

Notes from Meeting, Delph
 17 April 2017
 In Attendance: Mark, Scott, Ruben

Here is an assessment of our meeting, focusing particularly on procedural aspects of Delph deliverables. A fuller discussion of the meeting, with agenda, follows after the table. After today's discussion I would be happy to continue working with them on the project and I believe that they will add value.

Assessment

Assessment	Agenda Item	Justification
7	3. Procedural discussion about how to best use the data.	Delph can deliver what's required here with the help of a diverse team.
8	4. Procedural discussion about essential features of the data which need to be captured in the model.	Delph can deliver creative ideas and next steps.
9	6. Procedural discussion about model design.	Delph can deliver a model which is suited for purpose, and will help creating a data-oriented practice of using mmmm models and their like. I feel like we are now all on the same page about a modelling strategy.
7	9. Procedural discussion about previous modelling.	Delph provided confidence here about previous experiences.
7	10. Procedural discussion about computational complexity.	Delph has a workable strategy for dealing with these challenges.
7	11. Procedural discussion about readying the model output for use.	The discussion was entirely sufficient, but was narrowly cast concerning Delph responsibilities.
7	12. Procedural discussion about previous validation efforts.	The discussion seemed correct, but they seem to have limited experience in large multi-stakeholder engagements.
8	13. Procedural discussion of applying the model to stakeholder need and rhythm analysis.	Delph gave a creating and compelling story about new ways of using the model.
9	14. Procedural discussion of deliverables.	I'm very happy with the stated deliverables.
7	15. Procedural discussion of commitment.	I feel like this is going to need continuous monitoring.

We spent a good four hours (and a separate hour for lunch) discussing these agenda items. The original planned agenda is as follows. The meeting ran more or less according to plan.

Agenda

Time	Party	Points for Discussion
9:45 – 10:00	TUD	1. Data. Scott to walk-through the public CBS gridded data, and to provide a data dictionary for the privacy preserving CBS data.
10:00 – 10:15	TUD	2. Data Cleaning, Transformation and Missing. Scott to discuss issues of data type and missing data.
10:15 – 10:30	All	3. Model Specification. Group discussion concerning the spatial, latent and time series character of the data.
10:30 – 10:45		Break
10:45 – 11:00	All	4. Model Requirements. Group discussion concerning what sort of model might best capture city rhythms.
11:00 – 11:15	TUD	5. Model Formulation. Scott to present research details about the mixtures of Hidden Markov Models approach.
11:30 – 11:45	All	6. Model Formulation. Group discussion and brainstorm about model formulation.
11:45 – 12:00	TUD	7. Implementation. Scott to provide an R demo of the seqHMM package.
12:00 – 13:00		Lunch
13:00 – 13:15	TUD	8. Implementation with Latent Classes. Further discussion of using the package for spatial clustering
13:15 – 13:30	Delph	9. Estimation. Delph to discuss previous experience in estimating complex models on mid-sized data sets.
13:30 – 13:45	Delph	10. Computational Resources. Delph to discuss whether there are sufficient in-house computational resources.
13:45 – 14:00	All	11. Model Outputs. Group discussion about sample outputs and imbuing these results with the concepts of rhythm.
14:00 – 14:15		Break
14:15 – 14:30	Delph, Ahti	12. Model Interpretation. Delph and Ahti to discuss previous work on interpreting models for stakeholder need.
14:30 – 14:45	All	13. Model Interpretation. Group discussion about how to communicate and visualize the results for a variety of stakeholders.
14:45 – 15:00	TUD	14. Deliverables. Scott to make a finite list of deliverables and schedules.
15:00 – 15:15	All	15. Agreements. Group discussion about availability, interest, commitment to deliverables and schedule.

Mark and Ruben were there on time, and as agreed. They were open, patient, and willing to discuss the needs of the project. We had a productive and neutral discussion about the project, faults or limitations of delivery, what could be improved, and where the project was headed.

This is a short summary of the meeting. I have two points for summary – substantive and procedural. Substantive agreement is nice to have. The procedural points below, where Delph discusses their capabilities, and their way of working on the City Rhythm may be even more important.

1. [Substantive] We had a discussion of the CBS Microdata and extended data.
2. [Substantive] We had a detailed discussion of findings from the public gridded CBS data at the 100m square and 500m square level.
3. [Procedural] We had a deep discussion about what could be learned from this data, and whether the resultant model would be descriptive (summarizing the data), predictive (useful for pointing to new directions of change), or prescriptive (useful to guide decision-making). There was consensus that this is a research-oriented project that can, at a minimum, deliver useful descriptive results. With sufficient data and validation it may reach towards predictive or prescriptive modelling.
4. [Procedural] We had a productive discussion about what features of the data were most essential for capture. Mark and Ruben added additional productive requirements in the space of permitting additional data fusion, permitting expert or policy input, being more hierarchical in character, and being highly interpretable for decision-makers. Of the list of requirements, Scott emphasized spatial, dynamic and latent characteristics as being the most essential features of the data. There was little disagreement.
5. [Substantive] We discussed the econometric specification of the mixtures of hidden Markov models (mhmm). We discussed this using generative models, chains of probabilistic variables, and an analytic approach emphasizing the major classes of variables used in the model. We discussed how these models were best-in-class for prosody – the recommendation of rhythm and melody.
6. [Procedural] There was commitment to building an mhmm model, which is my preferred analytical solution to the problem. I am confident that this model can be built by the Delph team.
7. [Substantive] I gave a demo of an existing package in R which can certainly produce medium-sized mhmm models. Delph was in agreement to work with this package. We also discussed a Stan/R solution, which is a state-of-the-art environment for delivering these models. The stan models are still under research (2017). They may eventually deliver higher quality results.
8. [Substantive] We had a fairly lengthy discussion about a technical topic known as covariates. This technical concept has been known elsewhere in the project as “base notes.” Scott leans towards using as much rhythmic data as possible, but acknowledge that space and land usage are critical determinants of district type. Delph leans towards a heavier use of prior knowledge and a deeper use of covariates.
9. [Procedural] Delph discussed previous models built for practical business use, using tools such as multiple linear regression, probit modelling, and random forests. The discussion was deep and detailed, but would have been even more convincing had we been able to sit down over code and data.
10. [Procedural] Delph had appropriate measures at hand if the model results in the need for heavy duty computing. Options involved them buying time on Amazon servers. Delft agreed to complete the scaling up of the model if a 50% proof of concept was available.
11. [Procedural] The Delph team expressed worries that the outputs of the model would be “rhythmic” enough. We discussed a three-fold solution of richer data, richer model, and improved visualization can use to capture the data. Delph lead the discussion with good ideas about how the model might lead to actionable results and insights, and how these insights might be communicated.
12. [Procedural] Mark and Leo discussed delivering models to create business need. The insights were solid, and the model communication was primarily verbal in character.
13. [Procedural] There was a productive discussion about whether the model could be communicated at a shallow level – involving posterior predictive distributions and counterfactuals, a medium-weight level, involving model parameters, or a deep level involving a deeper understanding of the causal factors underpinning the YUPTA model. Delph was most comfortable at the shallow to medium depth. We discussed four modes of interaction – centering around verbal discussion and story-telling, technical documentation in PowerPoint or pdf, generating new data for tabulation or

discussion, and generating models for technical consumption or use. Delph was most comfortable with delivering “synthetic” data generated by the models, but acknowledged the importance of face-to-face communication and interaction with the team to enhance discussion. Delph had good ideas for graphical output and visualization for both public participation and engagement, as well as for exploring the rhythmic character of the data. They do not aspire to produce these visualizations.

14. [Procedural]. Scott, Reuben and Mark compiled a list of deliverables to be expected from Delph, as follows:

Data Cleaning	Delph can do whatever cleaning is necessary to work with the data.
Model Estimation.	A complete model specification and report is expected here, including determining the number of mixtures, the number of hidden states, and the number of observable outputs suitable for modelling the data. This should consider the robustness of the results, the quality of the fit, and the potential dangers of overfitting. Models for all the Netherlands may be possible as a stretch goal, but we discussed fitting some 10,000 grid cells central to the six cities as the main deliverable. Further discussion involves whether the model can be estimated for now on the public CBS data, and whether a separate enriched model can be made as more data becomes available.
Synthetic Outputs	Delph will deliver posterior predictive distributions for three districts in Rotterdam, Amsterdam and the Hague respectively. These counter factuals, or synthetic data will enable those districts to know their peers both within and without the city. The data will also describe possible transitions or beats the districts are likely to hit in the coming year or two, and why these are credible impacts for the district. The synthetic data will also consider urban design variables (including green space and public amenities) and the likelihood of these variables to transit the district between types.
Computational Complexity Assessment	Delph will do progressive analyses of these data, building up in scope and complexity and will report back whether the computational burden grows too heavy.
Workshop	Delph acknowledges the need for participation in additional workshops or small group meetings throughout the summer, as previously agreed upon. Delph acknowledges the need for a feedback loop between the validation efforts of Ahti and the model building exercise.
Threats to Validity Report	Delph to deliver possible challenges to the validity of the model, and potential threats to the effective use of the model in policy making. This can serve as further input to validation efforts by Ahti and others.