Reviewing Literature

1 Introduction

The aim of this guide is to help you write an account of the sources you draw on during your project. We shall adopt a basic template that summarises each item in a single paragraph, or two at most. One way to structure the account is to describe:

- the problem, issue or technology that was being addressed
- the solution or outcome that was proposed
- how it was evaluated, if at all, and what the outcome was
- the scope of the work presented in the source, and especially an assessment of whether it stops short of the work you are doing or whether it encompasses it in some way
- any similarities and differences between the work you have read about and the work you intend to do
- the ways in which it relates to the work you are doing and any specific contribution it can make to a solution.

This template isn't always applicable, not least because it can become monotonous to read. You will need to make your own decisions about which elements should be included and which omitted. Sometimes, the last two points are best dealt with having considered a number of related sources before taking an overview.

One key issue for you to decide is the extent to which you engage with the detail of a source. A good 'rule of thumb' is to do so in proportion to the extent to which you are going to actually use the work of the source, as opposed to considering it in more general terms. If you are using standard techniques from textbooks you do not need to cover technical details in great depth. If, on the other hand, the book is breaking new ground and the material is somewhat esoteric, then it should be considered as being more like an article in a journal or conference proceedings.

We think the best way to get used to writing review material is for you to look at some examples. Section 2 of this guide presents examples of good practice. However, we have contrived to make some examples better than others so that you can begin to recognise the differences yourself.

2 Examples

Note: In this section the term 'reviewer' refers to the author of the review (the student conducting the project).

2.1 Computer-supported concurrent design

Here is an account from a review of literature looking at concurrent design as part of a project to model and develop support tools for multidisciplinary design teams. In this part of the review the reviewer is looking at different models of design, which form the backdrop to the more detailed work they will undertake. Look for elements of the template in this one paragraph extract discussing just one source.

> Desa and Schmitz (1991) outline a concurrent engineering method and suggest concurrent design implies the use of multidisciplinary design teams who interact during early design. They advocate a method that they term 'Virtual Concurrent Engineering'. Via this approach, a designer's decisions are subject to evaluation by different downstream life-cycle perspectives (they concentrate on the manufacture and assembly aspects). They go on to describe a software tool, the 'Producibility Evaluation Package' (for analysing designs from a manufacture viewpoint), which has been used to evaluate the 'Virtual Concurrent Engineering' (VCE) approach. They conclude that the design resulting

from such an approach will be globally optimal when performance, producibility, assembleability, reliability, serviceability, etc. are considered. However, they do not discuss how conflicts between different life-cycle aspects may be handled. The designer retains control over the process and decides which evaluative advice to heed.

This account provides a fairly high-level account of the paper by Desa and Schmitz. It gives their definition of concurrent design and sketches the architecture of their method (VCE) and their notion of optimality. It points to a limitation of the work and, finally, to a statement that might be taken as a human–computer interaction (HCI) design principle.

At the end of the discussion covering both serial design and concurrent design, the reviewer then summarises the differences between them – choosing diagrams to do so, a very effective way of conveying a lot of information (see below).

The differences between the serial and concurrent approaches to design and the associated input of knowledge are summarised in Figures 2.2 and 2.3.

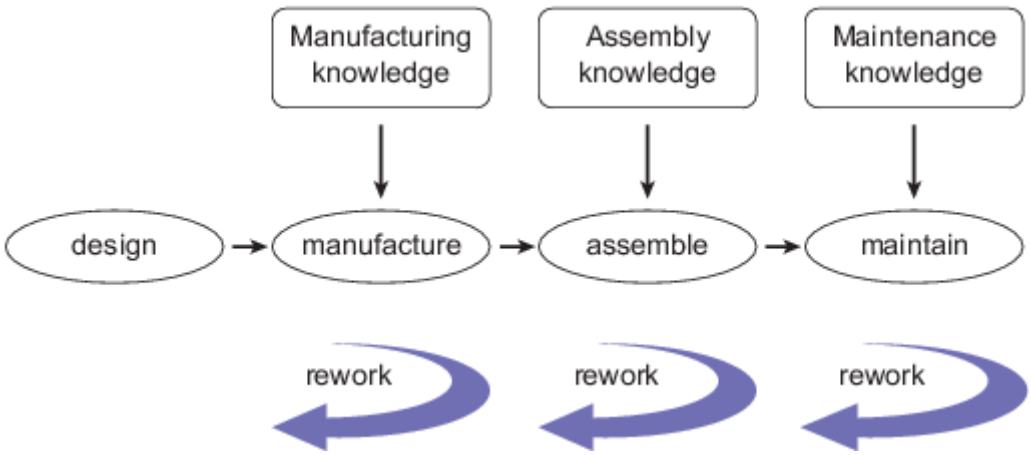

Figure 2.2 The serial approach to design and knowledge input

This shows how potentially costly and time-consuming rework can result when life-cycle knowledge is brought to bear downstream from the design process.

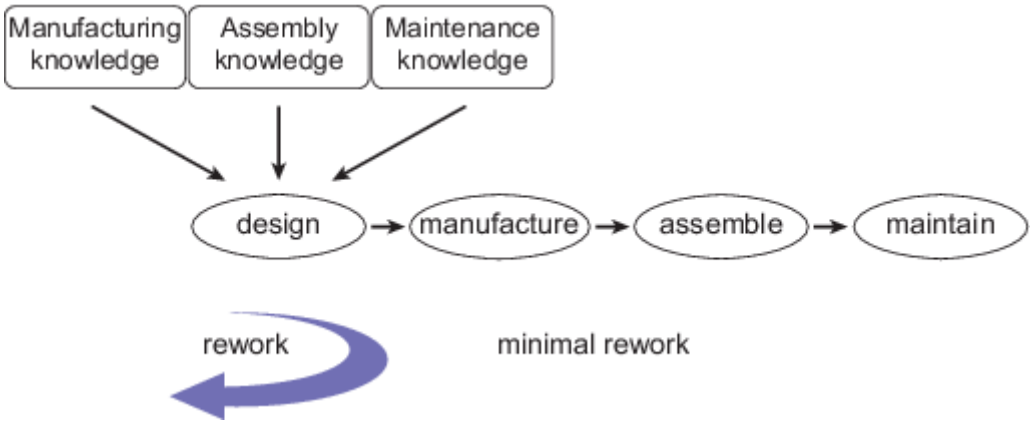

Figure 2.3 The concurrent approach to design and knowledge input

This figure shows how rework can be greatly restricted to the design process, with the input of knowledge about downstream life-cycle perspectives at this stage. This results in these downstream processes then proceeding with minimal rework.

2.2 Rural broadband

Here are some examples from a project investigating infrastructure technologies for providing internet access in rural areas (areas too remote for connection via conventional digital subscriber line (DSL) technologies). In this account the reviewer has found a high-level overview of one of the potential technologies.

> IEEE 802.22 is a standard for cognitive wireless regional-area networks. An overview of the standard is given by Stevenson and others (Stevenson et al., 2009). Provision of broadband internet access in rural areas is difficult due to range constraints on conventional copper-based technologies. IEEE 802.22 addresses this by providing standards for utilising vacant TV channels. The cognitive radio aspect of the standard involves dynamically identifying unused regions of the spectrum which are then used for communication with customer equipment.
>
> This article describes the IEEE 802.22 standard and the basic mechanisms to be used to implement it. IEEE 802.22 is one of the candidate standards being investigated in this project for use in the rural UK. The major apparent problem with the standard in this context is its use of vacant TV channels. UK TV spectrum is heavily utilised, though there is likely to be some extra spectrum availability after digital switchover is complete in 2012, when some of the current analogue channels will become vacant.

This doesn't conform well to the template (but it is still important information) because the article is describing a standard not a solution to a specific problem, although the standard must have been defined to address a specific problem. The standard is not evaluated in the article. The main problem with this account is that the reviewer is making unjustified assertions about the utilisation of UK TV channels and the availability of spectrum after switchover. Reference could have been made here to Ofcom and the Digital Dividend Review (Ofcom, 2010). If the reviewer is going to make use of IEEE 802.22 as a major component of their project, a detailed description of the standard (or the relevant aspects of it) will be required.

2.3 A computer model of executive attention

In this example, we have an account of a body of work that is near to the work that the reviewer is pursuing. Thus there is a fuller description. However, the reviewer is going to take a different approach, so although it is detailed it is not a completely detailed account.

> Franklin's IDA model (Franklin et al., 2005) can be viewed as an implementation of Baddeley's working memory using Baars' concept of Global Workspace Theory (GWT). IDA is a multi-agent system (Franklin and Gresser, 2003), an early implementation of which was able to billet US Navy personnel, responding to (electronic) notices of vacancies and requests for postings by assigning staff appropriately. IDA can communicate in natural language via email.
>
> Franklin's implementation of GWT in IDA uses software agents to determine the flow of information within the agent network (Franklin and McCauley, 2002). At the heart of Franklin's IDA is a non-hierarchical action selection mechanism dubbed a 'spreading activation network' (Maes 1989, 1990). Agents representing actions and motivations are made up of the following:
>
> - preconditions that much be true for the agent to be considered for execution
> - an 'add list' containing conditions that executing the agent will probably make true
> - a 'delete list' containing conditions that executing the agent will probably make false
> - an activation level, set if the agent gets executed
> - the actual code to be run.
>
> At each time-step the activation levels are re-calculated across the agent network, the agent with the highest activation level getting executed (resetting its activation level to zero for the next time-step). The various external, inhibitory and excitatory links from agent to agent form relationships between agents.
>
> In the most recent work on IDA, Franklin et al. (2005) present a cycle of computation implicit in the GWT model:

1. Event-specific attention agents build a ‘coalition’ of associated information agents on the basis of the amount of relevant information content found in the current representation of the environment.
2. A winning coalition is selected and its contents broadcast to all other agents.
3. Behaviour agents respond depending on their relevance to the information broadcast. Some initiate a behaviour stream, if one is not in place.
4. Competition between agents representing behaviours is resolved by selection of a single behaviour for execution.
5. Execution of the behaviour agent results in the creation of an expectation agent, which competes for attention in the ensuing cycle(s) if the anticipated results of the behaviour are not seen in the perceived environment.

Comparing IDA to human attention, clearly IDA selects less salient over more salient tasks through a number of biasing mechanisms, e.g. agents representing states, timekeeping agents, etc. In IDA, the content of external and internal representations is recognised during perception (early stages of the cycle) and thus informs the unfolding of the information flow in later stages and cycles (Franklin and McCauley, 2002). Priming is also implemented, as described above. The operation of attention, in respect of any one task, is intermittent. And the frequency with which a task is revisited is governed by the dynamics of the competition between attention codelets (with their coalition of information agents) and the rates at which the activity levels of the codelets decays in episodic memory. From the perspective of attentional functions, IDA has a monitoring mechanism (expectation agents). The model states a role for a planning mechanism to tackle non-routine problems but this isn’t implemented. One form of learning in IDA uses internal reinforcement mechanisms, the details of which depend on the memory subsystem. The reinforcement signal is derived from selection of an attention or behaviour agent so that frequently attended perceptual or behavioural associations are sustained whilst others are allowed to decay. The model specifies a mechanism to improve the performance of unfamiliar skills.

This account is possibly too detailed given that it is not going to be used. The final paragraph evaluates IDA by comparing it to features of human attention – a pretty high benchmark!

2.4 Evaluating e-Government applications

In this example the reviewer is attempting to identify the boundaries of current evaluation practice. Many of the references come from a seminal book, edited by Willcocks and Lester, containing chapters by leading specialists in their fields.

Evaluation in e-Government

Willcocks and Lester (1999) observe that, as far as Information System (IS) design and development is concerned, evaluation is one of the most neglected areas. However, this is not simply the result of omission; rather, it reflects the degree of difficulty inherent in developing appropriate evaluative criteria. The most frequently cited reasons for absence of evaluation are problems identifying and quantifying benefits and opportunity costs, unfamiliarity with evaluation techniques, difficulty interpreting results, and lack of time, data, information or interest (Ballantine et al., 1999, p. 142). Not only are there well-recognised problems with objective, usually financially based, evaluation metrics, but there is also little experience (at least outside the academic world) of using methods that seek to interpret and/or quantify the subjective (Powell, 1999, p. 159) or the intangible (Farbey et al., 1999, p. 184).

In the context of e-Government, the problems of traditional IS evaluation described here are rendered even more complex. Stakeholders are particularly diverse and include elected representatives, government officials, public not-for-profit, and private for-profit organisations. Users are not simply customers: they are clients. That is to say their relationship with the service provider may be governed by statutory entitlements, and professional and ethical codes. And in a separate and distinct role, users are also the citizens who express preferences and demand accountability via the ballot box. The range of evaluative criteria is also extended. Tangible criteria include cost cutting, enhanced

efficiency, service enhancement and development, and, for private sector participants, (long-term) profit maximisation. But to these we add the more intangible criteria such as perceptions of equity and social inclusion in respect of services, and outcomes such as community cohesion, sustainability, well-being, and trust.

In response to the problem of evaluation in traditional IS contexts, some academics within the IS community have argued for interpretive evaluation, which seeks to accommodate subjective assessment at every stage of a project in order to complement objective techniques (Walsham, 1999; Hirschheim and Smithson, 1999). Interpretive evaluation is neither prescriptive nor proscriptive in respect of the techniques that an evaluator may use, other than requiring the techniques to draw on the views of stakeholders in contributing to a subjective understanding.

Walsham (1999, pp. 374–7) identifies the main elements in the design of an interpretive approach to IS evaluation as follows.

- *Context* arises from an analysis of stakeholder assessments, both current and historical.
- *Purpose* is related to the stage of development of an IS. At the early stage it supports feasibility assessment, during development it feeds back on design progress, and post-implementation it focuses on achievement of goals. For all stages, purpose is concerned with achieving understanding (preferably shared).
- *Content* relates to the system goals (functional, economic, human, organisational, social and political), acknowledging that stakeholders will have different perspectives and motives in relation to the project.
- *Facilitation* requires the interpretive evaluator to assume a number of roles: facilitator of reflection, learner, teacher, reality shaper and change agent.

The emphasis on stakeholder engagement and the breadth of scope in respect of project goals aligns well with the e-Government context. In a comprehensive survey seeking to marry IS project contexts with approaches to evaluation, Farbey et al. (1999) consider qualitative, interpretive evaluation as the method of choice for the class of projects that are radical (as opposed to conservative) and for which objectives are fuzzy (as opposed to crystallised); a category into which we believe many significant e-Government initiatives fall. However, the very attributes that suit interpretive methods to radical projects and fuzzy contexts also mean that they offer relatively little by way of specific guidance to designers and managers. The elements of interpretive evaluation above provide direction at a very high level. Hence the aim of this paper is to elaborate elements of a framework that enhances and refines this support by identifying specific elements of an evaluative framework suited to e-Government projects.

This account covers a number of contributions in the book, weaving them together to draw a conclusion and point forward to the rest of the project.

2.5 Agent-based negotiation

In this final example, the reviewer intends to use the advanced negotiation concepts found in a research paper by Faratin et al. Accordingly, they give a detailed account of the main ideas from the paper.

Faratin et al. (1999a) give a comprehensive account of negotiation. It is defined as “a process by which a joint decision is made by two or more parties. The parties first ‘verbalise’ contradictory demands and then move towards agreements by a process of concession making or search for new alternatives”. A subset of negotiations consists of two or more parties, some of whom are seeking services (buyers) and some of whom are seeking to provide one (sellers). The buyers will let their initial proposal (contract containing a set of issues) be known to the sellers. This proposal would include the services that they require, along with an initial offer (of maximum utility) which would be the ideal price at which the buyer would wish to purchase the services. Both the buyers and sellers would have (at least should have) limits in mind for the values of the contract. They would also have an idea of what the quality of each attribute of the service they are seeking should be. The sellers would then decide to either accept, decline or counter the offer, perhaps making a concession in the hope of enticing the buyer into a mutual agreement on the matter. Following that, the buyer would consider the seller’s proposal in the same way as the seller and either accept, reject or return a counter-offer. The parties would then proceed to confer and compromise on the matter until either:

- a mutual agreement has been met
- one of the parties rejects the offer
- both parties agree to break off the negotiation
- a deadline, set by one or more of the parties, is reached.

The decisions as to whether the offer is accepted, rejected or countered are made with consideration to the value that the current contract offer has to the buyer or seller. This can be judged by price, quality and need in relation to the predefined range that the party set for itself pre-negotiation.

In an effort to obtain a maximum gain (utility) as a result of the negotiation, tactics and trade-offs can be used. Tactics are used by either the buyer or the seller to aid the decision on how much of a concession could be made on the next counter-offer. Tactics can be employed by considering criteria such as the remaining time and the previous behaviour of the opponent. Many negotiators use tactics or are swayed by the use of tactics subliminally. Trade-offs can be used to consider alternative contracts with different values of the attributes, which are worth the same to the agent as the original contract. This is dependent on how important the price is to the buyer in comparison to the delivery time. A buyer may well be willing to pay a higher price for a better service or shorter delivery time (Faratin et al., 1999a).

An abstract scenario is presented as follows.

Autonomous, intelligent agents negotiate services without the need for human interaction once the negotiation process has started. The agents negotiate a contract for the services of a leased communication line (Figure 1.1).

Figure 1.1 Contract specification for negotiation

Leased line contract

Issue	Type	Notes
Installation price	£	
Lease per month	£	
Days until installation	(0,1,…,*n*)	
Line speed	(T3, T1, DSL, Cable, ISDN-128k, ISDN-56k)	In order of preference

Two alternative protocols of negotiation are considered:

Bilateral strict turn-taking: parties take turns to propose an offer in response to the last offer (if any) made by the opposition. Since this protocol restrains each agent from exhibiting an offer until the other agent has presented theirs, it is not considered suitable for use in a situation where time is an issue. (For this reason, this protocol does not sufficiently represent the manner in which humans negotiate.)

Bilateral free turn-taking: as with human negotiations, agents may make an offer whenever they are ready to do so. An offer may be presented from party *a* to party *b*. If party *b* is not sure of the offer and is taking a long time deliberating, agent *a* may assume that agent *b* is not happy with the offer, and is unsure of how to counter it. This may persuade party *a* to put forward an alternative offer, in an attempt to come to an agreement. This would happen particularly in cases where time is short and of significance. In an attempt to hurry the proceedings they may offer another trade-off of their previous offer, in an attempt to hasten a response from their opponent.

Each agent needs to be able to evaluate an offer from the other. The following evaluation mechanism is used to calculate the score, V, of a contract, thus determining its worth (Faratin et al., 1999a):

$$V^a(x) = \sum_{1 \le i \le n} w^a_{j_i} V^a_{j_i}(x[j_i])$$

where:

x is the current offer

a is the agent

j_i is the ith issue

$x[j_i]$ is the offer for issue j_i

$w^a_{j_i}$ is the weight that agent a assigns to issue j_i

$V^a_{j_i}$ is the relevant scoring function that agent a assigns to issue j_i.

The mechanism works by scoring each issue on the contract individually using the appropriate scoring function, and multiplying the resulting score by the weight that the agent has assigned to it. For ease of comparison the weights are normalised, so that the overall score for the contract will be in the range [0,1]. For instance if the weights assigned are 0.4, 0.4 and 0.2, and all of the issues score to the maximum, then the total score for the contract will be 1.

It should be noted that the evaluation mechanism assumes that all issues are independent from each other, whereas in real-life negotiations it would sometimes be the case that the worth of one issue is dependent on the offer for another issue. If any scores relied on the results of other scores the scoring function would not take that into account, and so would not produce the desired effect. For a scoring function to take into consideration the relation of scores, it would need to be able to dynamically change either the scoring function used, the domain or even the weight. This would complicate the functions much more. Moreover, these mechanisms are designed largely for the use of non-cooperative, competing agents whose desires are primarily selfish and concerned with the realisation of personal maximum utility for a contract.

Description at this level is only necessary if the reader will need it to follow and understand the subsequent work of a project that implements such a mechanism, or one based very closely on it.

3 Scoping the review

The amount of accessible literature in just about any field is vast, and for an undergraduate project you need to focus very rapidly. But there needs to be a rationale to the focus you choose and this needs to be explained to the reader. Here is an example from a project looking at active machine vision in the context of surveying narrow-diameter concrete sewer pipes.

3.1 Machine vision

3 Literature review

The scope of this review is determined largely by a focus on vision research relevant to active inspection of continuous, smooth-walled cylindrical pipes. Section 3.1 examines the relevant work carried out in the field of active vision. It looks first at low-level object detection and tracking where the detailed description of the object is not of primary interest. It then looks at higher-level object analysis where, for example, the dimensions and orientation of an object are of primary interest.

I have chosen not to include extensive reference to active vision using stereo. Use of a second camera is constrained by the limited room available in the pipes I'm considering and second cameras entail additional expense – not least in terms of computational effort. More significantly, the cracks and fissures of interest are on the walls of the pipes and so, given knowledge of the pipe geometry relative to the camera and some basic information on distances (e.g. between successive pipe joints), the relative depths of different features may be derived from images taken with a single camera.

Section 3.2 looks specifically at feature detection in concrete sewer pipes. The features of interest in this domain are pipe joints, pipe junctions and pipe flaws such as cracks or fractures. This section also examines work that seeks to determine the vanishing point (VP) within a pipe. (The VP may be used as a valuable reference point for visual analysis – see Section 3.2.5.)

With this introduction the reader has a clear rationale for the selection of the chosen literature and has been provided with an account of the structure of the review.

4 Summary

- Write an introduction that explains why you have chosen the sources you have. How did you decide what to include and what to leave out? *This section will always be needed*.
- Identify the subject of each source you review. What is the problem or technology addressed? *This section will always be needed*.
- Describe what the source has to say about its subject. Is it a solution to a problem, a description of technology, a review of a subject or something else? *This section will always be needed*.
- Show how the work in the source relates to your project. What part of your project does it address? What are the similarities and differences between the work in the source and your project? How will it contribute to your solution?
- Some sources will be of greater relevance to your project and will therefore need to be discussed in more detail. Do not include long accounts and large amounts of detail unless the reader will need it to understand the project.
- Connect the information you have obtained from the different sources together and derive some useful conclusions relevant to your project.

Acknowledgements

The module team wishes to acknowledge the contributions of the following students and graduates whose draft work has been used to provide the examples in this guide:

Robin Barker

Karl Brammer

Dan Franks

Jason Garforth

References

Please note that as the references made in the examples are not strictly relevant to your work they have not been included here. The following is referred to in the main text of the document:

Ofcom (2010) *Digital Dividend Review* [online], http://stakeholders.ofcom.org.uk/spectrum/project-pages/ddr/ (accessed 22 March 2011).