Schrödinger’s Notebook
Thought Experiments, Quantum Epistemology and Fictive Worlds

Fictions in Science-Fictive Modeling

Einstein’s Dreams
Turing
Pauling
Background on Schrödinger

- Archival, narratorial, organizational, and analytical work conducted by the Quantum Physics History research team at the Max Planck Institute for the History of Science (http://quantum-history.mpiwg-berlin.mpg.de/elibrary/hqc1_talks). There are attempts to understand the contents of the research notebooks in order to better understand Schrödinger’s philosophical interests (See Walter Moore’s intellectual and personal biography of Schrödinger).

- Continuous work on Schrödinger’s wave mechanics provide the theoretical framework for understanding existing (quantum conceptualizing of bosons) and yet-to-exist models in particle physics. Also relevant in the development of accelerator physics. See Timeline history http://teachers.web.cern.ch/teachers/archiv/HST2003/publish/standard%20model/History/layer1.htm

Combining Macro-Micro Worlds

Our ‘reality’ (in the mundane sense) is based on the classical realization of macro-phenomena, a macro-locality that can be deterministically measured and evaluated. What if we decide to model a world where the micro and macro can co-exist? Where the cat paradox is played out within the realm of our sense perception; where the superposition of two different ontological states is plausible, where causality need no longer constrain the probability of any event happening, where the perceived real is not the defining factor behind that aspiration to realism.
Conceptualizing Realism

Major question of realism: does instantiation matter in the notion of realism and can ontology demonstrate this?

Realism in Quantum Mechanics

If we go to Einstein-Podolsky-Rosen’s paper entitled “Can Quantum-Mechanical Description of Physical Reality be Considered Complete,” we find that there is no incisive attempt to define what physical reality is other than to place it within the realm of physical states, quantity and degrees of freedom. This is of course related to the development of the Schrödinger’s wavefunction for representing micro-physical states, given by the scalar field symbol $\psi$ (psi). This was in reaction to the Copenhagen (classical QM) interpretation of physical realism that superposed classical orthodox models of physical reality (such as one finds in Newtonian physical models) onto the microscopic system.

Schrödinger himself believes that the model of realism employed by the early quantum physicists was that of naïve realism where observation can only be conducted through measurement (Schrödinger wants a broader access to the physical microstates). Instead of the language of realism, he seems to be proposing what translates roughly as ‘expectation-catalog’.
Factive Theoretical Elements

- Wave mechanics: time-dependent and time independent equations for a single electron.
- Probability predictions: using familiar scenarios from the mundane world to approximate similar physical conditions at the microscopic world.
- Replicating the problem of measurement and the outcome of the measurements.
- Playing ‘normative’ behavior of particle ensembles and also the problems of describing or explaining them.
- Setting out different interpretive variables.

Important points from “Die Gegenwärtige Situation in der Quantenmechanik”

Understanding the role of the psi-function in the measurement problem and in the development of the wave-function equations even as the very nature of its properties remain elusive.

One may measure first position from the initial arrangement of two interacting systems (object measured and measuring device), when a second position (the pointer position) can be reproduced within pre-determined error range, variable to the feature is defined by intervention to the original system, thus making it impossible to determine exactly what the next measured properties are like.

The model of the state represents the knowledge of the state but as there is no complete knowledge possible, there is no ‘complete’ model.
+ Thought Experiments and Fictive Elements

- No sharp delineation of what thought experiment means
  
  a) Simulation of an event or sets of events based on pre-determined theories or hypotheses without presumption of empirical outcomes. The experiment may be conducted within a ‘fictive’ rather than empirical-experimental world.
  
  c) Construction of a fictive universe with factual parameters by which one can test out different what-if paths.
  
  d) Mental models, mind labs and cognitive mapping.

+ Fiction in Science Modeling (Fine, “Fictionalism” from Hans Vaihinger)

- Fictions of 10 primary kinds:
  1. Abstractive (fiction that ignores reality)
  2. Of the mean
  3. Schematic: paradigmatic, rhetorical, utopian, type
  4. Analogical (connects to 6)
  5. Legal (Juristic)
  6. Personificatory: nominal
  7. Summational
  8. Heuristic (fiction as a contradiction with reality)
  9. Practical (ethical)
  10. Mathematical
Why Thought Experiments?

Predictions of Possible Worlds and Futures
• Realist world versus non-realist world.
• Epistemic world versus ontological world.
• A world containing the possibility of these different concepts.

Theoretical presentation for actual applications
• Utilization of different material platforms: virtual worlds, ontological databases, interactive narratives, game worlds.
• Even as applications are developed to map these experiments, the data produced act as tangible evidence that can then be used as simulation inputs.

Philosophical model-testing and creative-thinking
• Constructing geo-social environments for technical model-testing.
• Enabling ground for interacting between seemingly incompatible concepts, epistemic frameworks and scripts.
• Enabling different logics to co-locate.

Re-narrativizing the Cat Paradox

A woman wearing a flowing electric-blue jacket-dress walks into that dark room containing a conspicuously large screen.

Consoles looking like they have been built out of an organic substance surround the screen.

A computer lies in wait in the middle of the room, on standby to wake-up once a stroke is dealt. Projector screen ignited. Avatar enters.

A drill appears in one of the chambers and punctures the sealed jar before disappearing just as quickly.

Two chambers flipped and rotated in all directions before a curtain ‘virtually’ drops over the latter. What goes on behind?

Cat-wonderland, a Geiger counter peeks out at the far corner in a sealed jar.

A duplicate image of the cat-in-the-chamber is projected.

Two Geiger counters stand out prominently above the covered chambers. Data registered.

Four diagrams representing different, calculating the probability of the types of spins produced along the x-y-z paths...
A Thought Experiment In Motion: Scripting the Cat Paradox

Super-positioning the cat paradox on a universe where a virtual platform can exist so that the material real of our world can be jacked into different which-paths where one can superpose one’s avatar-observer.

In this situation, the which-path is rendered more determinate – one is in an equivalent situation of being able to peer into the box. If one is able to conceive such a determinate system, how would that change the way one theorizes?

In such a system, the unobservable can now be rendered observable. How far can one go with rendering that what-ifs? How does the simulation of micro-level ‘determinacy’ change the way we frame theories?

Do we need to determine, a priori, axioms, that will be guiding constraints or principles to the system or should we just insert fictive and factual parameters and see what plays out?

Creative Science, Thought Experiments and Virtual Manipulation

Creative Prototyping of scientific ideas

Using Bayesian networks to create multi-path scenarios on Whiggish history of science versus other scientific historiographies can bring about different outcomes. Using known evidence from history to map out causal links.

Modeling of an epistemic platform where one can play out the concept of interference and entanglement between an epistemic subject and object (can we transfigure the actions of wave function from the micro- to macrosystems – what would that mean and what computing tools can we use to do so?)

Visualization of thought experiments with transparent and black-boxed processes and causalities. This can be done in conjunction with the visualization of data from empirical experiments.
Stage of Work – Preliminary Dissertation Research

Currently investigating into the archives of the history of QM beginning with Bohr to the incipient of the LHC.

Content Building
- Tracing the epistemic and also ontological flows of the knowledge building through these archives
- Building a network to map out analyses

Content Analysis
- Revisiting of existing philosophical and critical theories and including them where relevant
- Construction of new theories

Theoretical positioning
- Revisiting of existing philosophical and critical theories and including them where relevant
- Construction of new theories

Practical Direction

Translating the script symptom across multi-modal platforms (creation of an interactive web comic, a game, and an actual virtual lab for the performance of thought experiments).

Deciding on whether there is a need for a coherent modeling system, and what that would mean.

The script produced from the science-fiction prototype be algorithmically coded and then programmed (choice of engine and programming platform to be determined). An intelligent and interactive system is to be built towards that end.
Conclusion

Future Directions:
Interdisciplinary Input.

Questions?
Comments?
Possible Collaborations in Intersecting Spaces?

Possible Directions:
Interdisciplinary Impact.

8/4/11