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Project Title: “Cultural evolution and long term economic dynamics: The case study of Rome.”

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1 ABSTRACT: Cell Communication

- Seminar Title: Principles underlying cells talking to each other with diffusing signals
- Speaker: Hyun Youk
- Date: 11/01/2016
- Abstract:

In this talk, Hyun Youk presented his studies about “Cell Communications”. His main object of study are cells that he calls “Quorum sensing cells”. They are made by autocrine cells, able to secrete molecule that can in turn change the secretion of that same cell. He presents us how autocrine cells can turn out to be “social” cells. The main idea is that such cells, when in certain amount can interact and auto-organize themselves and exhibits properties observed in different part of the human system.

One of the impressive properties of the studies leaded by Pr Youk is that they mix highly engineered cells design via complex and innovative synthetic Biology methods and Computational. Mixing those two approach they were able to synthetically create cells responding to different condition in very similar way than the mathematical model they studied. With the articulation of those two methods they studied how, given some particular condition, the “social” cell will behave with more or less autonomy and how they will be synchronized inside of more or less bigger collectives. They thus shown theoretical *and* empirically, how some cells with very general properties, can be used to design system with crucial properties that can be found in really different biological systems.

2 ABSTRACT: Human Evolution

- Seminar Title: Reconstructing 40,000 years of Eurasian population history from ancient DNA

- Speaker: Martin Sikora
- Date: 22/01/2016
- Abstract:

Martin Sikora was previously post-doc in a Lab in the PRBB. He presents us actual publication of himself and close laboratory focusing on genetics studies made on early European (Otzy the iceman, Sunghir peeople. . .) in order to try to reconstruct the colonisation of Europe done by early human (and Neandhertal) 40 000 years ago.

Those genetics studies of early European, that Martin called Paleogenomics, are living a great explosion during the last 5 years due to new genetics extraction and sequencage technics that allow researchers to use fewer biological material and thus work on ancient genetics.

By mixing the new results given by this new Paleogenomics with genomic maps made on actual European population, they can infer what subpopulation in the actual geographic and genetics space share more traits with what kind of early human and thus, give new hint to reconstruct the history of the early colonisation of Europe.

With these new technics they shed new light on this history, by showing that the colonisation was highly dynamics. They shows that the earliest human found in Europe (Otzy) have a different genetics background than actual European. This suggest a colonisation in different steps, with some of non fructuous first-steps and some inter breedings, between populations from previous colonization's waves, but also with Neanderthal that was in Europe long before Homo Sapiens.

They also compare the genetics history they recreate with the linguistics and cultural history that had been studied by archaeologist and show how their new findings are consistence with linguistics and cultural migration

3 ABSTRACT: Gene to Cognition

(<http://www.prbb.org/arxiu/event/1656>)

- Seminar Title: From gene to cognition in a mouse model of schizophrenia predisposition
- Speaker: Joshua A. Gordon
- Date: 22/02/2016
- Abstract:

Joshua Gordon present us is studies about schizophrenia. One of his big claims that that in his lab, they have been able to propose a “full” understanding of a psychological disease by explaining all the steps of the disease : from the genetics mutation, to the cell changes produced by this mutation, to the disfunctionment of the neural network there those cells are implicated, to the impact at the level of the cognitive system where this network is involved and finally to the pathologic behavior the change in those cognitive system generate.

Such a huge work imply thousand of experiment ranging from synthetics biology to neurophysiology and psychology.

His study start with the gene: 22q11, this gene, whens subject to microdeletion, is associated with different pathological phenotypes.

To test the impact of the gene they first use mouse model with artificial microdeletion. They train thos mouse in a T-maze, where they basically have to learn how to go out. The study simply show that such deletion seems to alter working memory, preventing the mouse to remember how to find the exit. This allows to make a first link between the two extreme of the scale presented before: the genetic problem (microdeletion on 22q11) lead to abnormal behavior (mouse unable to succeed in the T-maze task).

They then study what cognitive systems are impacted: they detect problem in the hippocampus and prefrontal prefrontal. Both sytems seems altered, as well as the interaction between them. Those results were obtained by measuring the synchronicity of Local Field Potential (a particular mechanics for measuring

electromagnetic waves deep inside the cortex). By detecting statistically phase between prefrontal spikes and hippocampus phases they can predict if the behavior of mice will be altered or not. Starting from that, they propose a wide range of study from computer model to behavioral studies, neurphysiological and genetics manipulation to understand what is wrong in the communication between the two zone. They show that the problem come from a gene responsible in axon development and growing and that alter the branching pattern that are less complex in the abnormal animals.

4 ABSTRACT: Sampling and Social relasshion

- Seminar Title: Selective Information Sampling and Judgments in Social Environments.
- Speaker: Gaël Le Mens
- Date: 19/02/2016
- Abstract:

Gaël Le Mens is an economist working on the cognitive side of economy. In this talk he presents us some of the work he did about how people change their judgement by select information in their environment and how this selection can be modified by personal experience, or biased toward sampling problem.

As an example he gives us the example of people doing Behavioral Sciences (in general). How and why, one student in that field will prefer to do lab experiment or go directly to the field? Le Mens propose that this is a two side problem. In one side lays the “inference” process, where our choice is only made after repeated use of both technic and selection based on our personal experience, in the other side lays the “sampling” process, where one will choose the technic he will used by selecting among the technics he is used to see other people using.

In the different studies presented, Le Mens showed how our decision can be impacted by the observation made in our social environment and how the inference we made with partial information can

To do so he proposed experiments based on money games where people are more or less exposed to social learning. With this experiments they extract some parameter that are changing the people choice and integrate those parameter in mathematical models. They then test the accuracy of this model on existing database such as the kind of restaurant people choose to go and like, and how the experience of other can modify or choice and drive the evolution of the prestige of the restaurants.

5 ABSTRACT: Deepmind

- Seminar Title: Deep neural networks and reinforcement learning for building intelligent machines
- Speaker: Silvia Chiappa
- Date: 26/02/2016
- Abstract:

Silvia Chiappa is member of the Deep Mind team, a group of people hired by Google working on artificial intelligence and Deep Belief Network (that have recently for the first time, beat the pest Go player of the World). She presented us some of the firsts experiments they made using deep neural network and how they used those tools to learn to computer how to play games. She showed us an example like pong and Pacman. In those game, without any *a priori* knowledge about the game, no rules are given, they only gave to network the full screen of the game and the different states of the button as input. The network is trained using the score it obtains will playings. They shown that without nothing else, the neural network is able to learn and play such games.

6 ABSTRACT: Intellectual Disability

- Seminar Title: Rembrandt: Remodelling brain development in intellectual disability
- Speaker: Mara Dierssen
- Date: 20/04/2016
- Abstract:

In her talk Mara Dierssen try to re-habilitate neuropharmacology. She argues that this area of research is an abandoned place, mainly because company are still in the neural doctrine. This view of neuroscience comes back to Ramon y Cajal and Sherrington and that state that neurons are the unit of computation of the brain. On the other hand, nowadays advanced in neuroscience have shown, more and more, than mental function arise from overlapping neural network in temporal synchrony. Many to many connexion connectivity matrices. Even though some people like Lorente de N already said that the design is recurrent and this recurrence allow functional reverberation, and no more and more focus in neuroscience has been put on the understanding of network of neurons as the key of computation, as those circuits can be fine tuned by plasticity

The aim of Pr Dierssen is thus to argue that Neuropharmacology has to take into account this new view of neuroscience into account in order to advance again. To do so she presented work made on the case of the genetic trisomy 21 down syndrome cognitive phenotype.

They observed that at the neurological problem, the morphology of the pathological neurons exhibits less dendric spines, with a dendric tree less dense. This leads to input and output problems define of the connectivity matrices. By different methods they shown the problematics protein: Dyrk1A. Mixing different technics, ranging from MRI, to Mathematial modeling and to behavioral experiment on mice and with human, they show that the problem caused by the proteins (ie, the poverty of dendric tree), leads to oscillatory problem between brains regions due to network connectivity problems. They show that by mixing pharamacological treatments (that they can design as they know the protein involved) and socio-cognitive treatments, the normal phenotype can be recreates with a high level a success.

This support the idea that, by taking into account the neural circuit as a whole, as the results of the interaction of genetics component and socio-cognitive interaction, successful new therapy can be designed, that work far better than the focus on finding *the* molecule that will solve all problems.

7 RIN4

Session of the 20st of April :

- Lego & gene: In that talk was presented how animals can be classified gives some particular genetics measurement
- All is not genetic: this talk presented with some example how and why all the information used to build biological individual cannot be only carried by genetics, and that some epigenetic factors have to be taking into account.
- Psychology animals cognition: in this talk where presented how animal learn to avoid dangers even if here is no danger and in what condition.
- Colombian slang Spanish: This talk presented how a Columbian slang has been translate in different language and how those translations show underline structure and differences shared by the language.
- Bike in Barcelone
- Art and Internet: This talked presented how internet have transformed the way to do art, and how artist know use internet and computer to create new, interactive artistic pieces.
- Technical implementation of 5G: this talk presented some technical problems that the deployment of 5G technologies will have to encompass

- Map representation and Psychology: in this talk was presented how some projections used to draw map can have a deep impact on psychological understanding on the world. item Models and history: in this talk I presented how and why we can use computer model to study history.

8 ABSTRACT: Prosody and Learning

- Seminar Title: From Sound to Early Grammar
- Speaker: Rushen Shi
- Date: 27/04/2016
- Abstract:

In her talk, Rushen Shi presented studies where they show how young infants acquire grammatical knowledge. The question they challenged with their study is the following: does it exist some grammatical knowledge in the words themselves that infants can understand? or does such properties are carried by the prosody and intonation properties of the sentences? To answer those questions Pr Shi propose different experiments with “false word” that seems to be words but aren’t, and false sentences, that respect (or not) some prosody supposed to carry the grammatical information of the sentence.

They create with those false words different “syntactic” constructions that they read to children born in totally different language environment that the language use to build the grammatical informations (to prevent some pre-native learning of the words). They present these artificial syntactic constructions with real construction, and by varying different combinations of real-words, false-words and prosody properties of the sentences, they show infants can detect bad grammatical construction without any notion of any language.

This results suggest 1) that infants are able to have sophisticated syntactic representation earlier than it was previously described and 2) that prosody is one of the central tool used by early infants to construct such syntactic representation.

9 ABSTRACT: Detect selection

- Seminar Title: Detecting selection with haplotype-based methods: benchmarking polygenic selection and application to *Heliconius* butterflies
- Speaker: Angeles de Cara
- Date: 09/05/2016
- Abstract:

In her talk, A. de Cara how it is possible to detect selection using statistics tool based on haplotype genetics sequences. She first made a review of different statistics models that allow to detect selection in big haplotype. She thus present us here case study, the *Heliconius* butterflies.

The methods she review first, allow in theory to detect the action of selection in rare positive mutation able to compare huge genome with million of genetics bases. The method she compares are IHS, nSL and H12 and she build artificial dataset of genomes made of 10 chromosomes with 1 million bases, using polygenic traits and artificial selection in order to create a benchmark. With this artificial setup they showed that these methods work mainly when selection is strong and traits are not so much polygenic.

They re-enforce their finding by testing again those methods on the tropical butterflies *Heliconius*. Those butterfly tends to mimics other species for different reasons and is an particular case of associative mating. They look at the species *Numata* and *Melpomene*, where it exists balanced selection due to associative mating. They showed that IHS and nSL work in particular case, whereas if H12 work also, it is too costly to be really useful. The overall work was still in progress as she needed yet to find more data on the butterfly to really compare the three methods.

10 ABSTRACT: Computational Social Science

- Seminar Title:
- Speaker: Hannah Wallach
- Date: 19/12/2015
- (Note: Non-PRBB seminar, talk given during NIPS 2015)
- Abstract:

Hannah Wallach presented us various study she has been working on with her team. In those studies she try to apply high level machine learning methods to study political and social science.

She first presented a tool that used Bayesian admixture model to explore communication networks and topic-specific subnetworks in email data sets. By mixing technique from topic modelling and network analysis she is able to visualize network of interaction between people inside a group of people, but also latent topic sub-community inside the same network, without a priori knowledge on such sub-community. Those study allow to make quantitative analysis on the social relationship within the group of interacting people, to visualize the hierarchical relation between those people, and to see who is working on what kind of topic within the group. It's particularly relevant to detect gender disequilibrium within particular different task related topic (decision/management process vs

The second work she presented try to extract latent cooperation networks between country using a world database and too look at the evolution of such network. To do so they use some complex machine learning tool based on matrices manipulation and latent semantic analysis that again work with Bayesian inference to recreate relationship between country and the semantic value of such relationship (ally, enemy, neutral). With their methods, they were able to extract and retrace the world political history by using only data containing information such as "PX do A to PY" where PX and PY are two country and A is an action of the type "attacks", "sends troupes", "menaces", ..., and no a priori historical knowledge.

The general presentation of Pr. Wallach was a nice illustration of the usefulness of quantitative methods, and more precisely machine learning methods, to study sociological and political relationship. They are the perfect tools to allow sociologists and historians to quantify their hypothesis and detect new patterns undetectable with simpler tools.