10th International Workshop

Neural Coding 2012

Programme

Prague, Czech Republic,
September 2–7, 2012

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http://nc2012.biomed.cas.cz/

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Foreword

All messages coming from our sense organs are carried along thousands of axons by myriads of action potentials before giving rise to our rich perceptions of the outside world. Ever since this surprising fact has been realized, the subject of neural messages has never ceased to fascinate students of the nervous system. However, the concept of 'neural coding' became widely used only in the sixties and early seventies. Times were ripe because the advent of the microelectrode made possible the routine recording of action potentials in central nervous systems, while the discovery of the genetic code encouraged thinking in terms of codes, information and cybernetic mechanisms. Surprisingly, this first major wave of interest was followed by a period of relative regress during the next twenty years. The subject came again on the forefront in the nineties. Likely encouraged by the advent of the computer age, neural networks became popular and computational neurosciences acquired an impetus that never waned since then.

Sensu stricto, neural coding can be defined as the field of neuroscience concerned with the representation of sensory and other information in the nervous systems, specifically in trains of action potentials and graded membrane potential shifts. Although everyone agrees that, at some point, neural information is carried by spikes, there is still a debate on the respective merits of rate coding and temporal coding. For practical reasons, rate coding remains popular among experimental neuroscientists, although an increasing number of experiments with various sensory systems in both vertebrates and invertebrates shows that individual spikes are fired with remarkable precision at millisecond timescales. There is no indication that the fecundity of this approach will soon be exhausted.

However, neural coding is often understood nowadays *sensu lato*, namely as deciphering how the activity of single neurons and neural networks gives rise to cognitive abilities and behavior. The great challenge of finding the neural correlates of consciousness is naturally part of this extended definition which also presents fascinating perspectives for the future.

Given this long history, diverse levels of investigation and clear opportunities for new developments, it comes as no surprise that neural coding is one of these biological problems that can attract the attention of scientists with very different backgrounds and skills. Since its first meeting was organized, also in Prague, a few years after the Velvet Revolution, in 1995, the series of Neural Coding Workshops has endeavoured to represent this diversity. Then and now, the aim of the workshop is to bring together researchers sharing a common interest in understanding how the nervous systems code and process information. But more than that: researchers who, whatever their field of specialty in biology, physics, computer science, psychology or mathematics, are ready to engage in fruitful discussions across the borders of their own discipline.

Fortunately, the 77 abstracts contained in the Book of Abstracts, with their rich blend of experimental and theoretical approaches, show that we are many to share the same expectations! We hope you will enjoy in the next few days the intellectual excitement of new findings and better understanding. Faithful to the tradition of this workshop series of offering a rich social programme in a lovely spot, we wish you also fruitful discussions and friendly exchanges during the many free times reserved in the presentation schedule in the inspiring environment of this beautiful city!

Petr Lansky, Jean-Pierre Rospars, Chris Christodoulou, Lubomir Kostal

Practical Information

The address of the **venue** is:

Czech Association of Scientific and Technical Societies (CSVTS)
Novotného lávka 5
116 68 Prague 1

Your **badge** is the key to access the conference rooms, coffee breaks, lunches and all the social activities. Please, be ready to present your badge at all times.

Each **talk** is allocated a 20-minute time slot. Speakers are requested **not to exceed the time limit** and to present the file with their talks to the chairman at the latest during the break before the session.

Posters should be hanged at the latest during the lunchtime at the day of presentation. The posters should be removed not later than the next morning. Each poster is presented during a 5-minute poster spotlight. Please, **do not to exceed this time limit**, the purpose is to attract participants to your poster, not to give a complete lecture.

Lunches will be served in the building of the conference venue.

Post-workshop publications

Reviewed papers will appear in special issues of two journals – *Brain Research* and *Mathematical Biosciences and Engineering*. The details of the submission procedure and deadlines will be given on the web page of the workshop (`http://nc2012.biomed.cas.cz/`) and the participants will be informed. The expected deadline for submission is **December 15, 2012**. The number of slots in each journal is fixed and cannot be increased. Therefore, the prospective authors are requested to confirm their intention to submit a paper by 30 September 2012 at `nc2012@biomed.cas.cz`, and to indicate which of the two journals they prefer or if their choice is exclusive.

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
09:00 - 10:00		09:00 – 10:40 Session I	09:10 – 10:40 Session IV	09:10 – 10:50 Session VII	09:10 – 10:30 Session IX	09:30 – 12:00 Round Table *(Optional)* Institute of Physiology, AS
10:00 - 11:00		10:40 – 11:20 Coffee break	10:40 – 11:20 Coffee break	10:50 – 11:30 Coffee break	10:30 – 11:10 Coffee break	
11:00 - 12:00		11:20 – 12:50 Session II	11:20 – 12:50 Session V	11:30 – 12:50 Session VIII	11:10 – 12:50 Session X	
12:00 - 13:00						
13:00 - 14:00		13:00 – 14:30 Lunch	13:00 – 14:30 Lunch	13:00 – 14:30 Lunch	13:00 – 14:30 Lunch	
14:00 - 15:00		14:30 – 15:45 Session III	14:30 – 15:30 Session VI	14:30 – 18:00 Guided Tour of Prague	14:30 – 15:50 Session XI	
15:00 - 16:00		15:45 – 19:00 Posters I (+ refreshment)	15:30 – 18:00 Posters II (+ refreshment)		15:50 – 16:20 Coffee break	
16:00 - 17:00					16:20 – 17:30 Session XII	
17:00 - 18:00	17:00 – 21:00 Registration (also on Monday)					
18:00 - 19:00		19:00 – 22:00 Dinner	18:30 – 22:30 Boat trip with dinner		19:00 – 22:00 Banquet Dinner	
19:00 - 20:00						
20:00 - 21:00						

Scientific Programme

Sessions I–VI include *both* oral presentations and poster spotlights (see p.5 for a programme overview). Posters included in the **Posters I** session will be presented in **Sessions I–III**, posters included in the **Posters II** session will be presented in **Sessions IV–VI**. Page numbers refer to the separate *Book of Abstracts*.

Sunday, September 2		
17:00–21:00	Registration	

Monday, September 3		
9:00–16:00	Registration	
Session I		
9:00– 9:10	Welcoming and practical information *Petr Lansky*	
9:10– 9:30	Activity Patterns in Networks Stabilized by Background Oscillations *Frank Hoppensteadt*	p. 49
9:30– 9:35	Interplay between Endogenous and Exogenous Rhythms in Recurrent Networks with Conductance-Based neurons *Stefano Cavallari, Alberto Mazzoni and Stefano Panzeri*	p. 17
9:35– 9:40	Precise coding of interaural level differences in the auditory brainstem *Zbynek Bures*	p. 13
9:40– 9:45	On dependency properties of the ISIs generated by a two compartmental neuronal model *Elisa Benedetto and Laura Sacerdote*	p. 3
9:45–10:05	Discrimination of binary patterns by perceptrons with binary weights *Andrey Olypher and Jean Vaillant*	p. 89
10:05–10:10	Independent components of wing kinematics in the fruit fly Drosophila *Soma Chakraborty, Jan Bartussek, Steven N. Fry and Martin Zapotocky*	p. 19

10:10–10:15	FM responses of midbrain auditory neurons modeled with artificial neural network based on multiple trigger features *T.R. Chang, T.W. Chiu and Paul W.F. Poon*	p. 21
10:15–10:20	Coding of woody and fruity odorant mixtures: Interactions of odorants with olfactory receptors and receptor neurons match the perceptual dynamics *M. A. Chaput, F. El Mountassir, T. Thomas-Danguin, A. M. Le Bon, B. Ferry and P. Viret*	p. 23
10:20–10:40	A novel mechanism for sparse and reliable stimulus coding in sensory cortices *Martin Paul Nawrot and Farzad Farkhooi*	p. 83
Session II		
11:20–11:40	Inferring nonstationary input activities from non-Poisson firing of a neuron *Shigeru Shinomoto*	p. 119
11:40–11:45	Ideal observer in the stochastic interpolation model of the auditory brainstem *Pavel Sanda and Petr Marsalek*	p. 113
11:45–11:50	Some remarks on a spike train model of interacting neurons *Antonio Di Crescenzo, Maria Longobardi and Barbara Martinucci*	p. 29
11:50–11:55	Brain States revealed by Bispectral Analysis of Microsleep *Pierre Dutoit, Vladyslav V. Shaposhnyk, Alessandro E. P. Villa and Stephen Perrig*	p. 33
11:55–12:15	Noise correlations in cortical networks *Nestor Parga*	p. 95
12:15–12:20	A simple estimator for mutual information *Maria Teresa Giraudo, Laura Sacerdote and Roberta Sirovich*	p. 37
12:20–12:25	A computational modelling approach to the problem of odour mixture segmentation *Pawel Andrzej Herman, Simon Benjaminsson and Anders Lansner*	p. 47
12:25–12:30	Nonparametric estimation of interspike interval distribution and its characteristics *Ondrej Pokora and Lubomir Kostal*	p. 99
12:30–12:50	Synchronization of stochastic neuronal networks *Lutz Schimansky-Geier*	p. 115
Session III		
14:30–14:50	Determinism, Randomness and the Question of the “Free Will” – Examined from a Neural Coding Perspective *Hans A. Braun*	p. 7
14:50–14:55	Can discrete Response-Stimulus Correlation distinguish Integration from Coincidence Detection? *Jacob Kanev, Achilleas Koutsou and Chris Christodoulou*	p. 55

14:55–15:00	Estimating Nonstationary Inputs from Firing Rate and Non-Poisson Irregularity in a Single Spike Train *Hideaki Kim and Shigeru Shinomoto*	p. 57
15:00–15:05	A Bayesian approach for estimating time-varying input signals from membrane potential of a neuron *Ryota Kobayashi, Shigeru Shinomoto and Petr Lansky*	p. 61
15:05–15:10	Fano Factor Estimation *Kamil Rajdl and Petr Lansky*	p. 101
15:10–15:30	Stochastic pooling networks embedded in cortical networks of excitatory and inhibitory neurons *Mark D. McDonnell, Pierre-Olivier Amblard and Minh-Son To*	p. 79
15:30–15:35	Synthetic and elemental coding of the pineapple "accord" and its components *Patricia Viret, Petryszyn Sarah, Michel Chaput and Barbara Ferry*	p. 149
15:35–15:40	Event-related potentials associated to decision-making in emotionally-primed Ultimatum Game *Alessandro E. P. Villa, Alessandra Lintas, Sarah Mesrobian and Marina Fiori*	p. 147
15:40–15:45	Computational investigation of Glutamate-AMPA interaction in synaptic transmission *Francesco Ventriglia and Vito Di Maio*	p. 143

Poster Session I (15:45 – 19:00)

Tuesday, September 4

Session IV

9:10– 9:30	Image coding at the electrosensory lobe of pulse gymnotiforms *Ángel Ariel Caputi, Ana Carolina Pereira and Alejo Rodríguez-Cattaneo*	p. 15
9:30– 9:35	Estimating latency in the case of inhibitory response *Marie Levakova and Petr Lansky*	p. 71
9:35– 9:40	An electrophysiological study of cortico-thalamic networks in PV depleted mice *Alessandra Lintas, Beat Schwaller and Alessandro E. P. Villa*	p. 75
9:40– 9:45	Optically Mapping Electrical Activity in the Ganglion of the Leech Hyrudo Medicinalis *Majid Moshtagh Khorasani, Evan W. Miller and Vincent Torre*	p. 81
9:45–10:05	Calcium Activated Potassium Currents Contribute to High Fat Diet Induced Inhibition of POMC Neurons of the Mouse Hypothalamus *Andreas Pippow, Moritz Paehler, Simon Hess, Lars Paeger, Merly C. Vogt, Tim Klöckener, Christophe Pouzat, Jens C. Brüning and Peter Kloppenburg*	p. 97

10:05–10:10	The interplay between network topology and structural synaptic plasticity in a model of cortical sequence learning *Daniel E. Padilla and Mark D. McDonnell*	p. 91
10:10–10:15	Effectiveness of information transmission in the brain-like communication models *Bartosz Paprocki and Janusz Szczepanski*	p. 93
10:15–10:20	Inverse Problem for Leaky Integrate-and-Fire Neuronal Models using Spike-Times Data: The sinusoidally-driven case *Alexandre Iolov and Andre Longtin*	p. 53
10:20–10:40	Patterns of single-trial auditory evoked potentials on the human temporal cortex extracted with the adaptive filter *T.W. Chiu, W. Qiu, Paul W.F. Poon, Kirill Nourski, Hiroyuki Oya, John F. Brugge and Matthew A. Howard III*	p. 25
Session V		
11:20–11:40	Firing mechanisms in the stochastic Morris-Lecar neuron model and its embedded leaky integrate-and-fire model *Susanne Ditlevsen*	p. 31
11:40–11:45	A Simple Algorithm for Simulating Firing Times predicted by a LIF Model *Aniello Buonocore, Luigia Caputo and Enrica Pirozzi*	p. 11
11:45–11:50	Novelty detection and jamming avoidance share common computational mechanisms in pulse gymnotiforms *Alejo Rodríguez-Cattaneo, Pedro Aguilera, Ana Carolina Pereira and Ángel Ariel Caputi*	p. 103
11:50–11:55	A model of Trial-to-Trial Variability in Monkey Motor Cortex *Thomas Rost, Alexa Riehle and Martin P. Nawrot*	p. 107
11:55–12:15	(Leaky) Integrate and Fire models can be coincidence detectors *Roberta Sirovich, Luisa Testa, Petr Lansky and Laura Sacerdote*	p. 125
12:15–12:20	Dependency problems in neuronal network modeling *Laura Sacerdote, Massimiliano Tamborrino and Cristina Zucca*	p. 109
12:20–12:25	Diffusion approximation of neuronal models revisited *Jakub Cupera*	p. 27
12:25–12:30	Slope-based suprathreshold stochastic resonance in populations of phasic neurons due to intrinsic ion channel noise *Brett Schmerl, Daniel E. Padilla and Mark D. McDonnell*	p. 121
12:30–12:50	Estimation of the information pathway for a motor command generation in an insect brain based on the physiological data *Ikuko Nishikawa, Yoshihiko Yamagishi, Hidetoshi Ikeno, Tomoki Kazawa, Shigehiro Namiki and Ryohei Kanzaki*	p. 85
Session VI		
14:30–14:50	Fast learning in single synapses and behavioral learning times *Guido Bugmann*	p. 9

14:50–14:55	Modeling the Relations between Neuronal Membrane Potentials, Ion Currents and Ion Channel Dynamics *Aubin Tchaptchet, Svetlana Postnova, Martin T. Huber and Hans A. Braun*	p. 131
14:55–15:00	Analysis of synaptic action in stochastic interpolation model of the auditory brainstem *Peter G. Toth and Petr Marsalek*	p. 135
15:00–15:05	Very Slow Synchronization and Variability of Interspike Intervals in a Globally Coupled Neuronal Oscillators *Ryotaro Tsuneki, Shinji Doi and Junko Inoue*	p. 137
15:05–15:10	Representational capacity of neural codes in the cortex *Lawrence York, Jan Pieczkowski and Mark van Rossum*	p. 151
15:10–15:30	Coding in the presence of adaptation *Wulfram Gerstner and Richard Naud*	p. 35

Poster Session II (15:30 – 18:00)

Wednesday, September 5

Session VII

9:10– 9:30	Genesis, dynamics and role of nested theta to gamma oscillations in an attractor network model of cortical memory *Pawel Andrzej Herman, Mikael Lundqvist and Anders Lansner*	p. 45
9:30– 9:50	Order patterns networks (ORPAN) – Concept and applications *Stefan Schinkel, Gorka Zamora-López, Olaf Dimigen, Werner Sommer and Jürgen Kurths*	p. 117
9:50–10:10	Neural Encoding of Saccadic Stimuli in the Retina *Tim Gollisch, Vidhyasankar Krishnamoorthy and Christian B. Mendl*	p. 39
10:10–10:30	Spike-triggered covariance revisited *Inés Samengo and Tim Gollisch*	p. 111
10:30–10:50	Modelling of Sensory Pathway of Swimming Initiation in Young Frog Tadpole Spinal Cord: a Developmental Approach *Roman Borisyuk, Kalam Abul AlAzad, Alan Roberts, Steve Soffe, Deborah Conte and Edgar Buhl*	p. 5

Session VIII

11:30–11:50	Efficient coding beyond the retina *Jonathan D. Victor, Yunguo Yu and Mary M. Conte*	p. 145
11:50–12:10	Channel Capacity of a Spiking Neuron *Shiro Ikeda and Jonathan H. Manton*	p. 51
12:10–12:30	Transmission efficiency in the brain-like neuronal networks. Information and energetic aspects *Janusz Szczepanski and Bartosz Paprocki*	p. 127

12:30–12:50	On reliable information transmission in simple neuronal systems *Lubomir Kostal and Ryota Kobayashi*	p. 63

Thursday, September 6

Session IX

9:10– 9:30	The Mechanism of Orientation Selectivity in Primary Visual Cortex without a Functional Map *David Hansel and Carl van Vreeswijk*	p. 43
9:30– 9:50	The effect of prestimulus oscillatory dynamics on the performance of a cortical attractor network model in a simulated stimulus detection task *Mikael Lundqvist, Pawel Andrzej Herman and Anders Lansner*	p. 77
9:50–10:10	Inter Neuron Nearest Spike Intervals based Method to Measure Synchrony under Low Firing Rates *Aldana M. Gonzalez-Montoro, Ricardo Cao, Christel Faes and Geert Molenberghs*	p. 41
10:10–10:30	Identification of noisy response latency in presence of a background signal *Massimiliano Tamborrino, Susanne Ditlevsen and Petr Lansky*	p. 129

Session X

11:10–11:30	Analysis of non-renewal spiking in neuron models with adaptation *Tilo Schwalger*	p. 123
11:30–11:50	Understanding disordered topography of auditory cortex through natural sound statistics *Hiroki Terashima and Masato Okada*	p. 133
11:50–12:10	Structural phase transition in the neural networks *Tatyana Turova*	p. 139
12:10–12:30	Coding of temporally incoherent odour mixtures in the antennal lobe of honeybees *Thomas Nowotny, C. Giovanni Galizia and Paul Szyszka*	p. 87
12:30–12:50	Non-markovian spiking statistics of a neuron with delayed feedback in the presence of refraction *Kseniia Kravchuk and Alexander Vidybida*	p. 69

Session XI

14:30–14:50	A model-based inference of synaptic connectivity from simulated multi-neuronal spike data *Katsunori Kitano and Ryota Kobayashi*	p. 59
14:50–15:10	Network Inference with Stochastic Hidden Units *Joanna Tyrcha and John Hertz*	p. 141
15:10–15:30	Information filtering by stochastic neurons *Benjamin Lindner*	p. 73

15:30–15:50	Dynamics of axon fasciculation and its consequences for ephaptic coupling *Martin Zapotocky and Debasish Chaudhuri*	p. 153

Session XII

16:20–16:40	Input synchrony estimation in the Ornstein-Uhlenbeck model through the slope of depolarisation at threshold crossing *Achilleas Koutsou, Petr Lansky, Jacob Kanev and Chris Christodoulou*	p. 65
16:40–17:00	Coding efficiency and detectability of rate fluctuations with non-Poisson neuronal firing *Shinsuke Koyama*	p. 67
17:00–17:20	Using the structure of inhibitory networks to unravel mechanisms of spatiotemporal patterning *Maxim Bazhenov*	p. 1
17:20–17:30	Closing remarks *Petr Lansky*	

Friday, September 7

Round Table Discussion (*Optional*)

9:30– 12:00	Venue: Institute of Physiology AS CR *Videnska 1083, Prague 4*

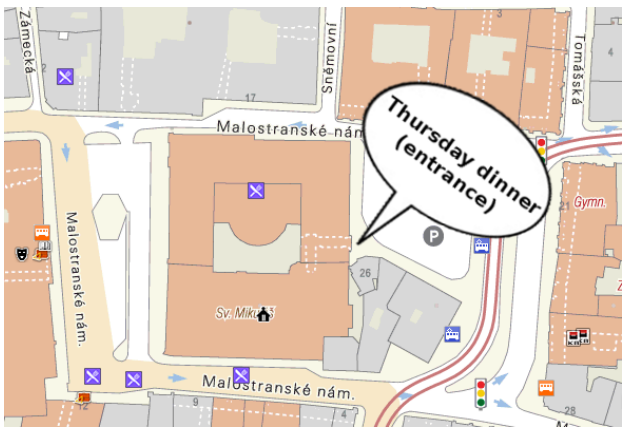
Social Programme

There are three **dinners** organized for participants and accompanying persons:

- **Monday, Sept. 3 at 7 pm:** Beer party in *Restaurant Klub Lavka* (just beside the conference venue).
- **Tuesday, Sept. 4 at 6:30 pm:** 4 hours Prague river cruise with dinner on the boat *Hamburg*. Embarking: *Rašínovo nábřeží* (see the map on the right) at **6:30 pm sharp!** To reach the embarking point:
  1. Two or three stops of tram number **17** in direction *Sidliste Modrany*, travelling time 3 minutes. The tram goes every five minutes, approximately.
  2. Walking up the river - distance cca 1.5 km.
- **Thursday, Sept. 6 at 7 pm**: Banquet dinner in *Restaurant Profesni dum, Malostranske namesti 25, Prague 1* (see the map on back cover, and the detailed map below). Walking distance by crossing the *Charles Bridge* is approximately 650 meters. Public transport – ask for details.

Participants and accompanying persons are obliged to wear their badges which are valid as tickets for all the above mentioned events. Without the badge, access is not guaranteed.

On **Wednesday, Sept. 5 at 2:30 pm** – the walking sightseeing to the *Prague Castle, Old and Lesser Town* is prepared. Several groups with guides will visit the most interesting historical places of Prague including the Prague Castle. Departure from the conference venue.



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Local Organising Agency:

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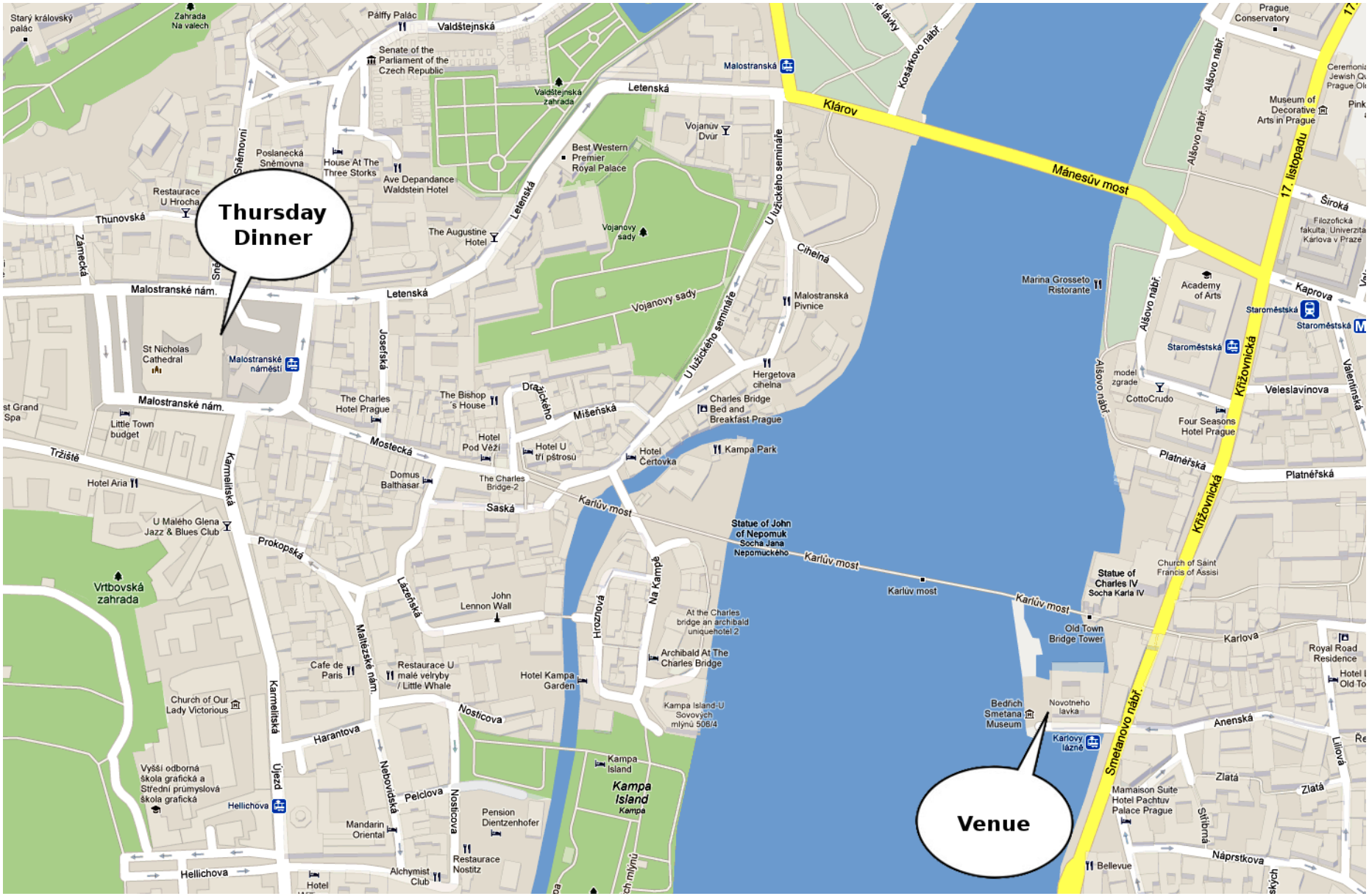
Thursday Dinner
Venue
Starý královský palác
Zahrada Na valech
Pálffy Palác
Valdštejnská
Senate of the Parliament of the Czech Republic
Valdštejnská zahrada
Letenská
Malostranská
Klárov
Mánesův most
Kosárkovo nábř.
Prague Conservatory
Museum of Decorative Arts in Prague
Alšovo nábř.
17. listopadu
Široká
Filozofická fakulta, Univerzita Karlova v Praze
Kaprova
Staroměstská
Křižovnická
Veleslavínova
Valentinská
Platnéřská
Smetanovo nábř.
Karlova
Anenská
Zlatá
Náprstkova
Bellevue
Mamaison Suite Hotel Pachtuv Palace Prague
Bedřich Smetana Museum
Novotného lávka
Karlovy lázně
Old Town Bridge Tower
Statue of Charles IV Socha Karla IV
Church of Saint Francis of Assisi
Royal Road Residence
Statue of John of Nepomuk Socha Jana Nepomuckého
Karlův most
Kampa Island
Kampa Island-U Sovových mlýnů 506/4
Archibald At The Charles Bridge
At the Charles bridge an archibald uniquehotel 2
Hotel Kampa Garden
Kampa Park
Hergetova cihelna
Charles Bridge Bed and Breakfast Prague
Malostranská Pivnice
Cihelná
U lužického semináře
Vojanův Dvůr
Vojanovy sady
Best Western Premier Royal Palace
Ave Depandance Waldstein Hotel
House At The Three Storks
Poslanecká Sněmovna
Sněmovní
Restaurace U Hrocha
Thunovská
Zámecká
Malostranské nám.
St Nicholas Cathedral
Malostranské náměstí
Josefská
The Augustine Hotel
The Charles Hotel Prague
The Bishop's House
Mišeňská
Hotel Pod Věží
Hotel U tří pštrosů
Hotel Čertovka
Mostecká
Domus Balthasar
The Charles Bridge-2
Saská
Karlův most
Tržiště
Hotel Aria
Karmelitská
U Malého Glena Jazz & Blues Club
Prokopská
Vrtbovská zahrada
Lázeňská
John Lennon Wall
Hroznová
Na Kampě
Maltézské nám.
Cafe de Paris
Restaurace U malé velryby / Little Whale
Church of Our Lady Victorious
Nosticova
Harantova
Vyšší odborná škola grafická a Střední průmyslová škola grafická
Újezd
Hellichova
Nebovidská
Pelclova
Mandarin Oriental
Pension Dientzenhofer
Restaurace Nostitz
Alchymist Club
Hotel
Marina Grosseto Ristorante
Academy of Arts
model zgrade
CottoCrudo
Four Seasons Hotel Prague
Statue of Charles IV Socha Karla IV
Kampa Island-U Sovových mlýnů 506/4
Kampa Island
Kampa