**Schedule online seminar**

January 8: first meeting. Then either: eight Skype meetings (every second week) with last meeting on 16 April (Option A) or six Skype meetings (every second week) with last meeting on 19 March (Option B).

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| Option A | Option B |
| **Format:** The online seminar spans over 16 weeks, with eight Skype meetings overall. The number of participants is 16, divided into pairs. Every pair of students is assigned one paper. For every paper one student in the pair gives a presentation on the paper while the other student writes a blog post on the paper. All students read all papers and discuss.  Ideally half of the participants have a solid background in an application field and half of the participants have a solid background in category theory.  The week following the end of the online seminar the students meet at the research school.  See <http://brendanfong.com/actschool.html>  for a draft call for applications (PLEASE DO NOT CIRCULATE). | **Format:** The online seminar spans over 12 weeks, with six Skype meetings overall. The number of participants is 12, divided into pairs. Every pair of students is assigned one paper. For every paper one student in the pair gives a presentation on the paper while the other student writes a blog post on the paper. All students read all papers and discuss.  Every pair of students is composed of one student with a solid background in category theory and one student with a solid background in the application field.  In the four weeks between the end of the online seminar and the beginning of the school, the students read individually the two papers for the research project that they will work on at the school. We leave it to the mentors and students to make contact during this period, via email or Skype, as they see fit. |
| * Jan 8: B. Coecke, M. Sadrzadeh, and S. Clark, [*Mathematical foundations for a compositional distributional model of meaning*](https://arxiv.org/abs/1003.4394), 2010. * Jan 22: A. Kissinger and S. Uijlen. [*A categorical semantics for causal structure*](https://arxiv.org/abs/1701.04732). In proceedings of LiCS 2017. * Feb 5: B. Fong, *Decorated cospans*. Theory and Applications of Categories 30 (2015), 1096-1120. * Feb 19: A. Carboni and R.F.C. Walters. *Cartesian bicategories I*. Journal of pure and applied algebra 49.1-2 (1987): 11-32. * Mar 5: J. Bolt, B. Coecke, F. Genovese, M. Lewis, D. Marsden, and R. Piedeleu. [*Interacting Conceptual Spaces I: Grammatical Composition of Concepts*](https://arxiv.org/abs/1703.08314). 2017. * Mar 19: J. Baez and B. Pollard, *A compositional framework for reaction networks*. Reviews in Mathematical Physics 29 (2017), 1750028. * Apr 2: J.C. Willems. *The behavioral approach to open and interconnected systems*. IEEE Control Systems 27.6 (2007): 46-99. * Apr 16: J. Henson, R. Lal, and M. Pusey, *Theory-independent limits on correlations from generalised Bayesian networks*, New Journal of Physics. 2014. | * Jan 8: David Spivak, Robert Kent. [Ologs: A Categorical Framework for Knowledge Representation](http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0024274), PLoS ONE 7(1): e24274 (2012). * Jan 22: Gunnar Carlsson and Facundo Memoli, [Classifying clustering schemes](http://link.springer.com/article/10.1007/s10208-012-9141-9), Foundations of Computational Mathematics (2013), 13:2, 221–252. * Feb 5: Peter McCullagh, [What is a statistical model?](https://projecteuclid.org/download/pdf_1/euclid.aos/1035844977), Annals of Statistics, 30:5 (2002), 1225--1310. * Feb 19: William Lawvere, The category of probabilistic mappings, 1962. (Nina has a paper copy of this article.) * Mar 5: Samson Abramsky and Bob Coecke, [Categorical quantum mechanics](https://arxiv.org/abs/0808.1023), in *Handbook of Quantum Logic and Quantum Structures*, Elsevier, 2008, 261--323. (We would only read the first part of the article.) * Mar 19: Joachim Lambek, Deductive systems and categories III. Cartesian closed categories, intuitionist propositional calculus, and combinatory logic, in *Toposes, Algebraic Geometry and Logic: Dalhousie University, Halifax*, 57--82 (1972), Springer. |

**Comments on Option A:**

* The goal of the online seminar and school is to bring early career researchers into the applied category theory community. Option A is designed to:
  + fully integrate the online seminar with the tutorial week and main workshop,
  + bring these early career researchers into the community as quickly and deeply as possible, and
  + equip them to perform independent research in the field, to maximise chance they stay within the community.
* To fit with these goals, the program:
  + Is based on active topics of discussion by senior members of the ACT community.
  + Guarantees participants see key ideas multiple times (reading, seminar, and online discussion on two papers, then lecture at school) spread over multiple months, to give them time to absorb them.
  + Ensures that each participant thoroughly engages with their research topic, and gives them ample opportunity to get feedback on their ideas and understanding, prior to the research week. (Since they bear the responsibility of both leading the 16 student group through a relevant paper, and publishing a blog post on the topic.)
  + Ensures they are familiar with the work of all mentors at the school, so that they can have meaningful mathematical conversations and learn how the mentors think, educating them both with breadth and depth.
  + Gives them the best chance of starting the workshop already with contributions that they can own and engage others with.
* As between ¼ and ⅓ of the participants at the main workshop (~16/55) will be drawn from the research school, it is important to the success of the workshop itself that these participants are conversant enough with the themes of the workshop to meaningfully participate in the discussion sessions. Moreover, the students themselves will derive the most benefit if they can fully take advantage of the opportunity to ask questions of and collaborate with the senior researchers. Option A is designed to ensure this is true.

**Questions about Option B include:**

1. With 12 participants, will there be a separate selection process for the research week? If so, how will we select these students? Or will we reduce working groups down to three students per mentor? (And the school down to 18 attendees of the 25 person capacity?)
2. The proposal suggests that each paper will be presented by an early career researcher specialising in the application field. These participants then transition to the research week. To which group, for example, will the statistician be assigned? Specialising in neither category theory or, say, linguistics, will they be equipped to contribute? Will participating in such a school benefit the student?
3. How will the reading list prepare the students to participate in the tutorial week or the workshop, again, especially the ones not specialising in category theory? How do we envision the student of probability theory interacting in the main workshop?
4. As a facilitator, I (Brendan), have very little expertise in the majority of these papers. How we will ensure we as a group can provide sufficient guidance on this reading syllabus to ensure it is the best use of the students’ time?
5. How does Option B ensure the students are suitably equipped to make progress during the short research week?

**Comments on Option B:**

* The goal of the online seminar and school (as stated in the proposal for the Lorentz Centre) is to bring young researchers from category theory and several application fields in the community. Option B is designed to:
  + Build the students’ knowledge of category theory in a progressive way through a series of landmark papers in applied category theory. At the end of the online seminar the students will be well equipped to read the papers assigned by the mentors for the individual projects.
  + Foster interaction and the creation of a common language between young researchers in category theory and in application fields, since every paper will be assigned to a pair of students, one with a background in the application field and one with a background in category theory.
* With Option B the format of the research school would follow a format similar to the one that has successfully been used in several mathematical communities to bring more women in the field (see, e.g. <https://www.birs.ca/events/2016/5-day-workshops/16w5142>). In this format senior participants suggest a research project and before the workshop itself junior participants are assigned certain readings. At the beginning of the workshop senior participants give talks on the projects, and during the rest of the workshop the participants work together in small groups on the specific research projects.
* Some reasons behind the choice of the papers:
* (Spivak, Kent 2012): illustrates how category theory can be used as a language to represent knowledge.
* (Carlsson, Memoli 2013): illustrates the importance of functoriality for data analysis, and how expressing problems with an eye towards functoriality can help in developing robust methods.
* (McCullagh 2002): landmark paper in theoretical statistics; it uses natural transformations to give a rigorous definition of statistical models.
* (Lawvere 1962): landmark paper in the application of category theory to probability theory.
* (Abramsky, Coecke 2008): landmark paper in categorical quantum mechanics.
* (Lambek 1972): landmark paper in the application of category theory to the theory of computation; extends the Curry--Howard correspondence to categorical logic.

**Some questions about Option A:**

* How does Option A ensure that we bring practitioners from application fields into the community? Will the current schedule require to reduce the number of students with a background in an application field to less than half? Will a participant with no solid background in category theory be well equipped to understand e.g. the paper “Decorated cospans” as early as in the third meeting of the online seminar?
* If we were to follow Option A we would effectively be running a research school that spans over four months. This is not in line with the original intent of the proposal communicated to and accepted by the Lorentz Center.

**Answers to the questions raised about Option B** (the numbering corresponds to the one in the questions raised above):

1. In Option B we reduce the number of student to 12, since the reading list of papers is reduced to six. As we understand, the 25 places for the research school is an upper bound, therefore we do not necessarily need to have additional participants, but if others feel that it is important to have four more participants during the research school, we would be happy to discuss this today during the meeting. One advantage on having fewer participants during the online seminar is that this could make discussions on skype slightly easier.
2. First, at the end of the three months of the online seminar the students should all be well equipped, from the point of view of their knowledge of category theory, to read the two papers assigned by the mentors. The chronological order in the reading list was chosen to build up the students’ knowledge of category theory in a progressive way. Second, the students will need to indicate during the application to the online seminar their preference for the research project, and therefore will be able to choose according to their background and interest. As for the specific question concerning the student with a background in (theoretical) statistics, such a student might for example be interested in working on Aleks’s research project. We do not think that it is realistic to expect that the students will participate in active discussions on projects different from their own during the research school (this might not be a realistic thing to expect from experts either), therefore we do not think that such a student could not benefit from the school just because she/he is neither a specialist in category theory or linguistics.
3. This question is partially related to the previous one, please see answer above. As for the specific question of how the student with a background in probability theory will benefit from the main workshop, it seems to me (Nina) that the work of several participants (e.g. John or Aleks) of the workshop has non-empty intersection with probability theory, so I don’t see how this would be a problem.
4. First, the idea is for the students to try to understand the papers on their own. We believe that since every pair is composed of one student with a background in the application field and one student with a background in category theory, the collaboration and development of a common language between the students within the pairs will be essential to the success of the school. Second, this objection could also be raised for Option A, as Brendan and Nina’s knowledge combined does not span all the topics covered by the eight papers suggested by the mentors.
5. The students will have one month to read the two papers given by the mentor. This is exactly the same amount of time that they are given in Option A. Furthermore, since the students will read the papers at the end of the three months of the online seminar, we think that at that stage they will be better equipped to read and understand the papers. In addition, they will all have read the papers related to the project in the month leading to the school, whereas in Option A some students will have read the papers related to their project some months earlier, and since in Option A the online seminar ends in the week preceding the school, there might not be enough time for them to prepare themselves appropriately.

**Addendum: Schedule research school** (most recent Sept. 24)

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| Tutorial Week | Monday, 4/23 | Tuesday, 4/24 | Wednesday, 4/25 | Thursday, 4/26 |
| 9:00 AM | Introductions (Lorentz/Organisers) | Juergen Jost (guest talk) | Morning report | Morning report |
| 9:30 AM |
| 10:00 AM | John Baez | Work in groups | Work in groups |
| 10:30 AM | break |
| 11:00 AM | break | Work in groups | break | break |
| 11:30 AM | Martha Lewis | Work in groups | Work in groups |
| 12:00 PM |
| 12:30 PM | Lunch | Lunch | Lunch | Lunch |
| 1:00 PM |
| 1:30 PM |
| 2:00 PM | Aleks Kissinger | Work in groups | Work in groups | Closing reports 1,2 |
| 2:30 PM |
| 3:00 PM | break | break | break | break |
| 3:30 PM | Pawel Sobocinski | Work in groups | Work in groups | Closing reports 3,4 |
| 4:00 PM |
| 4:30 PM | Group meetings | Afternoon report | Afternoon report | Next steps |
| Evening | Wine & Cheese |  | Dinner |  |