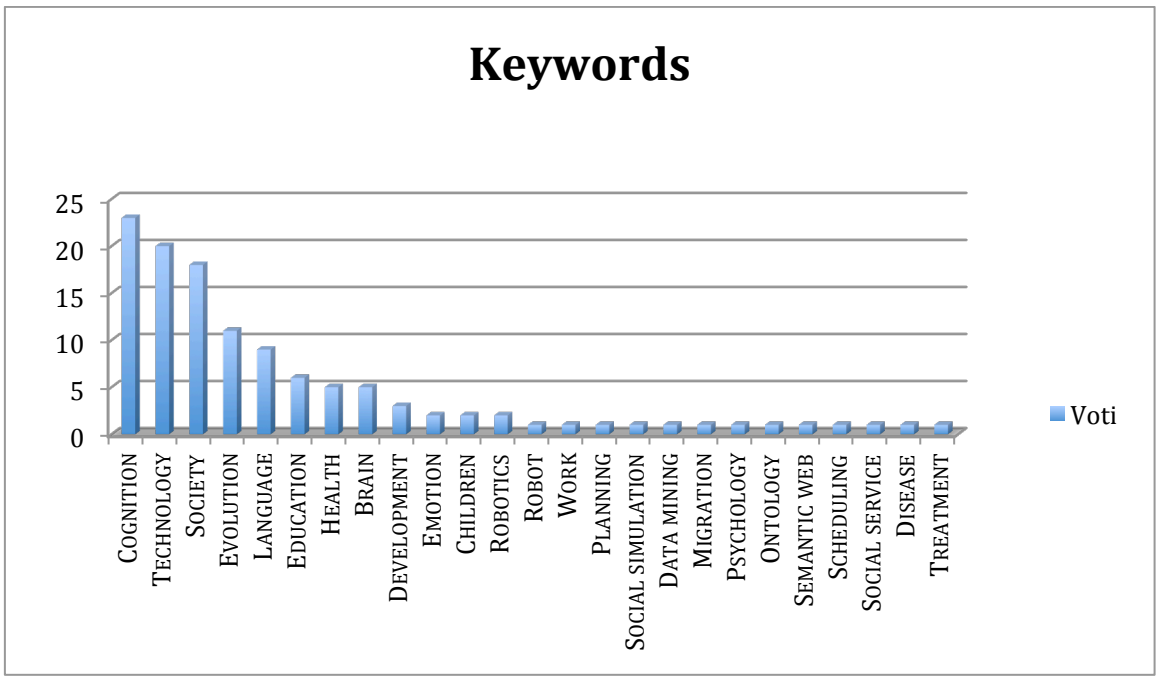


Figura 11 Votazione dei ricercatori ISTC sulle parole chiave

Dal grafico risulta un accordo pressoché totale (23 voti) sulla centralità del termine *Cognition*, seguito quasi immediatamente da *Technology*. Il termine *Emotion*, che compariva nella proposta iniziale, ha ricevuto solo due voti ed è quindi stato eliminato.

Le parole "vincitrici" sono state: *Cognition, Brain, Evolution, Technology, Health, Education, Language, Society*, per un totale di dieci combinazioni diverse:

- *Brain, Cognition & Evolution*
- *Brain, Cognition & Technology*
- *Health, Cognition & Technology*
- *Education, Cognition & Technology*
- *Technology, Cognition & Language*
- *Society, Cognition & Technology*
- *Society, Cognition & Education*
- *Brain, Cognition & Language*
- *Society, Cognition & Evolution*
- *Brain, Cognition & Health*

L'impossibilità di giungere a una soluzione che mettesse d'accordo la maggioranza rivela, oltre forse una sottovalutazione iniziale del problema, anche un aspetto molto interessante della comunicazione istituzionale: il confine tra la funzione comunicativa di un sito web e le implicazioni scientifiche di questa comunicazione è molto sottile, e va tenuta presente.

Molti ricercatori ISTC hanno mostrato di confondere un'operazione di comunicazione con una sorta di ribaltamento delle priorità dell'Istituto, e questo ha scatenato rancori e gelosie interne. "La sua area è più rappresentata della mia" è stata un tipo di rivendicazione più o meno esplicita che ha suscitato gran parte del malcontento legato alle parole chiave. In realtà, per come era concepita la struttura dell'Homepage, le parole chiave avevano l'obiettivo primario di fungere da ponte tra le varie aree di ricerca, e suggerire possibili percorsi ai visitatori a seconda del target (cfr. 2.3). La curiosità che avrebbe spinto un utente esterno ad approfondire una connessione piuttosto che un'altra non era legata al gruppo di ricerca e neppure a una

specifica area scientifica di riferimento, ma piuttosto alle domande che ruotando in Homepage connettevano tra loro parole di senso comune.

Questa difficoltà mostra che condurre un'operazione di profondo rinnovo comunicativo di un sito scientifico istituzionale può avere un forte impatto sull'auto-percezione degli scienziati. Per questo motivo, occorre prendere in considerazione la comunicazione interna almeno quanto la comunicazione verso l'esterno.

CONCLUSIONI: COMUNICARE L'INTERDISCIPLINARIETÀ

Unirsi per risolvere un problema comune. Questo concetto, che sta alla base di gran parte delle attività umane, è forse il modo più semplice per descrivere l'interdisciplinarietà. Gli studi interdisciplinari sono infatti processi che portano a rispondere a domande e risolvere problemi troppo ampi per una singola disciplina[17]. Questo richiede un superamento delle barriere sia in modo "orizzontale" (tra le varie discipline) sia in modo "verticale" (tra gli esperti, i decisori politici, il pubblico)[18], per poter pensare in modo davvero collettivo.

A volte questa sinergia può portare alla nascita di un settore completamente nuovo: le scienze cognitive sono l'esempio più affascinante e complesso degli ultimi anni.

La National Academy of Science ha rappresentato questo concetto in modo efficace con un'immagine (Figura 12), sottolineando che la differenza tra l'interdisciplinarietà e la semplice multidisciplinarietà sta proprio nella fusione tra i vari segmenti che concorrono per formare una nuova disciplina.

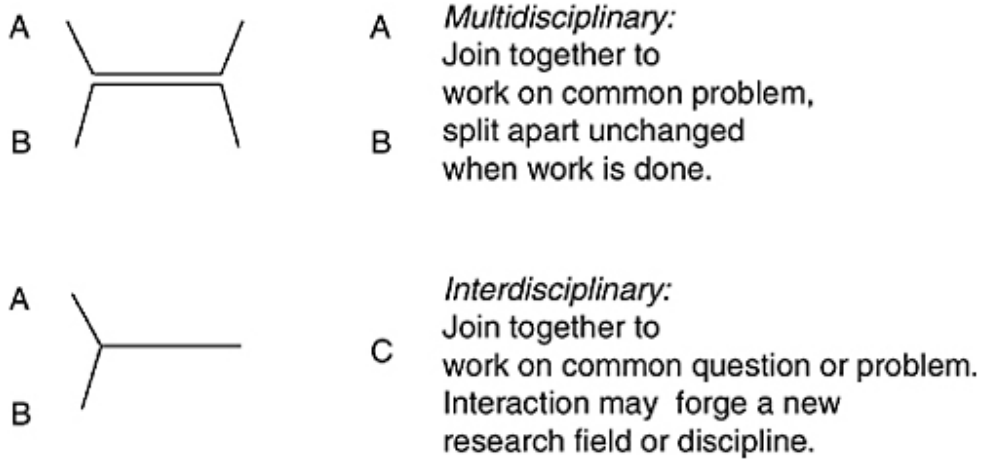


Figura 12 Differenza tra multidisciplinarietà e interdisciplinarietà, National Academy of Science

[17] Klein, J. Newell, W. H. (1998) Advancing Interdisciplinary Studies, Pp. 3-22. In *Interdisciplinarity: Essays from the Literature*, Newell, W. H. (Eds), New York: College Entrance Examination Board.
[18] Klein, J. (2004) Prospects for transdisciplinarity. *Futures* 36: 512-526.

Nelle scienze cognitive questi segmenti dialogano tra loro in modo particolarmente interconnesso. Qui infatti le divisioni disciplinari non costituiscono soltanto una barriera, ma addirittura un danno: nella fisica, nella chimica, nella biologia, le differenze disciplinari non sono così negative, perché le varie discipline che studiano la natura fanno tutte riferimento a uno stesso quadro concettuale ed esplicativo e usano uno stesso metodo di ricerca, l'esperimento di laboratorio. Invece nelle scienze che studiano la mente e il comportamento umano esistono teorie e metodi molto diversi tra loro: il risultato è un mosaico di conoscenze in cui le tessere non si combinano bene le une con le altre[19].

Le scienze cognitive hanno posto questo problema con chiarezza, facendo del dialogo tra le discipline una loro caratteristica distintiva. Come ha affermato Domenico Parisi, "Se una persona si qualifica come scienziato cognitivo è uno psicologo o un ingegnere o un neuroscienzato o un linguista o uno scienziato sociale, che non crede di poter capire tutto quello che vuole capire restando dentro alla sua disciplina."[20]

Comunicare l'interdisciplinarietà delle scienze cognitive significa tenere conto di questo: ciò che di primo impatto può sembrare un insieme frammentario di tanti settori è in realtà qualcosa di più della semplice somma delle parti. La sfida sta nel trovare una chiave di lettura in grado di cogliere questo aspetto: l'esperienza dell'ISTC-CNR presenta una possibile risposta. La metafora della connessione e il relativo slogan *Searhing for connections* porta con sé il potente messaggio dell'unificazione, in un certo senso insito nelle scienze cognitive.

A questo va aggiunta la specificità del mezzo di comunicazione scelto: un sito web ha il vantaggio dell'impatto visivo, e può trasmettere graficamente un'idea a volte problematica da tradurre in parole. Le stesse difficoltà incontrate durante la realizzazione del sito lo dimostrano: un rischio da evitare una volta scelta una strada di comunicazione è proprio quello di voler "esplicitarla" troppo, forzando i contenuti ad adattarsi in ogni maniera al *concept* scelto.

[19] Parisi, D. (2005) Mente come cervello. In *Dai neuroni alla coscienza*, Frontiere. Il meglio di Scientific American, Le Scienze S.p.A, Roma, pp. 146-147.
[20] *Ivi*, p. 149

Più efficace è stato invece fare un passo indietro e tornare a quella domanda che aveva guidato l'intero progetto del sito dell'ISTC: di che cosa si occupa uno scienziato cognitivo? Tenere sempre a mente questa domanda ha significato prendere in considerazione il punto di vista del pubblico durante ogni fase di sviluppo del sito, evitando che la scelta del messaggio comunicativo – l'interdisciplinarietà – prevalesse sui contenuti. Al contrario, la scelta è stata quella di costruire progressivamente i contenuti attorno al concetto di interdisciplinarietà, concetto che è emerso come immagine finale formata da tanti piccoli tasselli diversi. Così l'ISTC-CNR ha trovato il modo di cercare e stabilire connessioni per comunicare il ricchissimo mosaico delle scienze cognitive.

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Appendice: i testi del nuovo sito dell'ISTC-CNR

BRAIN – COGNITION – EVOLUTION

Can a monkey use tools?

Cracking a nut with a stone: at first, we thought only humans and chimpanzees could do it. But recent findings show that wild capuchin monkeys also know how to use tools. There is a long tradition of primatological research at ISTC, and the Unit of Cognitive Primatology and Primate Center (UCP) was one of the first in the world to study the cognitive skills of capuchin monkeys.

Tool use is commonly seen as a human trademark. Only chimpanzees seem to share this skill to some extent, with their ability to select stones for different uses.

But lately this vision has changed: some New World wild monkeys also use rocks as food-gathering tools. Wild bearded capuchins, *Cebus libidinosus*, use stone tools to probe for food, dig it out of the ground and crack open encased food. Capuchin monkeys separated from the human lineage around 35 million years ago, and their sophisticated behaviour was found to have something in common with that of early hominids.

At ISTC the Unit of Cognitive Primatology and Primate Center (UCP), one of the world's leading primate cognition research groups, is currently focusing on tool use. The UCP team was one of the first to watch capuchin monkeys put nuts on anvils and smash them open with stones. Since 2005, UCP contributed to the Etho*Cebus* research project (http://ethocebus.net) in collaboration with Brazilian and American researchers. The project aims to study the behaviour and ecology of wild bearded capuchins in Piaui, Brazil. These monkeys were found to be able not just to use tools but also to select the most suitable ones. But are these intentional actions? Do monkeys know they're selecting tools for a specific use?

The latest findings say the answer is “yes”: capuchins know that some stones work better than others, and make their choice accordingly. To crack palm nuts, for instance, adult capuchins transport heavier and harder stones than the ones they use to crack less resistant food items. They therefore deliberately select stones of appropriate size and hardness to use as hammers: like chimpanzees and humans, their use of tools is planned.

Can a monkey use money?

Capuchin monkeys can appreciate the purchasing power of tokens such as poker chips: at ISTC this is one of the most recent findings of Unit of Cognitive Primatology (UCP).

Despite 35 million years of independent evolution, capuchin monkeys are a valuable model to investigate the development of human traits, since they show many striking analogies with us in terms of encephalization index, lifespan, omnivorous diet, manipulative skills and tool use. Recently, researchers started to investigate capuchin symbolic competence by using tokens, inherently non-valuable objects that acquire an arbitrary value upon exchange with the experimenters.

At ISTC the Unit of Cognitive Primatology (UCP) led an experiment showing that capuchins, like us, can understand the symbolic value of an otherwise mundane object. The monkeys grasp this “money” concept despite the fact that they are so evolutionarily distant from humans.

UCP team trained the capuchins to associate valueless tokens of different shapes and sizes with specific foods. A poker chip, for example, represented dried apricot, and brass hooks represented Parmesan cheese. Then the monkeys were presented with a choice of two trays, each containing a piece, or pieces, of one of three different foods, labelled A, B and C. The foods were selected, according to the established tastes of the individual monkeys, so that A was nicer than B, which was nicer than C. In the test with real food, the monkeys chose one piece of A over two pieces of B; and would choose

one piece of B over two pieces of C. The effect continued so that they might choose one piece of A, their favourite food, over four pieces of less tempting C.

They were then offered a similar test, but with the trays loaded with tokens representing the different foods. The monkeys responded in the same way – for example choosing one A token over two B tokens. This shows that the same reasoning was used for both tasks. Capuchin monkeys can therefore use tokens to "buy" their favourite food, choosing the most convenient solutions. Just like us.

Do we think before acting, or do we act before thinking?

A responsible person thinks before acting, says conventional wisdom. But is it true? At ISTC the Goal-Oriented Agents Laboratory (GOAL) explores the connection between physical and cognitive skills, showing that thought doesn't always come first.

The origin of advanced cognitive abilities (such as planning, reasoning, language understanding) has always been investigated in psychology and more recently in neuroscience. At ISTC the Goal-Oriented Agents Laboratory (GOAL) is trying to set up strong connections between physical skills and advanced cognitive abilities. The group is thus contributing to the development of a novel approach, the embodied cognition paradigm. The paradigm aims at understanding the role of the body in cognition starting from some crucial questions: what is the influence of sensory and motor processes on higher-level cognitive abilities? Are they separated, as supposed in early cognitive science theories, or deeply interconnected? How could living organisms develop cognitive abilities on top of physical skills and the execution of bodily movements?

At ISTC the key hypothesis that the Goal-Oriented Agent Laboratory pursues is that primitive action control architectures of early living organisms provided the foundations for advanced cognitive abilities, such as planning, reasoning and mindreading through a reuse of predictive mechanisms in increasingly sophisticated ways.

In accordance with recent evidence in neuroscience and psychology, the Goal-Oriented Agents Laboratory claims that anticipatory and simulative mechanisms determined the first form of representational content. These anticipatory skills arose during evolution for action control and not for cognition, but their use led to increasingly sophisticated cognitive abilities. In fact the need to predict the outcomes of bodily actions spurred the development of complex cognitive skills. This also explains why cognitive tasks, such as linguistic or reasoning tasks, still retain sensorimotor "signatures" and recruit sensory and motor processes in the brain.

The body has therefore a fundamental role in cognition, which is regulated by anticipatory mechanisms. Considered this way, the embodied paradigm can probably bridge the gap between physical skills and high-level cognitive capabilities. Showing that humans both thing before acting and act before thinking.

How are the billions of neurons in your brain related to your behaviour and emotions?

If you could see the film of your life, you would first see a curious baby learning basic actions by interacting with the environment, then a child mastering increasingly complex actions, then a teenager in a storm of emotions and body sensations, and finally an adult exhibiting a fully developed goal-directed behaviour. If you could give a look into your brain you would see 100 billions of neurons connected with tiny "wires" in total longer more than two times the earth circumference. Strange as it might appear, it is this intricate and apparently messy neural circuit that is responsible for the film of your life. How? At ISTC the Laboratory of Computational Embodied Neuroscience (LOCEN) is working to answer this question

Food, sex and rock 'n' roll: this might well be the motto of complex organisms such as primates. Evolution has built a sophisticated motivational machinery in their brains that drives their learning processes, allowing them to flexibly adapt to the ever changing challenges posed by the environment.

Fundamental motivations, driven by neuromodulators such as dopamine and noradrenaline, are related to the achievement of biological rewards, such as food and mates for reproduction. In more complex organisms, evolution has built in also motivational mechanisms that drive the acquisition of an increasingly complex repertoire of knowledge and skills, clearly visible in children at play: curiosity, fun, the pleasure of learning (rock 'n' roll).

Under the drive of these motivations the billions of neurons in your brain process the information from your eyes, ears and skin, and exploit them for learning how to act and to achieve your ever-changing goals in different contexts. To this purpose, actions are organized in the brain in a hierarchical and modular fashion so that they do not interfere with each other. Instead, they can be easily adapted to new conditions and can be flexibly assembled for acquiring increasingly complex behaviours.

The mission of the Laboratory Of Computational Embodied Neuroscience (LOCEN) is to understand the brain mechanisms behind these processes by reproducing them with computational models. The approach followed is highly interdisciplinary. The architecture and functioning of the models are built on the basis of the available neuroscientific knowledge about the anatomy and physiology of real brains. The resulting structures are therefore required to reproduce the behaviours and the learning processes exhibited by real organisms in psychological experiments and ethological observations. This allows to understand the general principles of brain organization and functioning behind behaviour, and to produce detailed predictions that can be then tested in new experiments.

LOCEN believes that behaviour is acquired and produced by the brain via the interaction with the environment and with the internal body itself, mediated by the body sensors and the actuators. For this reason, the models it builds are often embodied in simulated organisms or even real robots (such as the humanoid robot “iCub”), and are situated in simulated or real environments as those of the experiments with real organisms.

Why do we hate waiting?

The ability to delay gratification is a turning point in the development of any child and an hallmark of advanced cognition in many species. Nevertheless, most animals cannot withstand delays longer than few seconds, even when substantial rewards are at stake, and also humans are often strongly averse to waiting – think of yourself queuing at the post office and imagine how long you could endure it. Researchers at ISTC are studying adults, children and non-human primates to understand which factors affect our tolerance for delay.

An egg today or a hen tomorrow? Similar dilemmas are known as intertemporal choices: the subject has to decide between an immediate but smaller prize and a delayed but greater outcome. Intertemporal choices are everywhere in our daily life. Enjoying the sunny day and going out for a stroll, or staying home to study for next week exam? Eating the chocolate cake at the end of the dinner, or observing your diet in order to lose weight for summer? Buying a lavish dress that really suits you, or putting the money in your savings for retirement? How we make these choices affects the quality of our lives, and people who systematically fail to postpone gratification are usually regarded as impulsive. Hence intertemporal choices have attracted a lot of attention in economics, psychology, psychiatry, ethology and philosophy.

At ISTC the Goal-Oriented Agents Laboratory (GOAL) and the Unit for Cognitive Primatology (UCP) collaborate to understand what cognitive, social and environmental factors determine tolerance for delay in adults, children and other species.

For instance, is there a connection between delay tolerance and tool use? Recent findings suggest so: UCP researchers showed that capuchin monkeys (*Cebus apella*), New World primates separated from the human lineage 35 millions of years ago, have a remarkable tolerance for delay, compared to the performance of similar species. This is paralleled by capuchins' uncanny ability in tool use, thus suggesting a correlation between the two traits.

Another issue is whether food may induce more impulsive behaviour than money, and why. In line with previous findings, GOAL researchers observed that humans are in fact

less tolerant for delay with food rewards than with monetary rewards of comparable value. On the other hand, this preference turned out to be independent from delay: humans are more motivated to accumulate money than food, even when no waiting is required to do so. This shows that money makes us more greedy, not more patient, and that people in our society suffer more of greed than of gluttony.

Finally, a delay may be easier or harder to tolerate: it depends on the costs of waiting. GOAL and UCP studies indicate that both adults, children and capuchins are more willing to sustain a delay if it is finalized to attain a desirable outcome. Moreover, the variety of actions available when waiting is essential: delays bother us especially when we have nothing to do meanwhile. This points to a qualitative dimension of delay, which cannot be reduced to a mere quantitative measure – how many seconds, minutes, hours, or days you have to wait. *How* and *why* we wait is crucial in determining our tolerance for delay.

BRAIN – COGNITION – TECHNOLOGY

Can a robot learn like a child?

Spontaneously acquiring new skills and behaviours: not only humans and animals can do it. Developmental Robotics research is currently working on the creation of truly intelligent robots that can learn in complete autonomy. At ISTC the Laboratory of Computational Embodied Neuroscience (LOCEN) aims to build robots that, just like children, can acquire increasingly complex behaviours based on curiosity and the pleasure to learn.

Traditional robotic approaches directly program a set of specific skills in robots, so that they can respond to external stimuli in a rather rigid way, without any capacity to flexibly readapt to new conditions and goals. Building robots that can autonomously learn new behaviours and re-adapt to new conditions is the new frontier of *Developmental Robotics* research.

Within this framework, the Laboratory of Computational Embodied Neuroscience aims to understand how various structures of brain, which have emerged during evolution, can allow higher organisms to autonomously develop new skills through the interaction with the environment. The core idea is that this is possible thanks to intrinsic motivations and a hierarchical organization of action. *Intrinsic motivations* are processes, such as *curiosity* and the *pleasure to learn,* that for example guide learning of children at play.

Playing activities might indeed allow robots to acquire many skills that can be later exploited to pursue goals useful for the users. Hierarchical controllers allow robots to learn new skills based on already acquired skills so to acquire increasingly complex behaviours in a cumulative fashion. This goal has a great importance for science, as learning based on intrinsic motivations is a hallmark of the intelligence of humans and other primates.

Moreover, it has huge technological potential: imagine if you can buy a robot, leave it to have its autonomous experience in your kitchen or in a mine, and then come back one month later and ask “Now wash the dishes and put everything in order for me” or “Dig the coal out of the ground and collect it into that container”. Autonomous robots could thus be exploited to perform complex tasks and conduct missions in hostile environments.

Can a robot predict long-term consequences of its actions?

Forecasting the future, avoiding dangers and anticipating opportunities: these skills are still very limited in current robotic systems. But at ISTC the Goal-Oriented Agents Laboratory (GOAL) is walking this path. The challenge is to create robots that can predict the long-term consequences of their actions. This research line aims at replacing reactive robots, which simply respond to their environmental stimuli, with goal-directed robots.

“What will happen if…?” Everyone makes predictions about the future by trying to imagine upcoming events. These anticipatory mechanisms are a crucial aspect of human cognition. Likewise, many animals do not passively attend stimuli, but predict those that will probably arrive.

Cognitive scientists consider such anticipatory capabilities as a precondition for autonomous mental life, since they allow cognitive agents to build up mental representations and pursue specific goals.

At ISTC the Goal-Oriented Agents Laboratory carries out pioneering studies on anticipatory behaviour. The idea is to explore these cognitive mechanisms from a computational point of view. The group aims at contributing to a general understanding of anticipatory behaviour through its modelization in artificial cognitive systems. This means, developing robots that can predict their own actions.

Current robotics systems can select the most adequate responses for their stimuli, but they have limited abilities to predict long-term effects of their actions. This makes them scarcely adaptive in open-ended scenarios, where task achievement can depend on factors that are not perceptually available.

The Goal-Oriented Agents Laboratory is starting to devise proactive robots, which can go beyond the here-and-now of current perception and behave as guided by internally generated goals. This will make the empirical study of advanced decision-making possible: goal-directed robots will help to better understand some features of human reasoning. The cognitive mechanisms underlying questions like “What will happen if...?” could be thus understood.

Can robots cooperate?

Not only single intelligent robots, but also team of robots! At ISTC the Laboratory of Autonomous Robotics and Artificial Life (LARAL) works on the creation of groups of physically assembled robots capable of cooperating.

The attempt to evolve complete artificial creatures is a key long-term goal for Artificial Intelligence. Cooperation between robots is one of the main objectives, since it implies high levels of interaction and communication. The Laboratory of Autonomous Robotics and Artificial Life (LARAL) is working on the development of robots capable of physically assembling and solving tasks that cannot be solved by single robots. These studies are based on a method that allows co-evolving the morphology and the control system of realistically simulated robots. As it happens in nature, the model creates a robotic genotype that does not directly specify the characteristics of the creatures but rather the "growing" rules. So all the robots evolve in their environment without a centralized control: they develop functionality on their own, and at the same time they learn to combine together, adapting to different situations.

Thus LARAL team is giving important contributes to the field of swarm robotics, which studies groups of robots tightly interacting and cooperating to achieve common goals. The group's claim is that behaviour is a complex system emerging from the interactions between the agent and the external environment. This is the starting assumption for the building of a swarm of robots: all the artificial creatures are generated with a developmental process, which make them able to evolve according to the different situations they have to cope with. Robots can therefore perform tasks such as displacement, exploration or object transportation under different environments and operating conditions. In search of a high degree of mobility, versatility and robustness, LARAL researchers used the social insect metaphor and the self-assembling abilities displayed when they transport objects or build nests as a model. This led to the design and implementation of robotic systems composed of swarms of robots that interact and cooperate to reach their goals.

How do robots see the world?

Future robots will evolve their behaviour depending on environmental conditions: this is one of Artificial Intelligence challenges. At ISTC the Laboratory of Autonomous

Robotics and Artificial Life (LARAL) is contributing to the creation of a new generation of robots able to take initiatives and changing reality.

Imagine you want to design a smart robot sensing the environment and carrying out difficult tasks. Traditionally, engineers tried to do this from the bottom up, building all the robot's parts and specifying their interactions rules in order to reach a desired behaviour. The result was always limited, since it was not possible to foresee everything. Now Artificial Intelligence is mostly giving up such hope of engineering control, relying instead on the so-called "self-organization". That is, letting the robot see the world with its eyes and learn from errors.

At ISTC the Laboratory of Autonomous Robotics and Artificial Life (LARAL) is walking this path. The idea works like this: the "designer" only sets up a flexible framework specifying the basic mechanisms of the robot – how it takes input from the environment and makes decisions. The following steps are left to evolution: the robot literary learns how to behave. After several experiences, it discovers the most useful properties and retains them in new tasks.

LARAL team uses the self-organizing method to develop coordinated groups of robots, which autonomously evolve. This approach is leading to a new generation of embodied agents that are able to directly interact with the physical world and with humans. Using a "personal" and not predetermined view of the world.

HEALTH – COGNITION – TECHNOLOGY

Can robots improve elderly people's life?

"You should not take your pill on an empty stomach!" In a futuristic elderly person's home this kind of advice could come from a robot. At ISTC the Planning and Scheduling Team (PST) is working to build artificial systems, which provide assistance services: robotics is therefore exploited for socially useful tasks.

Demographic statistics show that European population is slowly getting older. The aging process has brought increased interest for new ways to effectively assist elderly people and grant them a high level of independence. This means preventing social isolation and promoting new tools to improve the quality of life of old and partially impaired people. The challenges entailed by this goal have lead to the development of the emerging field of Artificial Intelligence for Eldercare.

Working in this direction, PST aims at building cognitive support technology for domestic assistive services. One of the main results of this research is a prototypical intelligent home, the *RoboCare* Domestic Environment. It is a joint national project lasted from 2002 to 2007, in which PST actively participated as the coordinating entity.

RoboCare recreates a three-room flat where sensors, robots and other intelligent agents coordinate to support the daily activities of an elderly person. In this scenario a truly autonomous robot is able to monitor the daily schedule of an assisted person in his/her own apartment. A sophisticated obstacles-avoiding system allows a continuous and safe navigation of the robot in the environment: it can therefore autonomously maintain awareness of its position and reach any accessible destination.

Speech synthesis is used to verbalize suggestions, predicting and preventing possible hazardous behaviours. “You have already taken your pills!” Such a warning is generated as a reaction to unexpected behaviours of the assisted person: this is expressed in the form of temporal constraints among the activities. Constraint violations (repeating an already done action, delaying important activities) trigger the proper system’s reaction.

The idea pursued with *RoboCare* is not to “replace” human caregivers, but to increase elderly people’s independence. This is exactly the aim of another important project led by PST team: it is called *ExCITE* and its goal is to allow old people to remain in their home environments, enabling loved ones and caregivers to maintain a higher level of communication and interaction with them. The idea is simple but effective: a remote-controlled robot able to move within the home environment is endowed with a teleconferencing system which allows relatives, friends or caregivers to contact the

assisted person. The challenge of *ExCITE* consists in moving laboratory experiments to real people life settings, thus exploring the ability of robots to reduce the sense of social isolation by bridging distance and facilitating interaction.

With *RoboCare* and *ExCITE* development PST has addressed one of the open challenges in AI, namely that of integrating intelligent skills to create a proactive assistant for everyday life.

Future steps will probably lead to the application of robotic platforms not only in domestic environments, but also in medical structures.

How can blind people see a painting?

Perceiving a painting through touching and hearing: this was the aim of an ISTC project, which realized a working prototype to allow a blind person to "see", exploiting the phenomenon of synesthesia.

3D forms, resin, music. These are the main ingredients to create a painting not to be seen but to be felt. Francesco Antinucci developed this idea in order to create a new art for blind people, combining the right shapes, materials and sounds.

The central, innovative idea of his approach lies in the use of synesthesia, a cognitive phenomenon thereby a perception in one sense modality spontaneously evokes a corresponding perception in another sense modality. In this case, the hearing of a sound produces the perception of a color. The basic correspondence was established by taking the three parameters defining each possible color – hue, luminosity, saturation – and assigning to each of them a corresponding parameter in the musical field: timbre, pitch, volume, respectively. The next step was to implement this into a working physical device: two advanced commercial software (Edirol Orchestral and Steinberg V-Stack) were run with a specific program, able to analyze the image of the painting into the three color component pixel-by-pixel and to convert each of these value into the corresponding musical sound in real time.

After that, a 3D version of the painting was realized in a 1:1 scale, first in plastiline, then in silicon rubber and eventually in epoxy resin, highly resistant to touch. The 3D painting was provided with a magnetic field three-dimensional miniaturized tracking device, to be fastened on the blind person's finger. With this last step, Raphael's *The Lady with the unicorn* was ready to be seen with ears and hands.

Is genetic testing privacy respecting?

Patient participation in health-care decisions should be guaranteed by the ethical doctrine of informed consent. But is it always like this? At ISTC several social and psychological studies showed that patients' privacy is not always respected when talking about genetic testing.

Informed consent is a well-established practice in clinical medicine, which in the last years has been extended to the genetic testing field. However, the two contexts are quite different from each other: genetic information is so delicate that it always needs an adequate genetic counseling.

Despite this, in Italy there is a diffuse trend to perform genetic testing as a "normal" laboratory analysis, asking blood samples from people at risk without any specific counseling. At ISTC researchers lead qualitative and quantitative studies to analyze the diffusion of this malpractice. Results showed that in theory all professionals involved in genetic testing services seem to agree that freedom of choice and privacy are the basic principle; but this is in practice far from been guaranteed.

An emblematic example is the case of a guy who accompanied his father affected by Huntington's disease to a Neurology center for the diagnostic genetic testing. The doctor took the father's blood and at the same time convinced the son to do the presymptomatic test. The guy never succeeded in receiving his testing result.

ISTC researchers collected and evaluated a big number of similar cases, concluding that genetic testing in Italy often is not privacy respecting. For this reason, there is a growing need of making quality controls of the analyses laboratories, of creating an

official register of centers offering genetic testing and of establishing an Authority to guarantee patients' privacy.

Is it possible to read the brain?

Predicting a person's mental state: usually brain-reading is associated to mind investigation. But the first goal of neuroscience is above all the understanding of the complex processes occurring within and among single neuronal pools generating behaviour. At ISTC the Laboratory of Electrophysiology for Translational Neuroscience (LET'S) has developed a new algorithmic method to not-invasively look into human brain.

Human brain perceives information largely before it reaches a person's awareness. Neuroimaging techniques aim at collecting this information to understand the different functions of the brain.

At ISTC the Laboratory of Electrophysiology for Translational Neuroscience uses neuroimaging techniques to examine the various patterns of neural connections. In fact different processing tasks have their own distinct patterns of neural connections stretching across the brain: this is a crucial aspect that must be taken into account in order to build up a complete theory of brain mechanisms. In order to reach this goal, LET'S team has developed in a new source extraction method, the Functional Source Separation (FSS). It can exploit the most valuable information provided by different electrophysiological neuroimaging techniques (MEG and EEG) and it estimates the time course of a neuronal pool along different experimental states.

FSS has successfully contributed to the development of intra-cortical connectivity indices. It is also potentially useful to build brain-computer interfaces, which can track a person's intent by recording his or her brain activity and translating it into commands of an external device. This new window into the brain helps improving rehabilitation practices, sustaining for example motor behaviour reacquisition in stroke patients.

Can computer games teach relational skills?

If we think about computer games, we usually imagine people playing alone for hours in front of a screen. But recently this view has been changed by a completely different use of virtual games: it is possible to use them to acquire relational skills and even to solve business problems. At ISTC the Advanced Learning Technologies Research Group (ALT-RG) is working in this direction, developing computer games with an educational function.

Computer games are no longer used for entertainment purposes only. Virtual spaces can also be exploited to acquire and enforce useful abilities: this is the goal of computer Serious Games, which are designed as means for problem solving. The Advanced Learning Technologies Research Group (ALT-RG) aims at implementing in a digital environment the educational methodology of traditional Role Playing Games, where players assume the roles of socially interacting characters. This approach allows a small group of people to give a theatrical performance for educational purposes. Each actor controls an avatar and interacts with other avatars in a virtual 3D scene.

One of the most successful games realized by ALT-RG team is called *Eutopia*. It starts with a storyboard which defines the general educational goal and the tasks needed to reach it. The users must play the roles assigned them by tutors, respecting the personality traits and cooperating with the other participants. The interaction among the users is granted by specific group sessions followed by the trainers, who provide feedback on strategies and evaluate outcomes. Players communicate via short text messages in public and private way, but also non-verbal communication is used (gestures, moods, tone and volume of voice).

Eutopia is currently used in several European countries in vocational training programs and university courses. It helps the development of relational and negotiation skills, which are tried out in realistic scenarios to solve social, cultural and even business problems.

Can we experience the past?

Travelling through time and space: not only science fiction talks about this challenge. At ISTC Francesco Antinucci created a virtual museum able to bring us to not existing places: the only thing we need is a simple click.

Imagine visiting a museum comfortably sitting in your house, without tickets to pay and crowds to avoid: The Virtual Museum of Iraq (www.virtualmuseumofiraq.it) works just like this, recreating a reality that does not exist anymore. It shows with 3D perspective antiquities on display at the Iraq National Museum in Baghdad, which housed some of the world's oldest and most precious artefacts and was destroyed during the U.S. invasion in 2003. It was closed for six years and re-opened in 2009, but many 10.000 years old items remain missing.

The virtual museum developed by Italy's National Research Council with support from the Ministry of Foreign Affairs was a project of ISTC senior researcher Francesco Antinucci, who points out that it is not a simple online reproduction. The museum was completely re-thought for the virtual reality, so to become a "physically invented environment".

Presented in Italian, English and Arabic, the multimedia exhibit contains images, movies, maps and timelines in seven different halls designed to be explored. Visitors can thus admire objects like an alabaster figurine of a female from 6200-5700 BC Samarra, a glazed brick panel from Ishtar Gate, Babylon, 605-562 BC, and a cuneiform tablet from 3400-3100 BC.

More than 100 researchers, scholars of ancient civilization and technicians collaborated on the project. Italians and Iraqis worked closely together on research and implementation of the virtual museum, to recover an important cultural heritage and, at least virtually, save it.

How can teachers learn to teach with technology?

New education methods require new teaching systems. From serious games to advanced computer simulations: how can these technologies be integrated in traditional lessons? At ISTC the Advanced Learning Technologies Research Group (ALT-RG) is developing dedicated teacher training programs on advanced e-learning techniques.

Enhanced education with technology: this is the aim of e-learning, which is rapidly generating new tools by exploiting the potential of computers. Outside the laboratories, however, uptake of advanced technologies remains low and the majority of e-learning programs are still based on video lessons and page-turning websites. Besides economic factors, one of the key problems of e-learning programs is that the huge majority of teachers receive very little training in how to use advanced educational technologies in Learning Environments.

For this reason, at ISTC the Advanced Learning Technologies Research Group (ALT-RG) is trying to find new ways to spread new Information and Communication Technology tools (computer games, robots, computer simulations, augmented reality systems), starting from trainers rather than users. Teching to Teach with Technology (www.t3.unina.it): this is the name of the European Project ALT-RG is coordinating in collaboration with partners from Spain and UK. The goal of the project is to develop an innovative teacher trainer program to promote the use of advanced learning technology by university teaching staff, school teachers and trainers in industry. Key features include theoretical classes to discuss the advantages of new technologies, practical workshops to simulate e-learning sessions and project works in which teachers prepare learning projects to use in their own classroom.

Teching to Teach with Technology involves the use of the most advanced products developed by ALT-RG team. Teachers will therefore personally experiment the learning methods of the future.

Will technology save or destroy schools?

The way children interact with the external world is quickly changing. How will this affect the learning process? Should school adapt to technological changes or maintain its traditional role in society? The answer of the cognitive scientist Domenico Parisi.

Schools and in general educational organizations are among the most conservative institutions in society. Society changes very quickly but schools and the way of learning at school have been the same for centuries. For this reason many people are convinced that schools, as we have known them so far, have come to an end.

The most important social change in schools is the appearance of the digital technologies of information and communication: visualizations, animations, interactive interfaces, simulations, computer games, the Internet, shared virtual reality. These technologies, and in particular simulations, allow us to learn not by reading or listening to words, but by seeing and doing, for example by altering the parameters of a simulation and by observing the results of these variations. Students going to school nowadays have spent the their pre-school years interacting with technology, and this has changed their way of communicating, of gathering information, even of thinking. How can these students not feel distant from a school system that knows nothing about this?

Educational organizations are closed to new technologies because they would determine a complete transformation of the entire educational system. But the use of the new technologies at school would make it possible to reduce the distance, today so large, between children who are “born digital users” and school, to push the development of these technologies in directions which are more positive from the cognitive and the social points of view, and to have a school which really works for both boys and girls. So only technology can save our schools.

Domenico Parisi was the director of ISTC from 1987 to 1995. His main research interests are the development of simulation models of individual and social behaviours

through neural networks, genetical algorithms and models of artificial life, and their applications in the fields of education, entertainment and divulgation.

TECHNOLOGY – COGNITION – LANGUAGE

Can a computer produce emotional speech?

Text-to-speech synthesizers are widely used. At ISTC the Speech and Multimodal Communication Laboratory (SMCL) is trying to develop this useful technology in order to gain the transmission of emotions in speech communication.

Electronic speech synthesizers started to spread in the early 1980s. The first results were often barely comprehensible, but now the "ability" of computers to talk is well-known. In the last years researches in this field strongly focused on the effort to make speech synthesizers sound less robotic and to reproduce human speech in a faithful way. At ISTC the Speech and Multimodal Communication Laboratory (SMCL) is following this direction. One of the most important result is the Italian version of FESTIVAL, a multilingual text-to-speech system developed by the Centre for Speech Technology Research of Edinburgh.

SMCL's aim was to switch from a neutral "narrative style" to a more varied "emotive style". In order to do that, voice processing algorithms for emotional speech synthesis were focused on the control of phoneme duration and pitch, which are the main parameters for voice quality.

Now FESTIVAL also speaks Italian, and it does so almost like an Italian speaker. This emotional speech synthesizer has several application fields, from assistive technology for impaired users to electronic games.

Can a robot speak like a human?

Imagine to have a face-to-face conversation with an intelligent virtual agent. At ISTC the Speech and Multimodal Communication Laboratory (SMCL) completed the first

step to reach this goal, starting precisely from the "face": the result was LUCIA, an emotive talking head.

Human-computer interaction is widely investigated in many research fields. The possible applications go from dialogic systems for information access and e-commerce services to e-learning tutoring for teaching language skills, by way of animation of avatars in virtual environment and computer games.

But is it possible to build completely autonomous agents? An intelligent robot should not only mimic human actions: it should also *behave* like a real person. Eye movements, facial expressions, appropriate gestures: it is very hard to catch all these nuances in an artificial system. At ISTC the Speech and Multimodal Communication Laboratory (SMCL) tried to put out this challenge developing a three-dimensional animated computer talking head. Its name is LUCIA and it produces emotive and expressive natural speech with a big variety of facial expressions and labial movement. LUCIA emulates human mimic muscles by the use of specific functions selectively activated. These facial animation parameters are fundamental for achieving a natural movement, which is also regulated by intensity and duration constraints.

SMCL's aim was to came up to a model capable of simulating an emotional behaviour. In order to do that, the voice was an essential factor, as the transmission of emotions passes primarily through speech communication. In order to program LUCIA's voice, SMCL team designed an integrated software which was able to emulate a real human by reproducing the movements of some markers positioned on his face and then recorded.

Can computers talk a universal language?

To make computers speak the same language we cannot just use technology. First an analysis of the main concepts involved is needed: at ISTC this is the job of the Laboratory for Applied Ontology (LOA). Here, theory comes before practice. This simple claim contains a deep overturning of the traditional approach, which used to

start straightly from computational models. This means involving both people and computers, which in any case have always people at their ends.

Databases are made up of codes expressed in binary systems and stored together. But behind data there are concepts: how can they properly be translated so that they maintain the same meaning for everyone? For instance, how can different social services (like health services) build up a common glossary? To answer these questions, an interdisciplinary approach is needed. Both theoretical and technological aspects are essential.

At ISTC the Laboratory for Applied Ontology tries to put together Computer Science and Linguistics using the instruments of Philosophy and Logic: its aim is to build up a new unified paradigm of computer language.

The key is considering Computer science not just as a technical subject: computers have always people at their end, so it is crucial to build a global service framework able to account for complex processes involving both people and computers.

If we want machines to understand each other and people to agree with the meaning of machines language we need to make words explicit. To do that, we have to face ontology before technology.

An ontology is a description of the concepts and of the relations between concepts: its aim is finding unambiguous meanings of words.

It is useless to perfectly learn Java or HTML languages if we don't start from day-to-day language. This is the reason why a real interaction between people and technology is essential: it is the only way to build a new unified paradigm of computer language.

How can different databases exchange information?

Building up robust frameworks for the automatic management of informatics content: this is not only a technological challenge, but it requires also a precise conceptual analysis. At ISTC the Laboratory for Applied Ontology (LOA) works on the

essential elements which define computational data. These studies have an important impact on many social aspects.

The communication between different informatics systems is a typical e-government problem. In fact the use of technology to facilitate interactions between government and citizens has a huge impact on social services.

Imagine a simple operation like transferring information from a system to another: the two databases must communicate. This means that there must be a common language behind the data. The same happens if Social services need to interact.

The Laboratory for Applied Ontology faces exactly this kind of problems. The group builds up general computational models that must respond to specific requirements. In order to do that, different research fields are put together and this allows a strong interdisciplinary approach.

The first step is analyzing all the main concepts involved. “Service”, “commitment”, “actions”: all these words – used in any social service – can have ambiguous meanings, which have to be explicated. Once we have the abstract framework, we can translate its concepts into practical information. It is only at this point that technological applications are used.

The Laboratory for Applied Ontology considers therefore technology as the binding element between the initial theoretical analysis and the final computational models. This approach, called applied ontology, views computational models as complex systems involving technical data alongside human needs.

How can you enrich your blog or personal homepage?

Imagine you are a blogger and you want to enrich your posts with related external contents. Now this is possible without any additional search: just use the new open source platform Interactive Knowledge! It was developed jointly at ISTC within the IKS project by the Semantic Technology Laboratory (STLab) and its function is to enhance content management systems.

There are several hundred types of CMS (Content Management Systems) around, but most of them are based on a poor technology. For this reason the Semantic Technology Laboratory (STLab) tackles the challenging goal of creating a platform for semantically enabled content and knowledge management, targeted at small and medium CMS technology providers within the European integrating project IKS: http://www.iks-project.eu. The first result achieved by STLab team and its European partners is an open source platform, by which end users can interact with rich contents in a very intuitive way. Thanks to Interactive Knowledge software, a website or a blog can be automatically enriched with relevant content just on the basis of its amount of available information. But this is not its only function. Interactive Knowledge can be also used to aggregate contents starting from some keywords: for example, a journalist working on an article can gather additional information on his topic from external sources.

IKS is constantly trying to involve people from existing open source development communities, in order to bring interaction and "intelligence" to content management systems. Taking part in the specification, design and implementation of Interactive Knowledge is easy: you can both actively participate by sharing your open source system or suggest further enhancements.

Future steps will aim at "understanding user intentions": a simple Google search will be contextualized according to meaningful contents. After registering as a user, a consumer querying a search string like "Holiday houses, Italy" could receive only structured information focused on his specific needs, e.g. house name, place, available dates, facilities, distances, etc.

How can you quickly scout around CNR?

Who are the major experts in Artificial Intelligence at CNR? Who is responsible for Resource Management? Now this kind of information can be found with a simple *click*. At ISTC the Semantic Technology Laboratory (STLab) developed a software able

to automatically create a Semantic Social Network out of the data and documents of CNR.

The Italian National Research Council (CNR) is the largest research institution in Italy and it has a very complex data network: finding information can sometimes be difficult. For example, where should I search if I am looking for all the people working in a specific field? Standard search engines are not accurate enough to intelligently organize a website's contents. But at ISTC the Semantic Technology Laboratory (STLab), in collaboration with the CNR's Information Systems Office, solved this problem. The solution is at this link:

http://webtemp.src.CNR.it/semanticscouting/semanticscouting2.php

It is called *Semantic Scout* and it is a new software, specifically thought to support CNR expert finding and project management. Its function is to hybridize linked data and semantic search technologies in order to automatically create a Semantic Social Network within CNR information. This provides added value to a search: each entity is graphically represented as a focused node connected to leading researchers, their work packages, their participating institutes and department.

Semantic Scout is based on the idea of exploring, as opposed to searching: this drives the user along multiple paths which could be previously unknown. Such claim is translated into the ability to materialize on demand, and in one place, the relevant information about who in CNR is involved in some academic or technological context. Making information easy to find once and for all.

SOCIETY – COGNITION – TECHNOLOGY

Can humans and robots socialize?

A child playing with an intelligent robot can easily grow fond of it and… vice versa. At ISTC the Speech and Multimodal Communication Laboratory (SMCL) is participating in the European Project ALIZ-E, aiming at establishing any-depth social relationships between humans and robots.

Moving human-robot interaction from the range of minutes to the range of days: at ISTC the Speech and Multimodal Communication Laboratory (SMCL) is working within the European Project ALIZ-E (http://www.aliz-e.org/) to reach this aim. Currently most robots only operate in the "here and now", while this project is trying to study cognitive robots capable of maintaining credible affective interactions with humans over an extended period of time.

The protagonists are children: their open and imaginative response to artificial creatures encourages promising applications.

ALIZ-E began in April 2010 and involves partners from the UK, Germany, Belgium, Netherlands, France and Italy. One of its central scientific goals is implementing memory systems to make robots able to store and recall experiences, to learn from them and to adapt their social behaviour on the basis of past skills.

Another key aspect of ALIZ-E understands emotions in children-robot relationship. Robots should be able to interpret the emotional content of the interaction, giving appropriate signals back to the child. Non-verbal behaviour therefore plays an important role and it must be tightly connected with verbal communication.

SMCL is focusing exactly on this part, applying its research on **Errore. Riferimento a collegamento ipertestuale non valido.** in order to contribute to the realistic setting where children and robots interact. In fact the ALIZ-E project will take robots out of the laboratories, putting them to the test in a health education role. Robots will play with young diabetic patients in the pediatric department of San Raffaele Hospital in Milan: socialization is therefore combined with possible therapeutic benefits.

How can data travel from Mars to the Earth?

Pictures and videos coming from Mars show more and more faithfully what future astronauts would see from their spaceships. But how are space data currently transmitted to the Earth? At ISTC the Planning & Scheduling Team (PST) has

developed a solution to complex scheduling problems by applying Artificial Intelligence technology.

The first spacecraft sent by the European Space Agency (ESA) in the Solar System entered Mars's orbit in 2003 and has since then performed excellently. It is called Mars Express because of its rapid development time and it uses sophisticated instruments to study the geology, atmosphere and surface environment of Mars. It has returned extensive spectrometric science data, including breathtaking 3D color pictures and videos confirming the presence of water on the Red Planet's rocky terrain.

The huge amount of information generated by the spacecraft must be downloaded to Earth in the correct sequence. Traditionally this task was managed using human-operated scheduling software sending commands to Mars Express and telling it when to dump specific data packets. This was excessively time-consuming and a simple mistake could lead to permanent loss of data, as the onboard memory is limited and after a certain time it is overwritten by newly collected information.

But in 2004 the Planning & Scheduling Team (PST) developed a solution to this problem. Its name is Mexar2 and it is an advanced software tool for continuous support to data dumping activities. Its integration in the Mars Express mission planning system has largely eliminated any loss of stored data packets: it works by intelligently synthesizing the commands to be uploaded onboard the spacecraft for returning memory data to the Earth.

Mexar2 reduced the mission planning team's workload by 50 percent compared to the old manual method. Thanks to PST Mars Express has thus become the first European deep-space exploration mission using a value-adding Artificial Intelligence technology. This success led the group to work on new possible applications of these techniques to space missions.

In machines we trust?

Technology controls an important part of our lives. Every day we use a lot of different devices, trusting they will work. At ISTC the Trust, Theory and Technologies Group (T^3) focuses on the interaction between humans and machines in order to understand what technological trust really means.

Complex social phenomena are strictly associated with trust, which is a key factor to understand how cooperation, economic exchanges and communications develop in society. But how about artificial objects? Can we still talk about trust? At ISTC the Trust, Theory and Technologies Group (T^3) has shown the answer is more complex than expected.

The starting point is that trust is one of the major problems for the success of machines. It is important to study people's trust in the computational infrastructure: apparently human-computer interaction is based on the notion of trust. Most of us don't know how our laptop works, but we keep switching it on every day without any fear of explosions.

However, trust is a much wider concept then security: a safe environment is not sufficient to provide trust, and trust could be even damaged if the security is pushed too far by an invasive technology. Technology can easily provide security: every step of an online communication has procedures for transmitting users' data safely, i.e. cryptography, security protocols, biometric technologies and so on. This does not mean trust though. Imagine we have indeed obtained a secure environment: here agents can act freely and confidently because they are protected by technology. But this is not a real trust building atmosphere because trust can exist only when there is risk, when agents do perceive the possibility of being cheated yet decide to run some risk and trust the partners anyway. In case of technology, users do not decide to be engaged in cooperation despite of the risks perceived: they accept to use technology just because they do not see any risk. So the hard technology protected environment kills the possibility of trust: agents will feel safe, not trusting.

But in a world in which machines are becoming more and more autonomous, this is not enough any more. In fact "safety" is a poor concept if applied to machines able to solve problems like and better than humans: how can we be sure they are actually reliable? Here the concept of trust becomes essential. The most an artificial agent is autonomous, the most we need to find a way to measure its trustworthiness.

For these reasons, T^3 group came to the conviction that building trust in technology is a fundamental goal to use machines responsibly. This goal is not just a matter of protocols, architectures, mind-design, clear rules and constraints: trust is in fact considered as a mental state, which is strictly based on social context. For this reason, T^3 team is trying to develop computational models able to include the risk component into human-computer interactions. These models are also necessary for the relations between artificial agents: since they are able to autonomously evolve, we should take control of this process if we want their evolution to be effective. Only this way we will really trust machines.

What is social simulation?

Reproducing social processes with computer simulations is a big challenge for sociology. At ISTC the Laboratory for Agent Based Social Simulation (LABSS) is following this path, shading new lights on the complexity of human social behaviour.

Can social artifacts such as norms and reputation be studied as scientific objects? Can social behaviour be modeled? These questions were nonsense in traditional sociology, which was based on a descriptive approach. But in the latest years the focus of social science has moved on to the study of complex collective reality through computer science. Simulating society: this is the challenge of the new research field, which aims at reproducing some aspects of social life with computational models.

At ISTC there is a long tradition of social simulations. Born in the 1990s, the Laboratory for Agent Based Social Simulation (LABSS) works at the intersection among cognitive, social and computational sciences. Its main claim is that social intelligence is a group of properties of multi-agent systems: for this reason, LABSS's goal is to model the

emergence of social relationships from a collection of artificial agents which independently interact on networks.

This research contributes to understand many micro and macro dynamics of social life, bridging the gap between the descriptive and the experimental approach. How do new conventions and norms spread in society? What is the role of reputation in competitive settings? How do socially desirable behaviours emerge? LABSS team works to answer these and other questions, making social simulation a fundamental tool connecting technology and society.

SOCIETY – COGNITION – EDUCATION

Can children go to school alone?

"No, it is too dangerous": this would be most parents' answer. But social studies show that the acquisition of environmental knowledge is strongly influenced by experience. For this reason, at ISTC *The City of Children* international project is following an experiment called "We go to school alone".

Imagine a city where the typical citizen, with all his needs and requests, is a child: this is exactly the model pursued by the ISTC international project *The City of Children*. The leading idea is to enhance children's autonomy and participation. In order to make this possible concrete actions are needed: the experiment "We go to school alone" tries to follow this path since 1991, offering to many families the opportunity to see their children become independent in a safe way.

The starting point is the school: teachers' support is necessary for the successful outcome of the initiative. In class, children should compare all the different itineraries from home to school, examining possible dangers. Then a "things to do" list is presented to the Hall, which is invited to enhance safety around the school.

At the conclusion of the preparatory activities, the initiative is launched with a day of celebration attended by the mayor. From then on, children go to school on their own.

Will children save our cities?

"Sorry for disturbance, but we are playing for you". With this slogan *The City of Children* international project works on concrete proposals to encourage children participation on cities construction.

If you ask an adult and a child to describe modern cities they will give similar answers. But if you ask how to change and improve them, the answers will be extremely different: children are just not resigned to accept any trade-off between convenience and personal freedom. This is the reason why taking into account the children's point of view can lead to a real change in the urban environment.

Since 1991 the international project *The City of Children* promoted by ISTC has proposed to the city administrators to change the parameters they use for assessing urban policies. The goal is lowering the viewpoint to the height of a child in order not to overlook anyone. In fact children, by expressing their needs, are good representatives of all citizens, starting from the weaker ones.

The project was adopted by several mayors and today involves more than 100 Italian cities, several Spanish cities and the largest cities in Argentina.

The City of Children works on various concrete missions to encourage child participation. One of the most significant is the Children's Council. It is made up of about 20 children nominated within different city schools and it periodically meets, once or twice a month. School methods (raising of hands, written reports) are strictly forbidden: children must feel free to express their thoughts and to share them with schoolmates.

The Children's Council discusses and votes proposals to improve the city and every request must be taken into consideration. The youngest citizens are therefore involved in the creation of their own future.

Can we learn through evaluation?

Can evaluation be an opportunity to learn something new? And under which conditions? Can the evaluation process even change a service? At ISTC the Evaluation Research Group (ERG) works to answer these questions.

The term “evaluation” is usually associated to control, test. This happens because the concept of evaluation recalls a very familiar experience for everyone: the exams. Fear, anxiety, waiting for judgement: is it possible to free evaluation from these meanings?

Some evaluation approaches, like the Guba and Lincoln’s Fourth Generation Evaluation, say this paradigm shift is possible. At ISTC The Evaluation Research Group (ERG) refers to this method. The aim is to evaluate health and social services building new research paths able to involve all the different stakeholders. In this way the evaluation process gives new value both to the singe participant and to the whole organization.

ERG researches show how the participatory evaluation can make explicit what was implicit between people cooperating in a group, an organization, a health service. This “new knowledge” is concretized by the evaluation itself, which can improve the everyday practice related to the evaluated service.

The evaluation becomes therefore a support to operators’ work, also through the construction of new working tools. After the evaluation process, in fact, ERG team promotes the introduction of new methods developed together with the involved stakeholders. For example, a new system to schedule data in a hospital can truly improve the service quality if created with a bottom-up practice. The evaluation process can thus stimulate cooperation and promote a real change.

How can we evaluate childhood services?

Educational contexts play a crucial role in child development. How can we evaluate their quality? At ISTC the Human Development and Society Group (HDS) has set up a system of evaluation of early child education and care services.

Socialization is a fundamental aspect of children's cognitive development. At ISTC the Human Development and Society Group (HDS) is studying children in their socialization contexts, with a special focus on out-of-home childcare contexts. It set up a system to evaluate early child education and care services. In the system the evaluation is aimed at both monitoring the quality of early childhood services and improving it.

The evaluation is not based on a settled model of "good quality" service and even the definition of quality will result from the discussion among stakeholders. All the stakeholders participate in the evaluation: service staff, managers, administrators, and parents. Their participation is regulated by rigorous procedures and based on a shared documentation of the practices implemented in the service. Both participatory and documentation procedures are to be adapted to the cultural and social context in which the service operates and parents and professionals are involved. The procedures take into account the two goals of evaluation activities, which are supporting improvement and innovation of service quality and controlling their compliance with regulations.

The Human Development and Society Group adapted this system in different contexts and sites: In the years 1999-2002, it collaborates with the Region of Umbria within a program of monitoring early childhood services in the region, and in the years 2004-2009, set up a system for evaluating the quality of early childhood care and educational services accredited and subsidized by the Municipality of Rome.

Is poverty an objective condition?

Poverty is often defined in absolute terms of low income. But how do poor people perceive themselves? A ISTC the Evaluation Research Group (ERG) is working to answer this question. Showing that the social perception of poverty is anything but objective.

Economic status, sex, educational level, political orientation, media use: people's viewpoint about poverty depends on many different factors. At ISTC the Evaluation Research Group (ERG) is studying the impact of these aspects in order to understand

the process of self-attribution of poverty. The fundamental question concerns what people think about social stratification and inequality: do they believe that poverty results from insufficient individual efforts or from failures of the economic system? Likewise, do they give credit for wealth to the individual himself (hard work, talents) or to structural factors? ERG's studies show that these beliefs are highly influenced by a wide range of socio-economical elements.

Considering the variable Sex, women in case of poverty tend to an external localization of causality. External attributions correspond to the "it's not my fault" idea: women more than men perceive poverty as a situation of need and subordination beyond their control, so that it cannot be attributed to individual aspects.

The same happens with media use: people who get more informed tend to think that poverty is due to external factors more than people who get less.

Talking about the political orientation, data show something probably deriving from traditional ideological categories: the conservative approach tends to give big importance to the individual role, so it sees poverty as an internal aspect, while the sociodemocratic approach underlines the huge role of society, giving thus an external localization of poverty.

Finally, the variable Income reveals a preference for external explanations, which are fatalistic for people having (or perceiving to have) a bad economic status.

These results show that people attitudes towards the causes of poverty and wealth are influenced by important social and economical elements.

ERG research is addressed to a central aspect of the policy-making: the interventions for contrasting poverty are in fact highly influenced by people's point of view.

Why should users be involved in service evaluation?

Can users evaluate the services they use? Under which conditions is their participation into the evaluation process effective? Is participation a duty or a right?

At ISTC the Evaluation Research Group (ERG) starts form these questions before evaluating a service.

We run the risk of simplifying the complexity of social and healthcare evaluation if we do not include the users' point of view. People needs, expectations and resources are in fact fundamental while establishing an evaluation process: it is impossible to gain a comprehensive and exhaustive knowledge of the quality of the service without taking into account the judgement of all the involved stakeholders.

In recent years, evaluation methods starting from users' point of view are becoming increasingly spread. At ISTC the Evaluation Research Group (ERG) has developed a specific expertise to promote the participation of different weak subjects, such as persons with mental disease, minors, detainees. ERG researches show that these users are able to actively contribute to the construction of quality indicators systems. Of course it is not enough to get them involved into a single encounter: it takes time to build the mutual trust needed to promote participatory strategies. The effectiveness of users participation, as well as their empowerment, develops and strengthens along the evaluation process.

But is it always useful to involve users in evaluation? Definitely not. If there is not a true will to take into account user's needs, their involvement becomes counterproductive. For this reason, decision-makers willingness to really change the service is a fundamental condition of participatory evaluation.

BRAIN – COGNITION – LANGUAGE

Can a robot understand language?

Language is a very complex system, involving many brain processes. Is it possible to reproduce it in artificial agents? At ISTC building a robot able to understand language and speak is the goal of the Laboratory of Autonomous Robotics and Artificial Life (LARAL).

The discovery of the mirror neurons system has deeply changed the relationship between gesture and speech. Brain revealed to store a vocabulary of actions that can be applied to different objects; the mere watching of a given object activates potential motor acts even without any physical movement. This new evidence had a big impact on cognitive science and more recently in robotics. The main challenge became modelling the mirror neurons system into artificial agents: can a robot understand language just like us? At ISTC the Laboratory of Autonomous Robotics and Artificial Life (LARAL) is trying to reach this goal. Within the European project Italk – Integration and Transfer of Action and Language Knowledge in robots (http://italkproject.org), researchers are attempting to educate a baby humanoid robot called iCub which, at a metre tall, is the same size as a three year old toddler and is able to crawl, sit up, feel, see and hear. The iCub robot develops its capabilities in the same way as a child, progressively learning about its own bodily skills and how to interact with the world. Next, the toddlerbot uses what it learns individually and socially from others to bootstrap the acquisition of language, and uses its language abilities in turn to drive its learning of social and manipulative abilities.

Since motor system is a prerequisite for speech in humans, it can be considered as a prerequisite for speech also in artificial systems: mirrors neurons mechanisms are therefore reproduced in robots. In iCub this creates a positive feedback cycle between using language and developing other cognitive abilities. Like a child learning by imitation of its parents and interacting with the environment around it, the robot will eventually master basic principles of structured grammar.

By constructing artificial intelligence systems that have structural features similar to ours, we may be more likely to create robots that can ape human abilities. Developing at the same time new scientific explanations of the relations between action, language and social skills.

Is sign language universal?

Deaf people do not just communicate with gestures: they use a complex language with a complex grammar, which can express any kind of concept, from concrete to highly abstract. Sign language is not universal: as hearing communities, each deaf community has its own sign language, deeply linked to the culture within has been developed. At ISTC, the Sign Language and Deaf Studies Research Unit (SLDS), within the Language and Communication Across Modalities Laboratory (LaCAM), has a very long tradition of sign language studies, with a particular attention to the sign language used by Italian deaf people: Italian Sign language or LIS.

Signed languages are just like spoken languages: they have their own grammar, syntax, rules and constrains, and they aren't based on the spoken language used in the Country they belong to. The SLSD has provided the first description of phonological, lexical and grammatical aspects of LIS. Currently, one central research topic is the study of the peculiarity of sign languages, distinguishing them from spoken languages. In this context, following the semiological model developed by French researcher Christian Cuxac, the Sign Language and Deaf Studies Research Unit (SLDS) is studying highly iconic structures largely used in LIS signed discourse to depict and to describe events, objects, concepts, etc., taking in due account the iconic features that Sign Languages do indeed display in their primary, face-to-face form.

More general considerations linked to the “face-to-face” status of Signed Languages have to be posed, because of the lack of an adequate writing system which can be used to write and transcribe signed discourses. Appropriated investigations of the crucial features distinguishing Signed from Spoken languages require representation and annotation tools that are still to be developed. Since 2005, SLDS unit begun experimenting the use of Sign Writing as a tool for both composing LIS texts directly conceived in written form, and transcribing video recorded LIS corpora of narrative, discourse and conversational texts.

The lack of written forms of their signed languages might be one of the reasons that render more difficult, for deaf signers, to achieve appropriate literacy skills. SLDS

research shows that relying on written LIS texts, deaf signers can autonomously perform meaningful comparisons between LIS and written Italian at different structural levels: lexical, morphological, syntactic, textual, pragmatic.

What is the relationship between gesture and language?

Since the very beginning of our lives human interaction is characterized by two complex systems of communication: gestures and words. At ISTC the Gesture, Language Acquisition and Developmental Disorders research unit (GLADD), within the Language and Communication Across Modalities Laboratory (LaCAM Lab), studies gestures, language and their interaction in child development.

Gesture is a robust feature of communicative development, as all children use gestural behaviour. Speech and gestures are bound to each other in time, testifying with their synchrony a close link between these two systems.

Systematic interest in communicative gestures performed by infants in the first stages of language acquisition and development underwent a rapid expansion in the mid 1970s. In this period gestures were explored primarily as relevant features of a prelinguistic stage, that is, as behaviours that preceded and prepared the emergence of language. At that time language was identified more or less explicitly with speech.

Currently there is a new interest which provides the possibility to better explore since the beginning the tight link between gestural motoric and spoken linguistic representation in young children. A clear continuity between prelinguistic and linguistic form emerged: between actions, gestures and spoken words. But how children's gestures become organized into the adult speech-gesture system?

At ISTC the GLADD research unit works to answer this question. These studies strongly support the view that there is a remarkable continuity between prelinguistic and linguistic development, and that symbolic skills that are most evident in vocal linguistic productions are inextricably linked to, and co-evolve with more general cognitive and representational abilities. Researches showed that initially gestures have the function

to help the child in the construction and expression of meaning. This happens through the use of different functions: pointing, conventional-interactive gestures (such as “yes”, “no”, “good”, “hello”), representational gestures that mimic specific objects, actions or events. When words start to be emerging and integrate gestural production, gesture use is specifically linked to language development.

When children start to produce longer strings of words, they also begin to perform pragmatic gestures that are not a part of the referential meaning: this signs the evolution of gesture language system in infancy towards the adult system.

Which are the relations between lexical, attentional and perceptual processes in reading aloud?

Reading aloud involves several aspects, which are usually studied independently. At the ISTC the W-Read group (Reading and Lexical Processes Lab) is investigating the relation between perceptual, attentional and lexical components in reading, with the purpose to shed a new light on some aspects of dyslexia, both developmental and acquired.

The simple operation of reading a single word requires many cognitive processes, and reading speed is limited by eye movements. One goal of the W-Read group (Reading and Lexical Processes Lab) is to clarify how perceptual, attentional, and lexical components interact.

The relationship between these components is investigated by studying unimpaired participants and neurological patients affected by neglect dyslexia (ND), a reading disorder often associated to the attentional disorder of unilateral spatial neglect (USN). In reading single words or nonwords, ND patients may misread letters, or groups of letters, that occupy the contralesional side of visual space. Usually the lesioned hemisphere is the right one, so that the unattended space results to be the left.

However, some patients read words better than non existing words (lexicality effect) and they differ with respect to the type of reading errors. Some patients may produce

more letter substitution errors (the word "*albero*" read as "*pobero*") while others produce more omissions (the word "*albero*" read as "*bero*") always interesting the left-side of words. Some studies of the W-Read group have documented a relation between error type and the lexicality effects, suggesting that substitutions and omissions represent the two extremes of a single functional impairment, which manifests itself with different degrees of severity. Recently, the two error types have been proposed to reflect the disruption of two different mechanisms, a visuo-spatial mechanism (responsible for omissions) and a perceptual integration process (which would be responsible for substitution errors).

Finally, the recent use of eye's movements' recording in word reading, may help use to understand whether there is a relation between which letters the patient fixates and what he/she reports.

SOCIETY – COGNITION – EVOLUTION

Are animals altruistic?

Grooming, cofeeding, agonistic alliances: these behaviours in primates can be defined as altruistic, since they benefit the recipient at some costs to the actor. At ISTC the Unit of Cognitive Primatology and Primate Center (UCP) found that the role of altruism in primate evolution is significant in order to explain their social behaviour.

"You scratch my back and I'll scratch yours" is a familiar saying people use when they expect another person to exchange a favour. Our closest cousins, monkeys and apes, take this expression literary. They engage in "grooming," a social interaction in which one individual sits close to another and combs through its hair, removing dead skin or parasites.

In general, animals frequently engage in behaviours that benefit other individuals. Several hypotheses have been proposed to explain the evolution of such apparently altruistic traits, but mostly from a theoretical point of view. At ISTC the Unit of

Cognitive Primatology and Primate Center (UCP) is trying to study altruism starting from hard data. Researchers realized the first quantitative test comparing the relative role of kinship and reciprocity in shaping how animals distribute their altruism among group members. They built a database including 25 social groups belonging to 14 different species; kin relations among the subject were taken into account. For each social group, UCP team considered grooming given and received by each member to/from each other group member, and their kinship. Results were quite unexpected: in direct contrast to the prevailing view, reciprocity appeared to play a much larger role than kinship in explaining primate grooming.

This finding underlines the importance of grooming practice: it does not only remove external parasites, but it leads to tolerance, social support, mating advantages and bonding between individuals within a social group. All these characteristics are ruled by altruistic behaviours, which apparently follows a new proverb based on reciprocity: "The most you groom me, the most I'll groom you".

How do cognitive and social processes interact in children?

Cognitive processes in early childhood have widely been explored over the past thirty years. At ISTC the Human Development and Society Group (HDS) is giving important contributions to the study of children's experience in their educational contexts. Deep interactions between socialization and cognitive aspects of this experience have been found.

Most studies agree that environment plays a crucial role in the development of children's cognitive and social processes. However, there are not many studies that analyze the relationships between these processes inside educational contexts. This is one of the main research topics of the Human Development and Society Group (HDS) at ISTC. One of the fundamental aspects of its research is the study of children's interactions with peers and adults and their sharing of meanings during everyday life inside an early childhood service. An essential complementary element of the study of children's cognitive and social experience is the analysis of parent's representations

and behaviours towards child education and parental responsibilities. The HDS Group focuses on this topic since many evidences showed that children's early socialization is a crucial step in family life as well as it has become an important social phenomenon of urban life in modern cities. Since many years, several surveys have been carried out to analyze the organization of the family's daily life and its influence on children's social and cognitive experience.

The relevance of children's socialization on their cognitive and social development has many implications for planning, analyzing and evaluating early childhood services. The evaluation of these services is another important research field of the Human Development and Society Group, which is developing several methods for analyzing and assessing the quality of early child education and care services.

Is social reality real?

The world is full of social facts. Paying the bill, getting married or owning a house: these actions don't belong strictly to the universe of natural facts, but we cannot say they do not exist. What is then the nature of social reality? At ISTC the Goal-Oriented Agents Laboratory (GOAL) is trying to find an answer starting from the approach of cognitive science.

How do things like money, marriage or property exist? How are they related to physical things? These questions have been widely explored in philosophy and sociology, but when we move from collective to individual behaviour the problem of the nature of institutions seem to be underestimated. Psychology has only recently started to consider this limitation, but there is still insufficient attention to the quintessential human social ability: the capacity to act within social institutions and to construct social reality.

At ISTC, The Goal-Oriented Agents Laboratory (GOAL) is walking this path. It focuses on the conventional arrangements arising between individuals during the constructions of social reality. What are social institutions? How do we construct social reality? GOAL researchers try to answer these questions from a cognitive point of view: institutions

are mental conventions shared (also unintentionally) by all the people involved. These conventions are also social means for the sake of common ends and are sources of tacit agreements.

For example, it is a general interest to respect the institution of ownership and property: if you recognize that something I own is mine, I will do exactly the same. This happens because we share a common representation of the concepts like “yours”, “mine”, “owner”, “property”, “stealing”, and so on. Beliefs employing these concepts predispose people to behave in a certain way: respecting private ownership, paying the rent, leaving the parking space to the driver who finds it first. At the same time, they confer reality to the underlying concepts – property, rent, priority – leading to a particular social behaviour.

How do rumors travel and spread?

Did you ever think about gossip as a complex social activity? Chatting is one of the most universal social behaviour and it is not just a frivolous entertainment. At ISTC the Laboratory of Agent Based Simulation (LABSS) is developing computational models to understand the cognitive basis of gossip.

Why do we like speaking ill of people? Where does the irresistible tendency of buzzing about things come from? The answers may lie in our cognitive processes. Exchanging social information is fundamental for many activities, from partner selection to group cohesion. Gossip has therefore deep roots in our social behaviour, since what people believe about others is crucial in order to establish relationships.

At ISTC the Laboratory of Agent Based Simulation (LABSS) studies gossip as one of the ingredients of society. The group performed simulative experiments on a computational system reproducing agents’ behaviour during informational cheating. This approach belongs to the multi-agent-based social simulation, which applies artificial models to study the complex mechanisms of social and cognitive artifacts.

The analysis of these simulations revealed that gossip is deeply related with an important cognitive aspect of humans: reputation. The internal representation people have of themselves and of others plays a crucial role during the selection and communication of information. LABSS focused on reputation as both a property of agents and a process of transmission of beliefs about this property. Gossiping means discussing the transmissibility of reputation, and this process takes place during many decision-making processes. it is by moving across personal beliefs about people's reputation that rumors travel and spread.

What is the glue that sticks us together?

Human beings naturally interact with each other. This social behaviour is allowed by a powerful element existing between us: *trust*. At ISTC the Trust, Theory and Technologies Group (T^3) works to build up a complete theory of trust.

What is trust? Is it a mental attitude? An intention? A behaviour? And why is trust so important to stick people together? At ISTC the Trust, Theory and Technologies Group (T^3) aims at finding an answer starting from the mind of a trusting agent. The underlying idea is that we need a cognitive architecture, built up by beliefs and goals, to adequately address trust. This perspective is against the reductive view of trust as simple reciprocity: In T^3 socio-cognitive model, trust is not only conceived as an attitude towards the other, but also as a willingness, a decision to rely on people around us. This makes us vulnerable and dependent from them even if there is not reciprocity at all.

Trust is therefore considered as a complex relation made up of mental ingredients: shared beliefs and common goals. If a person trusts a friend, he/she thinks that there are some motivations that will lead her/his friend to act in a certain way on the basis of common views. There is an underlying motivation that drives trusting agents toward a shared expectation involving elements as honesty and reputation. In this framework it is quite clear why we trust friends. First we believe they want our good, they want to help us; thus they both will adopt our request and will keep their promise. Moreover

they do not have reasons for damaging us, and even if there are some selfish interests, friendship will prevail.

Besides these internal aspects, which are related to the trustee's mind, there are also external elements playing a crucial role in the process of reliability evaluation. This kind of trust has little to do with internal beliefs, and is related instead to the world's condition. That is, the general context in which the trustee operates. This explains the reason why we can trust someone only because we find he/she in a generally considered trustable context (i.e. school).

Finally, there are quantitative aspects to be considered: trust can be measured by the strength of those mental ingredients (beliefs and goals), which generate it. In fact trust has degrees: we can trust someone more or less depending on different elements. And there is a threshold under which trust is not enough. The degree of X's trust in Y is grounded on the cognitive components of X's mental state of trust. The degree of trust can serve as a rational basis for the decision of relying and betting on Y: together with the importance or utility of a goal, the degree of trust contributes to the evaluation of the risk. So the quantitative dimensions of trust are based on the quantitative dimensions of its cognitive constituents.

T^3 group believes this approach can be useful to understand complex social phenomena besides trust, from economic exchanges to artificial environments.

Why do we feel surprise?

Unexpected events, possible dangers, mismatches: the feeling of surprise is triggered by many different factors. How do its mechanisms work and why is surprise so important? At ISTC the Goal-Oriented Agents Laboratory (GOAL) is working to build a cognitive model of surprise.

We all know how being surprised feels like, but why do we feel surprise? At ISTC the Goal-Oriented Agents Laboratory (GOAL) studies the cognitive structure of surprise to answer this question.

First of all, there are two main different kinds of surprise, each one associated with a particular phase of the cognitive processing. There is a “first-hand” surprise, due to the perceptual mismatch between what the agent sees and its previous expectations. This kind of surprise is ruled by the law “the more I was sure, the more I am surprised”. For example, if I believe my best friend is living in Berlin, and suddenly he/she knocks on my door, I am surprised because I didn’t expect him/her to come. From a cognitive point of view, this is a discrepancy between an incoming input (my friend arrival) and a previous knowledge (my friend staying in Berlin).

The second kind of surprise is deeper and more complex. It has something to do with astonishment: it is generated when an event is in contrast with the previous long-term knowledge and expectation. If, for example, a policeman knocks on my door and enters my house to arrest me when I have done nothing, I am surprised not just because I did not expect this event. The cognitive reason of my surprise is that the event destroys some strong and radicated beliefs I had (let’s say, that honest people do not get arrested, that law is fair, and so on.)

Despite the differences, both kinds of surprise – the mismatch-based and the astonishment – are based on beliefs, which are denied by something new. So we feel surprise because of what we can call a “cognitive failure”.

BRAIN – COGNITION – HEALTH

Can brain stimulation enhance physical skills?

Sending electrical impulses to specific areas of the brain can provide remarkable therapeutic benefits for many neural diseases. At ISTC the Laboratory of Electrophysiology for Translational neuroScience (LET’S) is carrying out pioneering studies on rehabilitation techniques using brain stimulation.

It is proved that if we learn to do an easy physical task (like a finger tapping sequence) our primary motor cortex area (M1) enlarges. But what happens if M1 excitability is enhanced with transcranial stimulation, a non-invasive method that induces weak

electrical currents in the brain? The Laboratory of Electrophysiology for Translational neuroScience (LET'S) has found that our procedural learning abilities improve. So there is a double boundary between learning processes and brain alterations: this result can have a huge impact on medical treatments, helping to find new approaches for neural disease like stroke, Alzheimer disease, multiple sclerosis and depression.

Using specific techniques developed in its Laboratory, the LET'S team aims to personalize the rehabilitation settings. In stroke patients, for example, there is often a loss of voluntary movement and a weakening of arms and legs. The functional recovery of these abilities can widely change among patients even with similar lesion impacts: LET'S is working to exploit this individually variable potential to enhance standard post-stroke therapies.

LET'S team also investigates the applications of robotic rehabilitation capable of personalizing treatments. This technique uses brain stimulation to introduce non-invasive electric signals into the brain, increasing the activity of the hemisphere affected by the stroke. Physical abilities can therefore be enhanced not only through traditional physiotherapy, but also by exploiting brain plasticity.

How can we enhance reading fluency in dyslexic children?

At ISTC the W-Read group (Reading and Lexical Processes Lab) has conducted several experimental studies showing that morpheme-based reading can increase reading fluency in children with dyslexia, who are otherwise prone to slow analytical reading processing.

For children with dyslexia, the presence of familiar root and suffix morphemes in a stimulus (e.g., CASS-IERE, 'cashier') may lead to faster naming times than in the case of stimuli that are not analyzable in morphemes (e.g., CAMMELLO, 'camel'). At ISTC several studies of the W-Read group (Reading and Lexical Processes Lab) have shown that morphemic constituents affect positively the speed of children with dyslexia in reading aloud. This happens for both pseudowords and words; both low-frequency and high-frequency words; both long and short low-frequency words.

These results suggest that access to morphemes may help less skilled readers to compensate the difficulty they show in processing word units in a single fixation. In children with dyslexia, morphemes may provide reading units that are larger than single letters (which entail extremely slow and analytical processing) but are smaller than words (which readers with dyslexia find difficult to process as a whole). Morpheme-based reading can thus reduce the limitations due to analytical reading in less skilled readers and speed up their reading process.

Overall, W-Read studies show that morpheme-based reading aloud may favour reading fluency when whole-word processing is less likely, because of processing limitations on the reader's part. They also show that the reading of Italian children with dyslexia can be based on units larger than single letters, and that larger grain size units, such as morphemes, lead to faster reading performance. Whether the reading advantage shown by readers with dyslexia on morphologically complex stimuli is due to facilitated access to the word's meaning is still to be demonstrated. However, the whole set of these studies strongly suggests that reading based on morphemic units should be given a central role in the training intervention with dyslexic readers of transparent orthographies to increase reading fluency.

Do parents talk to children about hereditary diseases?

Many hereditary diseases can be passed on within families from one generation to the next. How do parents with genetic disorders face this with their children? Do they tell the truth or not? At ISTC a psychological study has been realized to investigate the communication of risk in families living with Huntington's disease.

Huntington's disease (HD) is a neurodegenerative, autosomal dominant, late-onset disease neither curable nor preventable. There are two main issues related to talking to children about it, both difficult to face: the first concerns the affected parents themselves; the second concerns the implication for the kids.

At ISTC, parental practices of informing children of risk for HD have been investigated. Researchers also focused on the differences, if any, in truth disclosure from a

generation to the other. An anonymous Internet survey was proposed to visitors from HD families on the AICH Roma website (Italian Association of Huntington Disease, http://www.aichroma.com). The survey explored the following issues: the way they, as children, had been informed of risk for HD; the best age to receive the information and the ideal provider; whether being informed is useful or not; the way they, as parents, had informed (or planned to inform) their children.

Eighty-five individuals responded: 80 were HD family members and 5 partners. Preliminary data show that parents have difficulty in talking with children about disease and risk. The majority of respondents had children in condition of risk: about 80% of children had a parent who was carrier, symptomatic or at risk. Among respondents, those who did not have children stated they would inform them in case they had, while the majority of those who actually had children did not provide any information nor showed any clear intention of doing it in the future.

Telling children the truth about HD and risk raises therefore ambivalence. ISTC study also showed that the opportunity to access good sources of counselling and support seems relevant in order to enable families to manage the emotional distress of giving such information.

Do psychological traumas change our brain?

Post-traumatic stress disorder (PTSD) is a clinical condition that may affect victims of psychological trauma. But how is our brain modified after a strong shock? And is it possible to modify it back? At ISTC a promising study started to answer these questions.

Neuroimaging techniques have recently been widely used to evaluate psychotherapy effects. Functional studies like positron emission tomography (PET) can reliably detect changes in cerebral blood flow, suggesting a specific role for each brain area involved in the various components of emotional processing.

At ISTC, in collaboration with researchers from “Tor Vergata” University, EMDR Italy Association and “La Sapienza” University, these techniques have been applied to study Post-Traumatic Stress Disorder (PTSD). Results revealed the benefits of a treatment called Eye Movement Desensitization and Reprocessing Therapy (EMDR), which was able to have good effects on brain functions. In other words, after EMDR the patient felt better, and this corresponded to a neural change in his brain.

This finding has a potential huge impact on post-trauma treatment. PTSD is a stress disorder affecting some victims of psychological trauma such as accidents or abuses. PSTD causes memory and mood dysfunctions, learning difficulties, conditioned fear due to involuntary recalled flashbacks of the traumatic event. This leads to the sensitization of the brain networks involved in fear response, in particular a deficit in the inhibition of amygdala, which is constantly activated by prefrontal cortex because of the persistent threat sensation.

Eye Movement Desensitization and Reprocessing Therapy (EMDR) is a specific form of psychotherapy for trauma-related disorders that works on the reduction of distressing memories to lower their lingering influence. ISTC study monitored for the first time the neurophysiology changes occurring during EMDR psychotherapy, revealing that after several therapy sessions the prevalent electrical brain activity moved from prefrontal cortex to temporal, parietal and occipital regions. This result suggests a cognitive processing of the traumatic event: a promising finding both for the therapy and for the neuroimaging techniques to monitor it.

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