

Welcome to the 2021 edition of the DFT summer school

dynamicfieldtheory.org

Virtual summer school

- like last year, we do the school in virtual/online form...
- ... the decision turned out to be wise...

Lectures will be video taped

- videos will be edited: final discussion not included, only speaker video visible..
- but if you ask a question during the talk, you will be heard..
- => if you do not want to be in the published video, ask your questions at the end of each talk

Who am I

- Gregor Schöner
- 80s Physicist by training, dissertation on bifurcations in stochastic dynamical systems.... [Hermann Haken]
- 80s Postdoc in dynamical systems thinking in *movement science* [Scott Kelso]
- began a long standing collaboration on dynamic instabilities in *visual perception* [Howard Hock]

Who am I

- 90s first stint at INI: began work on oscillations and population code in *cortical neurophysiology*
- and developed attractor dynamics approach in *autonomous robotics*
- 90s CNRS Marseille: began long-standing collaboration with *developmental psychologists* Esther Thelen, John Spencer
- Director of the INI = Institut für Neuroinformatik (Institute for Neural

Who am I

- 2000s.. second stint at INI.. director and chair Theory of Cognitive Systems
- toward an integrated neural theory of movement generation
- toward neural dynamic process accounts of higher cognition

INI lecturers and tutors

■ Sophie Aerdker

■ Lukas Bildheim

■ Raul Grieben

■ Cora Hummert

■ Daniel Sabinasz

■ Rachid Ramadan

■ Jan Tekülve

■ Lei Zhang

Guest lecturers

- Yulia Sandamirskaya, Intel Corporation and INI Zürich (ETH/Univ. Zürich)
- John Spencer, Dept. Psychology, University of East Anglia, UK

Audience

- we have over one hundred registered participants (130 last time I checked) ...
- => advantage of the virtual over the physical format in which we could only accomodate about 20 participants..
- very diverse backgrounds and locations ...

The virtual format: lectures

- daily lectures and live interactions via this Zoom channel
- from 3 pm to 6 pm Central European (Summer) Time...
- which is 9 -12 am on the American East coast... as you go further west...
- and late evening for listeners in the East, e.g. India and further...

The virtual format: exercises

- first 3 days: “home work” exercises ...
- we’ll present those at the end of today’s session
- “feedback” sessions on Tuesday/Wednesday
- support through web-based discussion forum

Workshop portion

- lectures and exercises are open to anyone
- a selected group can do the “hands-on” model building workshop
- with one-on-one tutoring...
- selection needed due to our limitations in man-power...
- but you can do the projects on your own... based on the website ...

dynamicfieldtheory.org

- you already used it to get here
- let me tell you a bit more about it..
- learning resources
- schedule
- documents
- discussion fora

youtube.com

- search for “dynamic field theory”
- https://www.youtube.com/channel/UCNIMiiU_I02kC2kMNdqBRGQ

Lectures will be video taped

- and posted under “documents”... so that participants in other time zones can watch the lectures asynchronously
- and will also be on that youtube channel

Live sessions: discussion

- we would love to have a lot of discussion/
questions...

Workshop participants:

- welcome session on Thursday at 10 am
- which has more technical content...

Survey over the summer school

- ... no general introduction.... comparison to other theories and history of thought as we learn more about DFT, not up-front

Core lectures

■ I) DFT foundations...

- start with neurophysics
- neural dynamics
- excitatory recurrence: detection instability
- inhibitory recurrence: selection instability
- neural dynamics of fields, instabilities
- examples how field models are linked to data
- embodiment: linking to sensors and motors

Core lectures

■ 2) DFT higher cognition

- multi-dimensional fields

- binding

- coordinate transforms

- binding through space

- localist vs distributed

- learning in DFT

- perceptual grounding

- mental mapping

Core lectures

■ 3) DFT autonomy

- sequences of states/actions
- neural dynamics of the condition of satisfaction
- illustration in an autonomous robot
- 3 principles of how to select the next state/action
- intentional agents
- relation DFT - embodiment
- relation DFT - information processing
- relation DFT - VSA and distributed representations

Special lectures

■ I) Scene representation and visual search [Raul Grieben]

■ expands “binding” lecture and shows how objects are attentional selected..

■ key to any embodied cognitive action directed at objects

■ links to the psychophysical literature on visual search

Special lectures

■ 2) Models of grounded cognition [Daniel Sabinasz]

- expands perceptual grounding
- generating descriptions from perceived scenes
- inference
- towards conceptual structure (language)

Special lectures

- 3) Neural process models of intentional states [Jan Tekülve]
 - expands intentional agents
 - two directions of fit
 - 6 psychological modes of perception-memory-beliefs and action-prior-intention-desires
 - autonomous learning

Case study

- I) Using mouse tracking to study visual search [Cora Hummert]
- an experimental paradigm to find signatures of postulated DFT representations underlying object-directed movement

Case study

■ 2) Action grammars in DFT [Sophie Aerdker]

- expands sequences of actions...

- toward a grammar of those..

- preliminary theoretical work...

Guest lectures

■ I) The WOLVES model [John Spencer]

- WOLVES= Word-Object Learning via Visual Exploration in Space
- a highly integrated model that accounts for many different sets of data
- developmental perspective

Guest lectures

- 2) Neuromorphic computing and neural dynamics [Yulia Sandamirskaya]
 - an introduction into neuromorphic computing
 - using neural dynamics to enable low-level embodied cognition on neuromorphic chips
 - perspective of a new computational paradigm helps position DFT

... let's get started