

## Pre-elicitation

A substantial amount of preparatory work is required before an elicitation workshop can take place. This document identifies the key steps and gives advice on carrying them out. Although not ‘essential elements’ of a SHELF application, the recommendations here are based firmly in the authors’ experience of practical elicitation.

### Quantity of Interest (QoI)

The first step is to identify the uncertain quantity or quantities for which expert knowledge is required. We refer to these as Quantities of Interest (QoIs). A QoI may be an endpoint in itself, but more often it is an input to a model that will be used to infer about some more complex phenomena, or to make decisions. We refer to the problem giving rise to the requirement for expert elicitation as the *wider context*. It is the wider context that gives meaning and importance to the QoI and its elicitation.

We often wish to elicit expert knowledge about several QoIs. For instance, a model may have several uncertain inputs for which we need to make use of expert knowledge.

### Definition

In order for experts to make meaningful judgments about a QoI, it must be defined clearly and unambiguously. Ambiguity is a problem in two ways. First, it will not be clear whether, and if so how, the elicited probability distribution meets the requirements of the wider context. There is a risk of false conclusions or poor decisions based on ambiguous inputs. Second, the experts may not all interpret the question in the same way, leading to confusion in the workshop. It is essential that all the experts are providing judgements about the same, well-defined QoI.

The SHELF package includes another advice document, “Definitions”, devoted to this topic.

It must be clear that the QoI has a unique value. Of course, this value is unknown because we seek to elicit expert knowledge about it, but if there are several possible values then again we have ambiguity. We are often interested in eliciting expert judgements regarding things that vary randomly, but a QoI must nevertheless have a unique (albeit uncertain) value. This challenge is also addressed in the document “Definitions”.

Finally, QoIs should be formulated so as to make the experts’ task as simple as possible, because the more difficult the judgement task the less reliable and accurate an expert’s judgements are likely to be. An important consequence of this is that it may be desirable to break the QoI

down into several components, which are individually easier for the experts to think about. These components now become QoIs. This process is known as *elaboration* and is also dealt with in the “Definitions” document. It is another reason why in practice we often wish to elicit expert judgements about several QoIs.

## The elicitation team

The following distinct roles can be identified as making up the elicitation team.

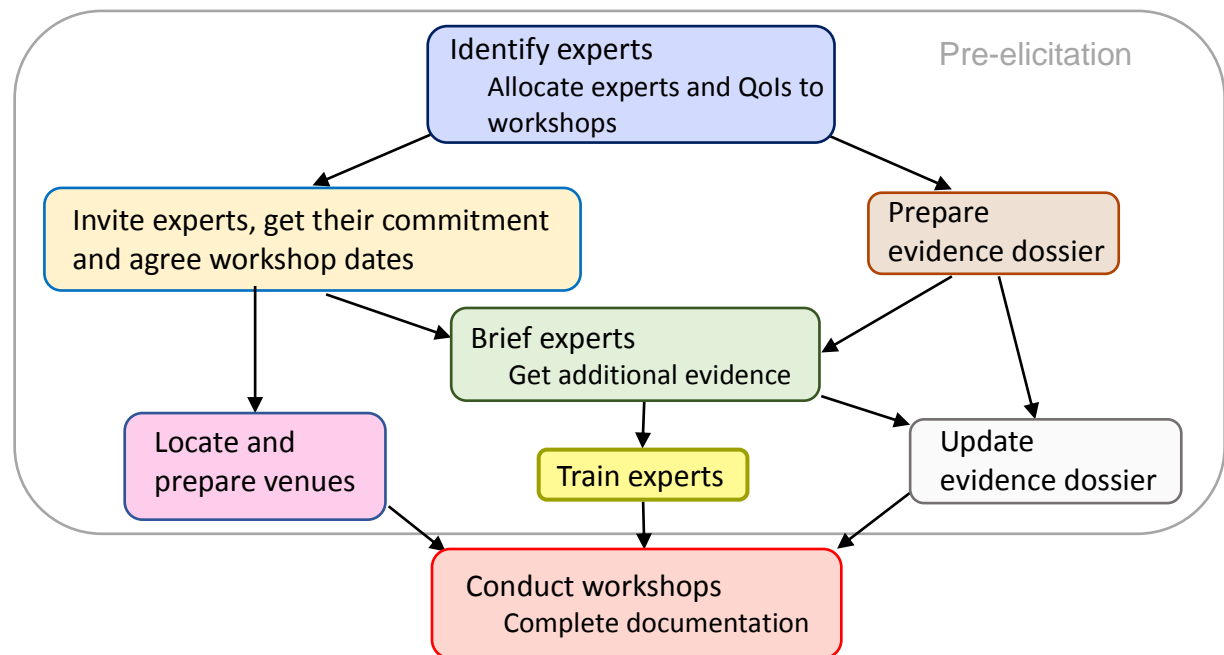
- *Client.* The client is the person or organisation requiring the elicitation, to provide input to their wider context. This person (or a representative of the organisation) will often be explicitly a member of the team.
- *Coordinator.* A good administrator will be valuable in coordinating the activity, particularly, the pre-elicitation tasks.
- *Facilitator.* The facilitator manages the elicitation workshop. This is a skilled task; see the advice document “Facilitator Skills”.
- *Recorder.* In order to allow the facilitator to concentrate on managing the interaction between experts, two additional roles are strongly recommended. The recorder takes responsibility for completing the SHELF templates – which may mean in some cases filling out these forms live during the workshop, but more often the recorder takes detailed notes during the workshop in order to complete the templates soon afterwards.
- *Analyst.* The analyst runs the distribution fitting software (for instance the R package “SHELF”) and displays the results during the workshop.
- *Adviser.* The facilitator is expected to have at least a basic knowledge of the field (enough, for instance, to have some understanding of the evidence dossier), but it is sometimes useful to have another assistant in the workshop, the adviser, who is more knowledgeable and can thereby help to avoid miscommunication or misinterpretation between the facilitator and the experts.

These roles can be combined if appropriate; for instance, it is common for one assistant to take the roles of both recorder and analyst.

## The pre-elicitation flowchart

Once the QoI, or a collection of QoIs, has been identified and defined, there is still much preparatory work to be done before the actual SHELF

workshop. This is the pre-elicitation phase, and is shown in the flowchart below.



This flowchart describes the tasks of gathering experts and evidence, and of preparation for the workshop(s). We now consider each task in turn.

## Identify experts

The experts are obviously a vital part of any elicitation, and it is important to recruit the very best group for a workshop. As a general guide, a SHELF workshop works best with between 4 and 8 experts. If we have too few experts we may not have covered the range of available expertise and opinion, and so may obtain a biased view of the QoI. But we would rarely need more than about 8 to achieve the desired coverage, and having too many experts leads to unnecessarily prolonged discussion and makes it more difficult for the facilitator to manage the workshop.

It may be that there is effectively no choice regarding which experts to use in the workshop. Sometimes, only a small number of experts is available, perhaps only one! Sometimes there may simply not be adequate resources to do more than select the most readily accessible experts. Ideally, though, a thorough search should be carried out to obtain a list of potential experts, from which the elicitation team can make a selection for invitation to the workshop.

The best group of experts for a workshop may not necessarily be the most senior, the most high-powered or even the most knowledgeable people. The ideal group of experts will

- have sufficient diversity of experience and opinion to achieve the desired coverage, and

- be willing to share their opinions and to listen to the opinions of others.

The following, for example, might *not* be good choices for a SHELF workshop.

- An expert who is highly-respected but is arrogant and unwilling to acknowledge any contrary opinion.
- A very senior person who has become a manager and lacks recent experience ‘at the coal-face’.
- A junior person who is unwilling to contribute their views, or who will simply defer to more senior members of the group.
- A representative of a stakeholder organisation who will always assert the organisation’s position.
- An expert whose experience, knowledge and opinions are expected to be very close to those of another expert in the group.

It may be that some of these people “ought” to be invited to the workshop – for instance the leading expert in a field “ought” to be included even if he or she will not be receptive to the opinions of others, or stakeholder representatives “ought” to be invited in the interests of openness and inclusiveness. The solution is to invite such people to submit written evidence to the workshop; see the discussion of the expert briefing below.

When there are multiple QoIs to be elicited, it may be necessary or desirable to run more than one workshop. In a single workshop, there is a limit to how many QoIs can be considered. A one-day workshop may elicit distributions for 1 to 4 QoIs (depending on complexity and whether the experts have already received training in making the necessary judgements). A two-day workshop may be able to elicit distributions for as many as 10 QoIs, but only if the experts do not need lengthy discussion to understand their differing opinions. Workshops longer than two days are not recommended.

So it may be necessary to group the QoIs into two or more workshops. Often, they quite naturally group in such a way that different experts are appropriate to different workshops.

Resources for running elicitation workshops are sometimes so constrained that it is not feasible to elicit distributions of all relevant QoIs in full SHELF elicitation workshops. Advice on how to proceed in this situation can be found in the document “Many Quantities of Interest”.

## **Recruit experts**

Having chosen experts for a workshop, the next step is to invite them and obtain their commitment to take part. Commitment is very important because we want experts to take their involvement in the elicitation seriously, so that their judgements will be carefully considered. To obtain

that commitment, they need to understand the importance of the wider context of the elicitation, and to recognise how their own expertise regarding the relevant QoIs will be valuable to that context.

The initial approach should provide the following information.

- Brief explanation of the wider context and why it is important.
- The specific area in which this expert's knowledge is sought (covering the QoIs to be elicited in the workshop).
- Date (or preferably a selection of dates) when the workshop is expected to take place.
- Date when experts who agree to take part will be sent more detailed briefing information.
- Request to reply as soon as possible, stating availability on the specified date(s).

It may be necessary to send reminders to experts who have not responded, and to send invitations to additional experts if any of the first invitees should decline to take part or are unavailable on the selected workshop date.

### **Initial evidence dossier**

There is usually some data or other quantitative evidence regarding the QoIs, but it is unwise to rely upon the experts to remember all the relevant evidence when called upon to make their judgements. The evidence dossier is a digest of the available evidence that is prepared in advance and provided for the experts' reference during the workshop. Advice on constructing one is given in the document "Evidence Dossier".

The team should have done at least some preliminary research into the available evidence in order to ascertain that expert elicitation is needed. They should prepare a first draft of the dossier based on the evidence that they are aware of.

### **Expert briefing**

Once the experts have been recruited for a workshop, they can be sent a briefing package to prepare them for the elicitation. The principal document in the package will be the workshop's draft evidence dossier, which tells them in some detail about the wider context and the specific QoIs to be elicited in the workshop, together with the evidence relating to them.

The briefing will also ask the expert to provide some information about their expertise and any additional evidence that they are aware of that is

not mentioned in the dossier. It should also allow the expert an opportunity to say whether anything in the dossier is unclear or ambiguous. SHELF has a suggested form for this purpose, the “Expert Enquiry” document. The importance of this information should be stressed and a deadline given for returns. Follow-up reminders may be required, so this deadline should be at least a week ahead of the workshop date.

In order to respond with additional evidence or to raise questions of clarification, and subject to any confidentiality requirements, the expert may discuss the evidence dossier with friends or colleagues – but *not* with any other experts who have also been invited to the workshop.

Finally, the briefing should prepare the experts for the judgement tasks that will be asked of them in the workshop. This should include an explanation of the principles of elicitation, including the subjective interpretation of probability. Experts are sometimes resistant to the idea of expressing subjective judgements, believing this to be unscientific, so it is wise to address those concerns in the briefing. The SHELF document “SHELF Expert Briefing” is one possible exposition of these ideas but may be freely adapted.

An alternative to a written briefing is the online e-learning course that is available at <http://www.tonyohagan.co.uk/shelf/ecourse.html>. This has been designed specifically to train experts in understanding subjective probability and to make the kinds of probabilistic judgements that are required in SHELF workshops.

If there are experts who have not been invited to take part in the workshop, but who are to be asked to supply written evidence, the request should be made at this stage. They should be sent the draft evidence dossier and a form requesting information. In addition to the information requested in the “Expert Enquiry” document, they should also be invited to express their own opinions regarding likely values of the QoIs. The document “External Expert Enquiry” in the SHELF package is suggested for this purpose. If the SHELF enquiry forms are used, it is important to send the correct one to each expert!

## **Revise dossier**

Following receipt of any additional evidence from the experts, the evidence dossier can be revised and a final version prepared for use in the workshop. If there is time, it can be sent to the experts in advance.

If information has been sought from additional experts who will not take part in the SHELF workshop, a *separate* document should be prepared containing the *opinions* part of all such submissions. This will *not* be sent to the workshop experts in advance and will only be revealed in the workshop after they have made their individual judgements.

## Organise venue(s)

The location for a workshop should be determined as soon as possible, preferably before the briefing is sent to the experts, so that this information can be included in the briefing.

The workshop should take place in a room that can comfortably accommodate the experts, the facilitator and any assistants in a boardroom arrangement. A data projector and screen are usually needed to display information such as fitted distributions or PowerPoint slides: the screen should ideally be visible to all participants. It is useful also to have a flip chart or whiteboard (and pens) for *ad hoc* notes and explanations.

It is recommended that name cards are made for all participants. In the anonymised parts of SHELF templates, experts will be identified by a code, such as “Expert A”, “Expert B”, ..., and so their name cards should display their code in addition to their name.

Each expert should be provided with a copy of the final evidence dossier, together with some paper to write down their individual judgements.

## Train experts

Experts will need training in making probabilistic judgements. Even if they have taken part in an elicitation before, they will need reminding because this kind of task is not a part of their regular professional activities.

Training may be given in the form of additional, more detailed, instructions included with their briefing package. Unfortunately, experience shows that the ideas are not absorbed in this way, and there is the risk of confusing the experts and losing their commitment. The suggested “SHELF Expert Briefing” document gives only a flavour of the kinds of judgements that experts will need to make, and does not attempt to train them.

The online e-learning course may be a viable way of preparing the experts, and is certainly better than simply asking them to read a detailed briefing. However, this will only train them in making their individual judgements. They can only learn how to make group judgements in the workshop itself.

Therefore it is always necessary for the workshop to include some training. We strongly recommend also that at least one complete practice elicitation is conducted, to familiarise the experts with the whole SHELF process. Although it is common to use ‘general knowledge’ quantities for the practice elicitations, such as the area of France, the population of Australia or the birth date of Tolstoy, there is much to be said for choosing more realistic and meaningful quantities. Outcomes of imminent events, such as the proportion of votes cast for a particular candidate in a

forthcoming election, can be more motivating, as can quantities in the experts' area of expertise. Practice quantities can be chosen in advance of the workshop, and if appropriate a brief evidence dossier can be prepared for them.

## **Post-elicitation**

Although this document has been focused on activities before the elicitation workshop, it should be noted that there will also be tasks after the workshop has finished. Templates will often need to be completed after the workshop, and in any event will need checking. If any revisions have been made after the workshop, the final versions of the templates should be sent to the experts for review. They can advise of any omissions or errors.

It is good practice also to send the experts a feedback questionnaire asking for their views on how the process was managed, and their thoughts on how it might be improved.

The templates, with their attachments, are a complete record of the elicitation workshop, but will usually only form part of the final report to the client. This will also provide details of pre-elicitation activities, and should include an executive summary of the outcomes.