**Poster Padova**

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***The Administration of Justice in Italy: The Case of Neurogenetics and Neuroscience. Project Research Activities***

In the last two decades courts all over the world have significantly increased the use of neuroscientific technologies and theories within civil and penal proceedings. In particular, behavioural genetics tests and neuroimaging techniques (i.e. TAC, RMN, PET, fMRI, etc.) seeking for genetic and neural correlates of behaviour and psychopathologies have been used to assess mentally disordered offenders (MDOs) and their culpability.

United States are the country with the widest record of neurolaw cases. Italy is in the forefront among European nations with two recent cases (Trieste 5/2009, Como 536/2011).

The Poster will present our Research Project ongoing activities on the topic. The Project aims at analysing ethical, social and biojuridical aspects concerning the use of neurogenetics and neuroimaging techniques within Italian legal context, with reference to European and international scientific debate. The Poster will show its multidisciplinary structure, capacity and experience in connecting multiple subjects, and its internal specialized scientific competences.

The Project consists of 3 subprojects:

**S1** The study of **bioethical and biolegal, neuroethical and neurolegal aspects** of the use of neuroscientific and neurotechnological advances in the Italian Justice (S1 includes a medical subunit and a cognitive subunit);

**S2** The **computational-linguistic** analysis of the lexicon of Italian sentences with neuroscientific data;

**S3** The **psycho-sociological** analysis of the public understanding of the use of neuroscience in the legal context in Italy.

The Project encourages best practices among legal professionals, Institutions and qualified experts, and contributes to the public understanding of neurogenetics and neuroscience by defining new strategies, elaborating guidelines and organizing educational and communication activities.

The Project meets considerable scientific and social requirements, such as providing for the delay and lack of analyses and evaluations of the impact of neuroscientific theories and technologies in Italy, especially within the administration of Justice, and encouraging general awareness on these topics.

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***Can Subthalamic Deep Brain Stimulation Modulate Moral Conflictual Decisions? An Experimental Study on Parkinson’s Disease***

Deep brain stimulation (DBS) is a procedure that involves the surgical implantation of a device that sends electrical impulses to STN to reduce motor symptoms in Parkinson’s disease (PD)1. The target structure for DBS is the subthalamic nucleus (STN), a small deep brain structure that is involved in motor and cognitive functions. Cognitive studies showed that STN DBS is able to modify conflictual decision-making2-4.

Nowadays no study investigated whether STN DBS is able to modify moral conflictual decisions. A recent neurophysiological study demonstrated that STN activity can be modulated by moral conflict processing5. Moral conflict can be defined as the difficulty in choosing an action when others actions are equally permissible/impermissible.

The aim of this study is to investigate whether STN DBS can affect reaction times (RTs) and responses of a moral task, composed by moral conflictual, moral non conflictual and neutral sentences in patients with PD.

11 PD patients with STN DBS implant performed the task in the DBS ON and OFF conditions with a 30 minutes time interval between the two sessions. A control group composed by 11 PD patients without DBS implant similarly performed the moral task twice.

The group analysis revealed that no significant differences in RTs and in responses to task sentences were found between the DBS ON and OFF conditions, nor between the experimental group in ON and OFF and the control group.

In order to analyze individual differences in performance, we considered only moral conflictual and moral non conflictual sentences that obtained concordant responses in the control group (≥8 concordant responses). Comparing responses given by each PD patient with DBS implant in ON and OFF condition, we found that 7 out of 11 patients gave more discordant responses to moral conflictual sentences in OFF than in ON conditions.

Moral conflict processing is affected by STN stimulation only in a subgroup of patients when analysis considered individual performances. These preliminary results prompt studies on morality and brain stimulation considering individual features, specifically cultural, clinical and social factors.

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***Correlati neurali dei processi decisionali nel dilemma morale: Emozioni e implicazioni legali***

Secondo il modello del doppio processo di Greene e collaboratori (2001, 2004), le decisioni che le persone prendono nei dilemmi morali sono il risultato di un’interazione di tipo competitivo tra processi cognitivi ed emozionali. Come supportato da studi di neuroimmagine, i dilemmi simili al *Footbridge* (in cui si deve decidere se sacrificare intenzionalmente una persona per salvarne un numero maggiore) coinvolgerebbero maggiormente i processi emozionali, determinando il rifiuto della scelta utilitaristica. L’intenzionalità svolge un ruolo cruciale anche nel dominio legale, essendo fondamentale nel determinare la punibilità di un’azione. La valutazione di possibili conseguenze di natura legale potrebbe quindi produrre un diverso equilibrio tra i due tipi di processi implicati nella decisione. Nella presente ricerca abbiamo confrontato i correlati neurali dei processi decisionali di due gruppi di partecipanti: un gruppo *Legal*, che ha riferito di aver tenuto conto durante la decisione di ipotetiche ripercussioni legali, e un gruppo *No Legal*, che ha deciso indipendentemente dalla valutazione di questo aspetto. Sono stati presentati 30 dilemmi tipo *Footbridge* e 30 dilemmi tipo *Trolley* (in cui il sacrificio di una persona per salvarne un numero maggiore è conseguenza prevista ma non intenzionale). Oltre alla percentuale di risposte utilitaristiche e allo stato emozionale esperito durante la decisione, sono stati misurati i potenziali evento-relati (ERP) e i potenziali relati al movimento (MRP). Nei due gruppi le scelte dei partecipanti sono state influenzate allo stesso modo dall’intenzionalità. Tuttavia, il gruppo *No Legal* ha mostrato durante la decisione uno stato emozionale più spiacevole, una minore latenza della P260, componente ERP che riflette l’impatto emozionale del dilemma, e una minore ampiezza del Potenziale di Prontezza, componente MRP che riflette la preparazione motoria. In assenza di riferimenti alle conseguenze legali, l’impatto emozionale prodotto dal dilemma si presenta quindi più precocemente e con maggiore intensità, rendendo la scelta più conflittuale.

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***Intentional conception: How conscious long-term intentions affect folk attributions of voluntariness and responsibility***

Starting from Libet’s (1983) seminal work, many findings on the timing of conscious will in voluntary action suggested that it may not cause behaviour, since neural action preparation starts before awareness of intention. Variants of this position are known as *illusionism* (Wegner, 2002).

Empirical support for illusionism was criticized both methodologically (Gomes, 1998) and conceptually. Some authors (Nahmias, 2002; Paglieri, 2010; Slors, 2013) noted that the experimental timing of conscious will may provide insight on action execution, but remains blind to early planning, when long-term intentions are conceived.

Two main thesis stand out:

1. A *logical objection*: proving that conscious will plays no causal role in action production requires showing lack of efficacy in both early planning and execution. Extant evidence addresses only the latter, thus it does not prove illusionism.
2. An *empirical claim*: the idea that conscious will is central in early planning vindicates the phenomenology of intentional behaviour.

We used experimental philosophy to verify (b), surveying folk intuitions on intentionality and responsibility in 200 students. Our scenarios described two distinct stages of action generation, Conception (the formulation of a long-term intention) and Execution (the final instantiation of the intended act): each stage was either consciously willed (free) or driven by factors outside of conscious volition (externally forced). We predicted that conscious volition at Conception, as opposed to Execution, would have stronger positive effects on attributions of intentionality and responsibility. Results confirmed this hypothesis: while this does not prove the causal efficacy of conscious intentions, it shifts the burden of proof on those who oppose folk intuitions (Nahmias et al., 2005). We also observed a gender effect on responsibility attributions, a confirmation of mechanistic incompatibilism (Nahmias et al., 2007), and an impact of moral considerations on responsibility judgements, connected to side-effect effects (Knobe, 2003; Pettit & Knobe, 2009).

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***Neurobiological correlates of the attitude toward human empathy***

**Introduction:** Understanding others is the principle on which empathy, compassion and forgiveness are based. Understanding others is a multidimensional construct, encompassing distinct processes1. Empathic concern (EC) describes the observer’s experience of feelings of compassion for a distressed target2. Personal distress (PD) denotes the observer’s aversive emotional response in reaction to a distressed target. While EC is more related to the concept of “true altruism”3,4, PD helpful behavior derives from the need to relieve discomfort in the face of someone else's plight.

Here we designed an fMRI study to assess whether empathy, as measured by the Interaction Reactivity Index (IRI)5 modulates the Hurst Exponent (HE), an index of time series predictability.

**Methods:** Thirty-one healthy volunteers (25 F; mean age±s.d.: 25±3 yrs) were enrolled. A single resting state time series was acquired for each subject. Subjects were instructed to lie in the scanner with eyes closed. All the subjects completed the IRI. The EC and PD subscales were used.

**Results:** The HE in the right amygdala and the right superior temporal sulcus (STS) was positively predicted by EC. PD negatively predicted HE in bilateral inferior frontal gyrus, right superior frontal gyrus, left precentral gyrus and precuneus.

**Discussion:** Higher EC was associated with increases in HE in the right amygdala and STS respectively involved in emotional resonance and mentalizing 6, both fundamental for empathy. Disruptions of amygdala activity and connectivity were associated to empathic deficits in psychopaths7, while HE is lower in the amygdalas of autistic patients 8.

On the contrary, PD was associated with a decrease in HE in cortical regions belonging to the “mirror neuron” system (MNS). MNS is thought to play a pivotal role in understanding others’ social behavior and in empathy9. Higher PD may prevent one from moving “into somebody else’s shoes”, effectively precluding MNS from acquiring temporal redundancy.

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***Neurofisiologia della coscienza ed etica degli animali***

In questo lavoro sostengo che alcuni progressi raggiunti dalla neuroscienza nel capire certi aspetti della coscienza, pongono dei fondamenti nuovi e più solidi nel campo dell'etica animale.

Esiste una gran varietà di motivazioni - culturali, religiose, economiche - alla base delle pratiche umane nei confronti degli animali, diffuse in tutto il mondo, ma vorrei sottolineare l'importanza del punto di vista cartesiano, come quadro filosofico, almeno nel pensiero occidentale, in cui trattare il problema dell'etica nei confronti degli animali.

Solo per l'uomo l'esistenza di un pensiero interiore consentirebbe uno stato di coscienza, per gli animali le loro capacità di controllo del loro corpo, e della loro interazione, anche molto sofisticata, con l'ambiente esterno, sono il frutto di una serie di reazioni meccaniche, a cui non corrisponde una consapevolezza mentale. Il modo di dire comune che un animale, quando subisca una minaccia, una privazione, o un danno fisico, “soffra”, è un'illusione, un pensare in modo antropomorfo e non scientifico.

Nonostante alcune rotture di questa tradizione, in parte da Darwin, e poi Lorenz e Tinbergen, i timori dei biologi a indagare una coscienza negli animali sono continuati fino ai giorni nostri, come ben descritto da Griffin (1994): “Animal cognition: yes of course; but animal consciousness: unlikely, or, if it does occur, impossible to detect, since whatever the animal does might be done unconsciously.”

Il quadro, ancora provvisorio, sui correlati cerebrali della coscienza, ha oggi aperto la strada al suo studio comparativo, allargato ad animali non umani, fino ad arrivare a stilare dei criteri scientifici per provarla (Seth et.al. 2005).

Ritengo un risultato importante la nuova idea della coscienza per gradi, con una continuità di espressioni nella filogenia (Liljenstrom e Arhem, 2008). Ciò rende giustizia all'idea della sofferenza animale in termini umani, dando consistenza più forte a teorie etiche come quelle di Singer (1975).

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***Racial prejudice influences the control of saccadic eye movements in response to gaze cues***

Humans tend to orient attention in response to averted gaze of other individuals [1]. Despite this phenomenon can be considered automatic to some extent, evidence is accumulating showing that it can be modulated by many social variables which characterize both the cueing face and the observer [2, 3, 4]. Here we investigated whether racial prejudice can modulate gaze-mediated orienting of attention by using an oculomotor task. All participants were White students. Each trial began with a centrally-placed White or Black face, with direct gaze, flanked by two placeholders. A black circle acted as fixation point and appeared between the eyes. After that, the picture of the same face with gaze averted rightwards or leftwards was superimposed, thus conveying the impression of the eyes looking either leftwards or rightwards. After a variable SOA(0 vs. 900 ms), the fixation point was replaced by either the “*+*” or “*×*” symbols. Half of the participants were instructed to make a saccade towards the placeholder placed rightwards when the fixation point was replaced by a “*+*” or towards the placeholder placed leftwards when fixation was replaced by a “*×*” symbol [see also 5]. The remaining participants responded using the opposite mapping. In the case saccade direction and gaze direction were identical, participants performed a congruent trial; in the case saccade direction and gaze direction were opposite, participants performed an incongruent trial. Gaze direction was random. All saccades that went in the intended direction were defined as correct saccades and those that went in the opposite direction were defined as error saccades. The results showed that participants committed more directional errors in response to the averted gaze of White than Black faces, but only at the shorter SOA, whereas no differences between White and Black faces emerged from saccadic RTs analysis. More interestingly, the magnitude of attentional orienting (RTs on incongruent – RTs on congruent trials) in response to Black faces at the longer SOA correlated negatively with a measure of racial prejudice. Taken together, these results suggest that racial prejudice can shape social attention.

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***Stimulating The Self - The Influence Of Conceptual Frameworks On Reactions To Deep Brain Stimulation***

Deep Brain Stimulation is generally considered to have great practical potential [1]. Yet, along with its remarkable efficacy, which is currently being tested in application to many pathologies, comes a certain number of complications. In particular, there seem to be several adverse psychological implications behind a relevant number of post-operative situations [2]. Whether these effects have to be attributed to a reactive response to a new situation or whether they are caused by the stimulation itself, or both, remains to be elucidated [3]. We take up this issue, and evaluate how various views and conceptual schemes concerning the mind-brain relationship might play a role in the ensuing (mal)adaptation to DBS treatment. It is valuable to investigate the relationship between different conceptual assumptions and the onset of psycho-social maladaptations in clinical settings [4]. In particular, we hypothesize that the frequently reported maladaptations might be partially caused by a conceptual shift away from dualism and towards a “neurocentric” materialism, promoted by the scientific explanation of the pathological situation [5]. We examine which conceptual framework is likely to play a dominant role in the perception of the general public of how the mind relates to the brain, and how this contrasts with the opinions of experts in cognitive neuroscience. We also investigate how these different conceptual frameworks might play a role in the occurrence of psycho-social maladaptations to DBS treatment in clinical settings. Finally, we suggest how a more inclusive, embodied embedded stance [6] towards the mind-brain relationship might help to overcome such maladaptations.

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***Are near-death-experience memories real? Ethical implications of a neuropsychological study***

Distinguishing between real and imagined, or made up memories of highly emotional events, is a central issue in many fields, ranging from psychoanalysis to forensic psychology. Prior research (i.e., Bastiaansen and Hagoort, 2003; Klimesch, 2012) has shown how specific electroencephalographic (EEG) activities are related to mnesic operations and memory features such as semantic integration and vividness.

We tried to push the boundaries of this research field, by applying those methods to the memories of near-death experiences (NDE). While the nature of NDE remains mostly unknown, these are characterized by a strong sense of “phenomenological certainty”, typical of the perception of daily life events. NDEs have been described by individuals as “real” and often as the most intense, vivid, important, and founding experience of their life.

In our study, we adopted an innovative integrated approach involving a hypnotic procedure to improve the recall process together with EEG recording in order to investigate the characteristics of memories and their neural markers comparing memories of NDE, real and imagined events. We included 10 participants with NDEs, defined by the Greyson scale (1983), and 10 control subjects without NDE. Memories were assessed using the Memory Characteristics Questionnaire.

This study implies a twofold theoretical discussion that covers the two main areas defined by Roskies (2002) as neuroscience of ethics, and ethics of neuroscience. On the first side, our findings showed that NDE memories were similar to real memories in terms of detail richness, self-referential, and emotional information. Even more importantly, the pattern of correlations between NDE memories and EEG frequency bands strongly differed from those observed for imagined memories. EEG results indicated that both real and NDE memories were linked to frequency bands that are very well known markers of memory. In particular, real memories were associated with high alpha band (in the NDEs) and gamma band (in the control subjects), whereas NDE memories were associated with theta band. While each of these frequency bands seems to reflect a particular aspect of recalled memories, NDEs recalls were also linked to delta band, which is also associated to states of trance, hallucinations and other non-ordinary states of consciousness. The overall pattern of EEG findings suggests that NDEs are experiences of real-like events, coherently stored in memory during an altered state of consciousness.

On the other hand, speaking about ethics of neuroscience, the implications of studying a topic often rejected as a pseudoscientific myth, and on which the literature is scarce, controversial and mixed with spiritual and religious beliefs, could be of great value. Specifically, as most participants reported, shifting this phenomenon under the light of science will have a great impact for those who, after a usually very traumatic accident, have to face embarrassment when not social stigma for an experience that could otherwise be potentially positive and restoring.

While these findings are not in any way conclusive, they contribute to the scarce knowledge on this intriguing topic, raising significant questions in those cases where the borders between life and death are not clearly drawn.

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***Does our Sense of Agency get better as we become adults? Evidence from a behavioral study***

The feeling of generating and controlling actions and their external effects is called Sense of Agency (SoA; Haggard & Tsakiris, 2009). In normal circumstances, people have a distinctive SoA for events caused by their own actions, which is relevant to personal responsibility. The vast majority of studies within the SoA field have recruited young adults as participants, while neglecting possible age-related differences in such phenomenon. Below a certain age, children are not considered responsible for their actions; the minimum age of responsibility is the object of legal debates and varies from 7 to 18 years old (Frith, 2013a; 2013b). According to this view, SoA may not emerge in the same way as in adults. The general idea is that adolescents may not be considered to be fully responsible for their own actions - and consequently not “complete” agents – since frontal lobes are not fully matured yet (Mackintosh, 2011). As a matter of fact, SoA seems to depend on the frontal cortical network’s functioning, as highlighted by different authors (Sperduti et al., 2011; David et al., 2008). The aim of the present work was to study how SoA could develop in children: we used Intentional Binding (IB) - i.e., the temporal compression between voluntary action and its sensory effect - as an implicit measure of SoA (Haggard et al., 2002). We also introduced a new paradigm that is potentially suitable to study IB in young adults (Experiment 1; N=20; mean age: 23 ± 1.41) and in children (Experiment 2; N=18; mean age=10 ± 0.97). Data from Experiment 1 replicated the IB, and Experiment 2 showed that such effect does not emerge in children when compared to adults (*p* < .05). Results indicate a possible developmental trend in SoA that could be linked to the maturation of the frontal cortical network.

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***Gene by gender interplay in moral choices***

While philosophers, psychologists and cognitive scientists have proposed distinct definitions of moral judgment, recent studies suggest that moral choices are modulated by neurobiological mechanisms.

The pioneering works by Greene showed that certain brain areas may be considered “specific” for moral decision and provided support for a dual-process theory, according to which two different patterns of neural activity are involved in moral choices: a fast, unconscious "emotional" system, and a slow, conscious "cognitive" system1, 2, 3. Furthermore, genetic associations between two allelic variants in serotonin transporter and oxytocin receptor genes, and moral judgment have been reported4, 5.

Because of their described association with impulsive behavior6, 7, 8, 9, we questioned whether four polymorphisms in genes involved in serotonergic and dopaminergic neurotransmission (SLC6A3–VNTR, DRD4-VNTR, *DRD4* rs1800955, *COMT* rs4680) would modulate the cognitive and emotional processes at the basis of controversial moral choices.

After signing an informed consent, 200 (102F) University students were recruited in a moral dilemma paradigm (N=56) designed to assess three variables: moral action type (Means vs Side Effect), life expectancy (Normal vs Reduced), self-involvement (Involvement vs Non-Involvement). They also provided saliva samples for DNA collection and completed the Impulsivity-Venturesomeness-Empathy Questionnaire (I7).

Significant differences between males and females were observed in the I7 scale scores. Moreover, only in males Venturesomeness scores correlated with the number of utilitarian responses.

Males, compared to females, gave a higher number of utilitarian responses, showed longer response times for non-utilitarian answers and judged as more acceptable the endorsed moral actions.

Interestingly, only females showed a significant association between allelic variants involved in dopamine level regulation in striatum and prefrontal cortex, and moral choices.

Our results are the first ones showing that impulsivity and genetic profile influence moral judgment in a gender-related manner, thus shedding new light on the neurobiological mechanisms underlying moral choices.

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**NeuroGenEthics: "The Angelina Jolie effect"**

Are we really responsible for our actions or are we influenced by factors unknown to our conscious reason? The study of neurosciences focuses on higher brain functions including human consciousness and moral reasoning. Studies of this nature have concrete consequences on individual and social life and according to Patricia Churchland, these consequences are “conditions” which consider when one is “in control” or “out of control". The first condition “being in control” focuses on the ability to inhibit inappropriate impulses, and the second condition “being out of control” concerns a deficit that can take on different shades inhibiting this ability. It can be said that the ability to be “in control” descends from a set of physical-chemical conditions whose presence or absence arises beyond our explicit control. An increasing interest in genetics of aggressive behavior has developed in literature over time and specifically regarding genes involved in the dopaminergic and serotonergic systems, as well as in sex steroids, glucocorticoids and arginine vasopressin. This has led to the idea that it was possible to make genetic tests applicable in psychiatry with the ability to define a genetic profile of risk. However, the results obtained to date are mostly contradictory, un-replicable and lack standardized protocols. The same could be said for mood and anxiety disorders, as well as psychosis, schizophrenia syndromes and antisocial and criminal behavior. The results found were that there wasn’t a simple mendelian transmission or connection of a few genes. The correlation between genetics and behavior has increased dramatically, but the regulatory and legal frames, within which these data and knowledge will fit, are not increasing in the same way. Today, we have to overcome this genetic determinism and generalize it in an interdisciplinary perspective without neglecting the ethical, legal and social issues and without slipping into a sort of "Angelina Jolie effect."

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***Per la nascita di una neuroetica dell'attenzione***

L'attenzione è una delle funzioni cognitive essenziali dell'essere umano. Il fatto che in ambito scientifico essa sia stata spesso considerata un fenomeno strettamente legato alla coscienza (si veda, ad esempio, Baars 1988 o Prinz 2000) è una delle prove più evidenti dell'importanza che questa funzione riveste.

La diffusione massiccia delle tecnologie digitali, rappresenta oggi un fenomeno rilevante nella misura in cui esse ci spingono a distribuire l'attenzione su più compiti, che sono svolti in lassi di tempo ristretti. La distribuzione dell'attenzione (o *multitasking*) viene favorita attraverso la costruzione di interfacce caratterizzate da un design pesantemente multifunzionale. I moderni Pc e tablet, ad esempio, permettono l'attivazione contemporanea di più programmi o la navigazione in più pagine web. Contrariamente a quanto sostenuto da alcuni, tuttavia, il cosiddetto *multitasking* è una pratica che comporta dei costi in termini di risorse cognitive disponibili (Gorlick 2009), determinando di conseguenza un calo generale delle prestazioni. Tale deterioramento delle capacità si registra ugualmente anche per le nuove generazioni (Ophir et al. 2009), che, pur essendo nate e cresciute in un contesto altamente digitalizzato, non sembrano essere immuni ai problemi che il *multitasking* comporta.

La possibilità che l'abitudine al *multitasking*, a cui le tecnologie ci spingono, renda più difficile concentrarsi per periodi prolungati su un unico compito, pone un problema di natura etica. Se le scienze cognitive confermassero tale ipotesi, infatti, la responsabilità di chi progetta queste tecnologie e soprattutto di chi decide il loro inserimento o meno in contesti educativi o di apprendimento, come la scuola, sarebbero molto più gravose di quanto si è pensato finora. In altre parole, chi progetta, gestisce o diffonde artefatti cognitivi che abituano ad un uso potenzialmente controproducente di una risorsa fondamentale come l'attenzione, dovrebbe essere guidato da un'etica dell'attenzione, o meglio da una neuroetica dell'attenzione.

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**Ri-abilitazione: empowerment o manipolazione cerebrale?**

Obiettivo della riabilitazione cognitiva è migliorare l’adattamento funzionale del paziente e il suo benessere, rallentare l’evoluzione dei deficit delle funzioni cognitive danneggiate da un processo morboso e favorire il recupero delle funzioni deficitarie con acquisizione di strategie di compensazione. A livello neurale, la riabilitazione cognitiva sfrutta i meccanismi di plasticità del cervello adulto. Questi, in modo diverso dal periodo critico neonatale e postnatale, permettono al SNC di modificare la propria microstruttura [5, 7] grazie alla stimolazione cognitiva con esercizi specifici di difficoltà e complessità graduate [2, 6, 8]. Terapia farmacologica e riabilitazione cognitiva sono spesso associate per ottimizzare il potenziale residuo e stimolare le funzioni cognitive deficitarie in pazienti prodromici (MCI), con demenza conclamata ma anche con lesioni focali a eziologia post-traumatica o psichiatrici [4, 7, 10].

L’associazione tra riabilitazione e l’aggettivo cognitivo muove un’interessante ma spinosa domanda.

Webster [9] definisce la riabilitazione come un processo atto a ristabilire una condizione di salute o una ‘normale’ attività; ciò implicherebbe un ritorno allo stato premorboso o a uno molto simile. Il prefisso ri collegato ad abilitazione fa riferimento a un generico ‘ancora in grado di…’, arduo in soggetti con danno organico. A scuola nessuno ci ha mai insegnato a memorizzare un testo, ma abbiamo trovato un nostro modo. Come nessuno ci ha mai insegnato a stimare prezzi, grandezze e distanze. Chi entra in riabilitazione deve raggiungere la consapevolezza del proprio stato di salute, dei limiti e delle capacità residue; solo successivamente può fronteggiare il cambiamento estrinseco del proprio modo d’essere e agire. Si opera quindi una manipolazione sul soggetto che deve apprendere strategie o è ‘forzato’ a compiere operazioni mentali non così naturali. Forse è bene iniziare a chiedersi quanto sia etico e che ricadute psicologiche abbia, sulla percezione di sé e sulla propria stabilità emotiva, suggerire, ad esempio, mnemotecniche verbali a chi precedentemente utilizzava strategie visive. Non è forse questo un caso più di manipolazione/learning piuttosto che di ri-abilitazione/empowerment?

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***The development of intention-based judgment of moral appraisal in four and five-year-old children***

Recently, it has been proposed a dual-process theory of moral judgment that rests on the division between action- and outcome-based value representations. Within this framework, it has been proposed that children, crucially between age 4 and 5, increasingly make moral judgment on the basis of an actor’s intent, rather than on consequences. While this is true for judgments of moral disapproval (Cushman et al. 2013), little is known about approval. Our aim was to fill the gap studying the development of intent-based judgment of moral appraisal. For the first time we tested the reliability of Cushman’s model for judgments of moral approval.

Ninety-six children between age 4 and 5, were presented with two stories, involving an attempted, but failed, help (good intention but no consequence), or an accidental help (good consequence but no intention). Children were asked to judge whether the agent was good and whether deserved to be rewarded or thanked. In this way we elicited judgments of both reward and moral goodness, concerning either accidental or attempted helping events.

We investigated the existence of a developmental shift from outcome- to intent-based moral judgment. We asked whether (1) this shift reflects the emergence of an adult two-process system and (2) older children will show a stronger differentiation of goodness from reward judgments in terms of the relative dependency on outcome versus intent.

Preliminary results suggest an age-related increase in approval judgments of attempted help. Also, five but not four-year-olds, judged the actor who accidentally helps more rewardable than good. Further analysis suggest that judgment of reward constrains goodness judgment, unlike the case of moral disapproval, in which naughtiness judgment constrains punishment judgment. We discuss the implication of these findings for current dual-process models of moral judgment.

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***Experimental Neuroethics***

Using mixed methods to explore the social perception of cognitive enhancement.

The prospect of improving normal cognitive function with technology has inspired conversation among many, drawing in academics, policymakers, journalists, business people, artists, and the general public. Its ubiquity is no surprise: the questions that arise in cognitive enhancement (CE) touch on core issues in philosophy, psychology, neuroscience, sociology, public health, and more. Opponents of CE use assert that it is unnatural, immoral, and robs citizens of their dignity (President's Council on Bioethics, 2003), while enthusiasts counter that CE is beneficial, widens the horizon of human potential, and may even be a moral obligation (Bostrom & Roache, 2009; Harris, 2005; Savulescu, 2006). The biopolitical arguments are interesting, but our primary focus is in understanding the evolving norms of society.

In our ongoing research on social perception of CE, one of the key objectives is to deepen our appreciation of the nuance and variety of positions that the public endorses. But how does one investigate what people think about the ethical, legal, and social issues raised by CE? How does one explore the factors that influence attitudes, beliefs, and behaviour; the building blocks for the construction of societal norms? And what do people say about why they think what they do? In order to answer some of these questions, we have taken a traditional quantitative method in social psychology and extended it for neuroethical discourse. The approach relies heavily upon the contrastive vignette technique (Burstin, Doughtie, & Raphaeli, 1980) in which participants respond to short stories (vignettes) about characters who, in the case of our experiments, are either contemplating or using CE. In the social sciences, the use of vignettes is well established; contrastive vignettes have been used with considerable success in health policy, experimental philosophy, legal studies, behavioural economics, medical sociology, and more.

The key feature of contrastive vignettes is that they systematically manipulate specified features of the issue. Participants are randomly assigned to read a *single* *vignette* (they are unaware that contrastive versions even exist) and then they answer a series of questions that measure their attitudes and beliefs about the issues presented. The primary outcome measure is the *difference* in the averaged response with the contrastive condition, rather than the stated preference offered by the participant. By comparing these averaged answers, we can explore the impact of small changes in *the context* of the CE debate upon, for example, public endorsement of CE use. An important advantage of this approach is that it reduces the impact of social desirability bias (Fernandes & Randall, 1992; Kahneman, 2011) upon the answers, as biases can be expected to be similar across groups in each contrastive arm, effectively cancelling each other. In our approach, we require participants to tell us why they answered as they did. This question provides qualitative responses that we analyze in concordance with the quantitative data gleaned from the primary outcome measures. We have found that this mixed methods design allows us to engage in a wide-reflective equilibrium; using public perceptions of ethical issues to help identify problems, guide our moral evaluations, and inform effective policy (Salloch, Vollmann, & Schildmann, 2013).

In our research on public attitudes towards CE (Fitz, Nadler, Manogaran, Chong, & Reiner, 2013), we have found our mixed methods approach to provide useful insights into the public’s hopes and fears: people readily distinguish between therapy and enhancement; they recognize but are little bothered by pressure to enhance; they consider both individual effort and social circumstances in judging the fairness of unequal distribution of CE; and people view the achievements of enhanced workers as inauthentic, yet still consider them worthy of promotion. We have found that the technique is useful in answering many of the questions that arise in the debate over human enhancement, and we are currently gathering data about the social perception of enhancement across various workplaces. At the Enhancing Responsibility conference, we will have quantitative and qualitative data that shed light on whether people are more comfortable with (or perceive more of an obligation to enhance) certain occupations enhancing compared to others.

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***Hacking the mind. Security and privacy issues in brain-computer interfacing***

A Brain-Computer interface (hereafter BCI) is a direct communication pathway that allows its user to control an external computer device exclusively with brain activity (Vallabhaneni et al. 2005). Today, BCIs are being increasingly implemented into health care to repair and assist cognitive or sensory-motor functions in patients experiencing cognitive or sensory-motor impairments including spinal cord injury, stroke, and motor neuron disease (Kübler, A., & Muller 2007). Additionally, consumer-grade BCIs are receiving increasing success among the general public for supporting everyday activities such as gaming, interactive television, marketing and hands-free control accessory for mobile technologies (Nijholt et al. 2009).

Although BCIs are significantly innovating both the treatment of neurological disorders and disabilities and the use of mobile technology, the security risks associated to these technologies have not received sufficient attention. Martinovic et al. (2013) have demonstrated the actual feasibility of hacking actually commercialized EEG-based BCIs to extracting sensitive information from the users, performing effective

side-channel attacks with a 'mind-spyware' based on P300 recorded event-related potential.

This peculiar form of crime executed against BCI-users can be defined 'mind-hacking' since the hack targets mental information. We argue that the prospect of mind-hacking imposes an extensive assessment of the dual-use and security issues of brain-computer interfacing.

This paper offers an overview of the possible sorts of hacking to which BCIs are actually subject or may be subject in the next future. In particular, it identifies the sources of vulnerability, delineates the possible actors and malware involved in the hack and discusses some ethical-legal-social implications peculiar to mind-hacking such as privacy, autonomy and intentionality. This contribution is aimed at taking a first step in

developing a systematic ethical and legal reflection on the security implications of BCI use and raising awareness about the potential misuse-threats related to the widespread availability of BCIs in health-care and among the general public.

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**Le nuove tecniche di analisi funzionali dell’attività cerebrale: verso una ‘lettura del pensiero’?**

Nell’ambito delle neuroscienze si stanno affermando nuove tecniche di analisi di risonanza magnetica funzionale (fMRI), quali le tecniche multivariate e gli algoritmi di *machine-learning*, sempre più raffinate e capaci di decodificare il contenuto mentale associato a specifiche risposte neuronali.

La potenza di questo nuovo approccio analitico si manifesta attraverso studi di *mind-reading*, in cui, partendo dalla risposta neuronale, vengono recuperati lo stimolo percepito o il pensiero espresso: una perfetta associazione fra l’attività neurale e il pensiero da esso derivato ci permette indirettamente di capire il funzionamento del nostro cervello. I primi tentativi di decodifica dell’attività cerebrale risalgono allo studio di Haxby e colleghi (2001), dove, per la prima volta, si associarono specifiche attivazioni neuronali della corteccia visiva extrastriata con le corrispettive categorie di immagini percepite dai soggetti. Negli anni successivi, Kriegeskorte (2008) espanse i risultati di Haxby (2001), aumentando il numero di categorie rappresentate e dimostrando una sostanziale similarità nella codifica dell’informazione visiva nelle aree extrastriate tra uomo e scimmia. Recentemente, Nishimoto e colleghi (2011), hanno ulteriormente affinato i metodi e sono addirittura riusciti, utilizzando esclusivamente l’attività neuronale generata dalla corteccia visiva primaria, a ricostruire il filmato che i soggetti sperimentali vedevano.

Se la corteccia visiva rappresenta un target ideale per la ricostruzione degli stimoli visivi percepiti, è anche vero che negli ultimi anni queste tecniche hanno dimostrato di essere valide anche per comprendere funzioni cognitive superiori. Recentemente, il nostro gruppo ha implementato queste metodiche nella discriminazione degli atti motori: un’azione vista o udita genera una risposta neurale coerente in un vasto network cerebrale, che ne permette il riconoscimento indipendentemente dalla modalità sensoriale con la quale l'azione è stata percepita (Ricciardi e colleghi 2013).

Questi dati suggeriscono che il 'codice neurale' associato alla rappresentazione del mondo esterno possa essere decodificato, aprendo nuove questioni nel dibattito di neuroetica (Farah, 2012).

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**Methodological and bioethical advancements in research involving patients in vegetative states.**

In the present poster we describe the principal outcomes of a three-year initiative in which we approached, from technical and ethical perspectives, the study of patients characterized by disorders of consciousness (DOC). DOCs constitute a critical issue whereby an inappropriate diagnosis (e.g. differentiating between minimally conscious and vegetative states) of a given pathological state may have profound consequences at the levels of treatment and end-of-life decisions (Friedrich, 2013). These diagnoses rest upon definitions of consciousness which, in turn, are dependent on residual cognitive and vegetative capabilities (Jox and Kuehlmeyer, 2013). Technological advancements in biomedicine (e.g. imaging techniques and constant monitoring of physiological parameters) recently demonstrated that the residual capabilities of DOC patients are often hard to detect and may vary depending on the diagnostic tool adopted (Giacino and Whyte, 2005). These considerations indicate that research on DOC patients constitute a needed objective. Yet, conducting research on patients with a limited-to-absent capability of providing informed consent entails fundamental bioethical concerns. Thus, in the present poster we describe the entire process behind the study of DOC patients encompassing ethics, psychobiology and biomedicine. We first describe the outcomes of a national survey (Farisco et al., 2014) aimed at addressing the clinicians’ perspective towards the requirement of informed consent in experimentation involving DOC patients. We then describe the state of the art regarding the nosography of different DOC states and the predictive value of test scales developed to define the specific condition of DOC patients. Additionally, we propose a novel comprehensive scale developed to integrate existing scales and provide a novel diagnostic tool. Ultimately we present a novel platform, capable of integrating behavioural and physiological parameters in the study of DOC patients.

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**Farmaci  e  Cognitive  Enhancement : Interrogativi  etici,  socio-sanitari  e  giuridici**

Introduzione

Il *Cognitive Enhancement* (CE) sembra proporsi quale possibilità ‘senza limiti’ della mente, con modalità ed aspetti di rischio rilevanti in salute pubblica, interessando un numero crescente di giovani, non solo studenti, e di adulti che utilizzano, a tal fine, prodotti e farmaci diversamente sperimentati e indicati in commercio. In *Neurofarmacologia* sonoinnumerevoli le sostanze destinate a modificare capacità fondamentali del sistema nervoso centrale (SNC), stile di vita *(lifestyle drugs)*, a incrementare prestazioni cerebrali (*viagra for the brain*), ad agire ‘esteticamente’ in ambito neurologico (c*osmetic neurology*).

Materiali e metodi

Da una *meta-analisi* condottasu 98 lavori e siti scientifici (*PubMed*), 27 riguardanti sostanze naturali, esaminando dettagliatamente una gamma di farmaci terapeutici e di prodotti erboristici, sono emersi esiti dannosi, tossici e iatrogeni differenziati. Sono state, altresì, indagate, sulle rispettive fonti giuridiche italiane/europee e su *De Iure,* le autorizzazioni concernenti sperimentazione e farmacovigilanza, la legittimità di prescrizione in assenza di patologia, le modalità di rilascio dei farmaci (diretta o attraverso *internet*), le possibili responsabilità personali e di terzi, nonché il configurarsi o meno della ‘lesione personale’, con particolare attenzione alla salute quale diritto-dovere.

Discussione e risultati

Dati ufficiali sulla popolazione occidentale, già in età precoce, rivelano un preoccupante aumento del consumo di psicofarmaci. Le dosi prescritte e distribuite di antidepressivi (quinta categoria farmacologica in Italia), sono aumentate del 340% dal 2000 al 2011; la spesa socio-sanitaria per il solo SNC, nel 2012, ha raggiunto i 1.400 miliardi di euro (24euro *pro capite*). L’incremento differenziale, rispetto al 2012,per consumo di antipsicotici, nei primi nove mesi del 2013, risulta dell’11,04% e per farmaci antidemenza del 27% ( Dati: Agenzia Italiana del Farmaco, Aifa,1.2014).

Modificare emozioni e stati d’animo, competere in attività, perdere peso rapidamente, oltrepassare limiti fisiologici nel fine settimana, ha coinvolto, nel 2013, in Svizzera, il 3% dei giovani (Swiss National Science Foundation, SNSF, 19.3.2014), ma perfino adulti assumono,impropriamente, *‘Neuroenhancers’,* farmaci prescrivibili e testati su precisi stadi di patologie particolari (Alzheimer, Parkinson, ADHD), con conseguenze biologiche ed economico-assistenziali. La fruizione indiscriminata di sostanze cosiddette ‘naturali’, di cui alcuni principi chimici ben noti come ‘*smart drugs*’, ‘*pep/happy pills*’, attraverso canali diversificati, propone interrogativi etico-sociali e bio-giuridici non meno trascurabili, non potendo l’esercizio del diritto all’autodeterminazione dell’individuo nuocere alla propria e all’altrui integrità psicofisica, con ripercussioni sul benessere sociale, sia in termini di costi sanitari che di *inappropriatezza* prescrittiva e di responsabilità degli operatori della salute.

Conclusioni

Dalla revisione dei dati emergono reali pericoli dall’uso incontrollato di tali farmaci anche in peculiari classi d’età. Comparazione e classificazione di *neurofarmaci*, meccanismi d’azione, controindicazioni dichiarate in sede di registrazioni/autorizzazioni comunitarie e nazionali, effetti collaterali di sostanze considerate ‘naturali’, suggerirebbero necessità di maggiore sorveglianza e prevenzione. Nell’ottica di una connotazione ‘soggettiva’ dell’idea di *salute*, il CE risulterebbe, per evidenze, comparabile con quanto acquisito in fatto di uso e abuso nella pratica sportiva. Rivalutando strategie educative e psicopedagogiche, da sempre agenti efficaci di CE, riteniamo che il ‘*doping cognitivo’* possa sollecitare ulteriori riflessioni e prospettive in *Neuroetica*.

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**La comunicazione della diagnosi di demenza: un problema eticio nella pratica clinica**

La Malattia di Alzheimer è una demenza degenerativa che ha nell’invecchiamento il maggior fattore di rischio, e la cui prevalenza è destinata a crescere con il progressivo aumento dell’età media della popolazione. Si caratterizza per una progressiva perdita delle funzioni cognitive, determinando difficoltà a ricordare e capire il mondo circostante (NINCDS-ADRDA, 1984). I trattamenti farmacologici attualmente in uso svolgono un’azione prevalentemente sintomatica ma non cambiano la storia naturale della malattia, che porta inesorabilmente a perdita delle autonomie e dipendenza dal mondo esterno.

È quindi intuitivo come la comunicazione di una diagnosi così infausta al malato ricopra un ruolo importante all’interno del dibattito bioetico: da un lato i pazienti nelle fasi avanzate non hanno la competenza per scegliere autonomamente trattamenti e percorsi assistenziali, dall’altro i pazienti nelle fasi iniziali hanno ancora capacità di giudizio ma verrebbero inutilmente esposti a stress psicofisico. L’assenza di trattamenti efficaci pone infatti questi pazienti a rischio suicidario e allo sviluppo di comorbidità depressiva (Draper et al, 2010)

La riflessione bioetica sulla comunicazione della diagnosi al malato si à sviluppata soprattutto nel campo dell’oncologia e nei paesi di cultura anglosassone, che hanno sposato la dottrina del consenso informato e dato sempre più spazio ai valori di autodeterminazione e diritto alla privacy del paziente. Per contro, in paesi ancora fondati sulla coesione familiare sia i medici che i familiari assumono un ruolo “protettivo” verso il malato e tendono a nascondergli diagnosi e prognosi. Questo atteggiamento è particolarmente frequente nel campo delle demenze, dove un aspetto critico è dato dal consenso informato a trattamenti invasivi e alla partecipazione a sperimentazioni cliniche.

Nonostante le linee guida dedicate alla gestione della demenza abbiano individuato nella comunicazione della diagnosi un elemento essenziale nella relazione medico-paziente (Waldemar et al, 2007) è ampiamente dimostrato come questa indicazione sia difficilmente trasferibile nella pratica clinica (Keightley and Mitchell, 2004; Kissel e Carpenter, 2007) Una recente revisione della letteratura (Carpenter e Dave, 2004) ha evidenziato le motivazioni a favore e contro la comunicazione della diagnosi: da un lavo rispetto per l’autonomia, comprensione dei sintomi, coinvolgimento del paziente nel processo decisionale e accettazione delle difficoltà; dall’altro la scarsità delle opzioni terapeutiche, le limitazioni cognitive del paziente e il rischio già accennato di reazioni depressivo-ansiose e suicidarie.

Un recente studio condotto dall’Istituto Superiore di Sanità (rapporto Istisan, 2011) su 212 medici nelle Unità Valutative Alzhemer (UVA) ha evidenziato come la comunicazione avvenga in circa i 2/3 dei casi, anche se il destinatario è quasi sempre il familiare o il rappresentante legale che chiede espressamente di evitare al paziente l’uso della parola “Alzheimer”. Questa tendenza a non voler informare il paziente sembra quindi essere piuttosto diffusa in Italia rispetto ad altri paesi. (Pucci et al, 2003)

Il dilemma etico è dunque sempre presente, e suggerisce la necessità di armonizzare i valori di “verita, autonomia e riservatezza” - fondamenti del rapporto medico-paziente – con gli aspetti deontologici, il concetto di privilegio terapeutico e, non ultimo, l’incertezza della scienza medica.

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**Empathy and Integrationality in Psychotherapy**

Building on J. Searle’s assumption, we state the need to study mental states starting from subjectivity, when until now verificationist’s attitude, based on EBM-RCT model and linear statistic methodologies was unable to detect psychotherapie’s “proprium”, leading to Alice in the Wonderland’s Dodo bird paradox, whereby “Everyone won and all must have prizes”: a supposed scientific status.

Nowadays, the diffusion of neurotechnologies, able to produce data analyzed by non-linear statistic procedures, could offer a different answer and seem more suitable to show how the biologic modifications in psychotherapies are similar to trance states (entities biologically essential, evolutionary adaptive and socially oriented), which pillars are empathy and narration.

These changes seems to be necessary and sufficient conditions for activating self-healing modules, independently by the single therapeutic approach. Authors will show why the original Integrational Mind Labs’ approach assume empathy consciousness and the resulting cooperative attitude psychotherapie’s “proprium” and its main vehicle of integration.

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