

**THINKING THE UNTHINKABLE:
USING PROJECT RISK
MANAGEMENT WHEN
INTRODUCING COMPUTER-
ASSISTED ASSESSMENTS**

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Thinking the unthinkable: using project risk management when introducing computer-assisted assessments

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Abstract

As the introduction of a computer-assisted assessment (CAA) is inherently risky, it is perhaps surprising to see how little coverage formalised risk management gains in the CAA literature. By defining the introduction of CAA as a project, this paper draws on the established project risk management literature. A cross-case analysis of six CAA applications is given, with numerous risks being identified. The concept of 'risk efficiency' is used to show how formalised project risk management can be beneficial to cumulatively learn from each CAA application, thereby becoming more risk efficient over time.

Introduction

Converting traditional methods of assessment (i.e. coursework, exams) over to computer-assisted assessment (CAA) is acknowledged as being a risky activity (Zakrzewski and Steven, 2000: p.202). Despite the risks, there appears to be little coverage of risk management advice in the extant CAA literature. Zakrzewski and Steven advocate an iterative 'Catherine wheel' approach to making the risks of CAA explicit, where each iteration is a yearly cycle of use followed by a post-hoc risk analysis and a widening of use (2000: p.203). However, most published studies are of small-scale CAA practice where the risks are perhaps more apparent and more easily contained, rather than the full-scale institutional implementation which is the context of this study.

In this paper, the introduction of CAA is viewed as a *project* (commonly delivered in the first instance through a 'pilot project'). A project can be defined as 'a temporary endeavour undertaken to create a unique product or service' PMI (2000). Lock (2000, p.4) suggests that "the principal identifying characteristic of a project is its novelty. It is a step into the unknown, fraught with risk and uncertainty." By defining the introduction of a CAA as a project, this paper can draw on techniques from the increasing body of knowledge on project risk management (e.g. Simon *et al*, 1997; PMI, 2000; Chapman and Ward, 2002; Chapman and Ward, 2003; Webb, 2003).

A cross-case analysis of six CAA implementations at the University of Southampton is given here; four of which were implemented successfully whilst two were not. At no time was any formal risk management process used, raising the question as to whether the two failures could have been avoided had such a process been adopted.

Whilst the paper identifies some potential risks inherent in implementing CAA, along with possible risk management responses, developing such a 'check-list' is not its primary purpose (see Zakrzewski and Steven, 2000 for comprehensive examples of CAA risks). The main aim here is to draw a link between the CAA and *project* risk management literatures. The concept of 'risk efficiency' is then used to conceptually show how the application of formal project risk management to the introduction of CAA can be beneficial.

Overview of project risk management

The ability to sense risk appears to be a basic instinct, the management of which has evolved over numerous millennia. In the current 'risk society', risk has played a central role in societal developments (Beck, 1992). These risk aspects are reflected in a broad base of literature covering: environmental issues (genetically modified foods, nuclear waste), data processing, security management (terrorism, insurance), project management, health and safety (design criteria, disaster planning), finance and economics (derivatives, concepts of risk/return), to name a few.

The origin of the word 'risk' seems to vary according to the literature. However, a common definition centres on that given by Bernstein (1996, p.8), who sees risk as 'a choice rather than a fate', indicating that risks can be managed or mitigated in some way. The term risk then implies a change from a known state to an unknown state, thereby creating a period of uncertainty.

Until the mid-1990s, risk was generally portrayed as a negative feature. More recently, the term has been viewed as either negative (i.e. to be minimised or avoided), or positive (i.e. to be maximised), or indeed both. The wider definition can be attributed to the development of risk management within a project environment, starting mainly with military developments in the 1950s. The Project Management Institute (PMI, 1996, p.111) states that "strictly speaking, risk involves only the possibility of suffering harm or loss. In the

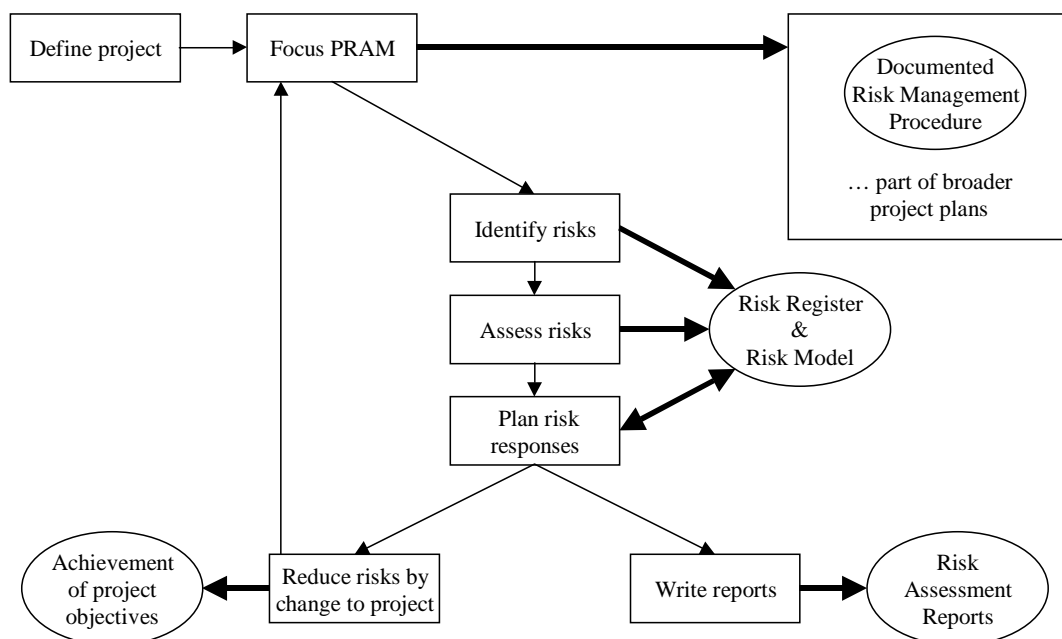
project context, however, risk identification is also concerned with opportunities (positive outcomes) as well as threats (negative outcomes)".

There are numerous standards, publications and guides available for project risk management, with many of the activities, debates and developments being channelled through the following groups:

- Association for Project Management: Risk Management Specific Interest Group (<http://www.eurolog.co.uk/apmrisksig/>).
- Centre for Risk Research, School of Management, University of Southampton, UK (<http://www.management.soton.ac.uk/risk/default.asp>).
- The Project Management Institute: Risk Management Specific Interest Group (<http://www.risksig.com/>).

Many risk management processes comprise iterations of identifying, analysing, managing and reviewing risks. The Project Risk Analysis and Management (PRAM) process, which was developed by the Association for Project Management risk SIG in the UK, is an ideal starting point (Simon *et al.*, 1997). An overview of the PRAM process is shown in Figure 1.

Figure 1: The Project Risk Analysis and Management process



Source: Simon *et al.* (1997, p.15)

Perhaps the most prominent project risk management publication is currently *Project Risk Management: Processes, Techniques and Insights* by Chapman and Ward (1997, 2nd edition in 2000). Chapman and Ward use the PRAM

guide as a basis and they go on to develop a detailed procedural approach for managing project risks.

Case background: Southampton's Perception pilot project

The University of Southampton purchased a site licence for Question Mark Computing's Perception V3 CAA system in 2002. The University had already rolled out the Blackboard virtual learning system (VLE) across the institution, and part of Southampton's managed learning environment (MLE) strategy is to roll out Perception as a site-wide CAA service that complements the VLE's quiz engine. The pilot project had several objectives which included: developing a compliance response to British Standard 7988, and piloting a full-scale, centralised, robust implementation of Perception across the institution. Southampton's system appears to differ from other CAA systems documented in the literature by the explicitly summative nature of many of the applications, and in the relatively large numbers of simultaneous test-takers that were envisaged. The pilot project CAA applications are summarised in Table 1.

Table 1: Overview of cases

Case	Date (m/y)	Discipline	Formative / summative usage	Number / level of students	Contribution to overall assessment
1	05/03	Science	Summative	80 2 nd year UG, 16 3 rd year UG	20%
2	10/03	Humanities	Diagnostic	60 1 st year UG	N/A
3	11/03	Healthcare	Form. & Sum.	c.300 PGR 100 PGR	Completion is a course requirement
4	11/03	Soc. Sci.	Form. & Sum.	280 1 st year UG	30%
5	12/03	Science	Summative	30 2 nd year UG	1%
6	01/04	Science	Summative	60 1 st year UG	20%

Two of the largest applications (cases 3 and 4) went wrong for technical reasons. In one case the outcome was largely negative in that there are no plans to use CAA again; whilst in the other case the outcome was more positive, due largely to recovery strategies deployed by the tutor (see Harwood, 2004). The other four applications were implemented successfully.

Methodology

Semi-structured interviews were conducted with the protagonists of each of the six CAA applications a few weeks after each assessment, with the aim of capturing directly the richest possible feedback before memories faded (Heyl, 2001), and also to give the tutors time to reflect on the entire process. Respondents were asked about their impressions of the CAA process from authoring to publication and delivery. They were also free to talk in detail

about anything relevant that impressed on them during the project. The interviews were transcribed verbatim and checked by the respondents. The interviews, together with the CAA Officer's notes (and in some instances feedback from participants), were developed into case studies.

The case studies were then used to form a cross-case analysis (Miles and Huberman, 1994) of the potential risks encountered when introducing CAA. Miles and Huberman (1994) advocate cross-case analysis as a way not only to extend the generalisability of case study findings, but also to deepen the understanding of the phenomena under study. They mention Denzin's (1989) 'multiple exemplars' approach as a way of identifying the salient features of earlier sensitising cases, and then bracketing them with the equivalent features of other comparable cases, so that outstanding elements can be synthesised into a new understanding of underlying mechanisms (Miles and Huberman, 1994: pp. 173-174).

Risk identification

Using Denzin's strategy, the risks from all the applications were grouped according to type. The three categories of risk identified were those that stem from the preparation of the CAA infrastructure (mainly technical aspects), risks that originate from the authoring process (principally procedural risks) and administrative risks that centre on the delivery process. A meta-matrix (Miles and Huberman, 1994: pp.187-191) was developed of the risks within each case, along with potential risk responses (see Table 2). As this was a retrospective account of the potential risks, there was little value in applying numeric values to them. Future applications of CAA would benefit from using the Delphi technique (Chapman, R., 1998) in order to quantify factors such as 'probability' and 'impact'.

Risk management and responses

Having identified numerous risks amongst the six cases, a number of risk responses were developed that should inform future practice (see Table 2).

Table 2: Risks and responses in the application of CAA

Identified risk (case number)	‘Proactive’ response: mitigating actions	‘Reactive’ response: contingency plans
Failure at point of delivery due to scalability issues (C3,4)	a. Load-test at realistic levels before any large-scale summative tests. b. Allow sufficient time for support staff to attempt to fix the problem c. Run a formative version of the test	a. Have a paper copy (Heard <i>et al</i> , 1997; Bull and McKenna, 2004) b. Substitute marks from formative assessments (Harwood, 2004)
Tutors abandon CAA due to perceived weakness in implementation (C5)	Keep channels of communication open between authors and support staff	Capture and address author feedback after each application
Wrong assessment published (C3,5)	Encourage academic and support staff to comply with internal CAA procedures	Discount compromised items
Tutors abandon CAA due to its’ perceived unfriendliness (C5)	Ease of use is an important factor in the uptake of CAA- capture and address author feedback	
Authors struggle to ‘reinvent the wheel’ with software (C5)	Keep channels of communication open between authors and support staff	
Publication date missed (C1)	Encourage academic and support staff to comply with internal CAA procedures	
Tests submitted prematurely due to inappropriate template settings (C2)	Use prefabricated templates to make assessments as clear and unambiguous as possible.	Re-issue test
Formal appeals due to weakness in test construction (C1)	Make training in pedagogy of objective tests and use of authoring tools a prerequisite for access to the service.	Discount compromised items
Formal appeal due to poorly-implemented negative marking (C6)		
Formal appeal triggered by QA issues due to selection of inappropriate CAA tool (C5)		
Communication gaps exacerbate existing issues (C1,3)	Encourage academic and support staff to comply with internal CAA procedures	
Environmental issues (C4)		
Cheating (C1,2,3,5,6)	Use random selection from large question pools	Use trained invigilators

Cont...//

Table 2: Risks and responses in the application of CAA (continued...)

Identified risk	'Proactive' response: mitigating actions	'Reactive' response: contingency plans
Formal appeals due to workstation issues (C1,2,6)	a. Allocate sufficient time before the exam for testing workstations b. Ensure that a class register is available so that sufficient workstations are booked	Have a spare workstation area available
Formal appeals due to unfamiliar test environment (C1)	a. Practice with formative versions b. Maintain tutorial and generic practice tests on all public workstation clusters	Monitor and address student feedback
Students protest about 'fairness' of CAA (sub formal appeal) (C1,5)		
CAA abandoned due to changes in course architecture (C3)	Offer advice to assist tutors in making informed decisions about the most appropriate methods of assessment.	
CAA abandoned due to staff turnover (C6)		

Discussion

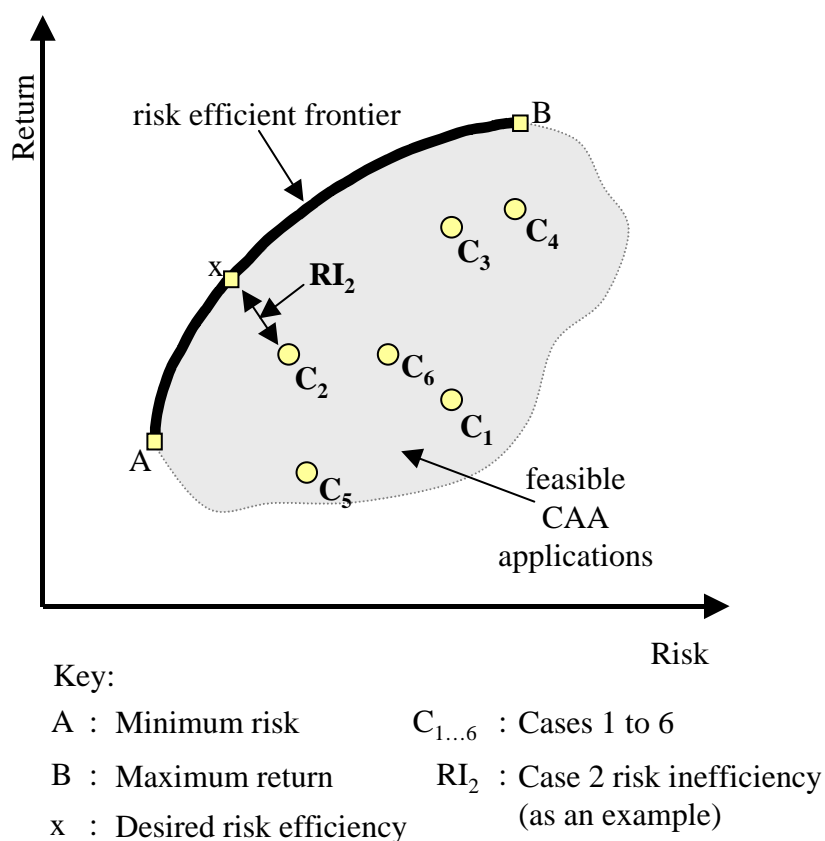
Upon retrospective analysis, a number of the potential risks were common across the cases. By not adopting a formalised project risk management approach during the pilot study, potential lessons (i.e. risks and risk responses) were not captured at the end of each application and passed on to inform actions in subsequent applications. This led to the pilot study being potentially 'risk inefficient' and may have been a contributing factor for the two applications to go down.

The origins of 'risk efficiency' can be traced back to the theory of portfolio management in Economics (Markowitz, 1959) with a premise that 'risk' and 'return' are inextricably linked. For an individual (or an organisation) to achieve a certain level of reward (both financial and non-financial), they have to accept a certain amount of risk. Risk efficiency has subsequently been employed as a mechanism to describe the interplay between risk and return in the project environment (Simon *et al.*, 1997; Chapman and Ward, 1997).

The concept of risk efficiency is introduced in Figure 2, with return (i.e. linked to the benefits from using CAA) shown on the Y-axis and risk (as discussed in Table 2) on the X-axis. The grey shaded area represents all of the (theoretically) feasible applications of CAA open to the institution in terms of their risk:return relationship. This area can be visualised as a 'risk:return envelope', in a similar way that aircraft have a definitive flight envelope, depending on certain criteria (anything outside of the envelope and the aircraft will not fly). A CAA application that lies outside of the 'risk:return envelope' would not be a feasible option. Point A represents an application that provides

the least amount of risk for any given level of acceptable return and point B represents the application providing the maximum amount of return for any given level of acceptable risk. A line can then be drawn between points A and B, along the feasible solution boundary, linking all of the applications that have the highest rate of return for a given rate of risk. Such a line is deemed to be the risk efficient frontier (Simon *et al.*, 1997; Chapman and Ward, 1997), which is shown as a smooth curve here for illustrative purposes. Once on the risk efficient frontier, an application that yields a higher rate of return can only be achieved, *ceteris paribus*, by accepting a higher rate of risk. Likewise, in order to move to an application with a lower rate of risk then a lower level of return would be expected. A desired level of risk efficiency (dependant on individual and institutional risk propensities) is shown as point 'x'.

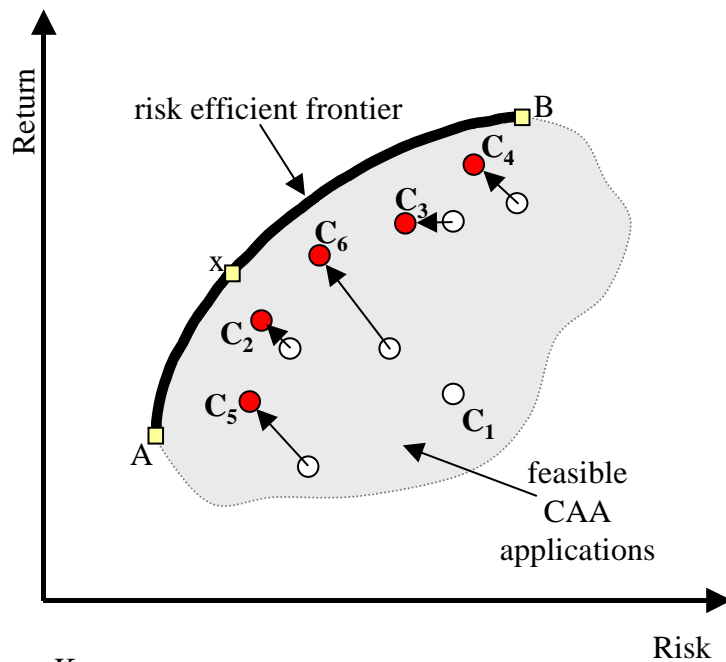
Figure 2: Theoretical risk efficiency framework for the CAA pilot study



It is important to view the above diagram as a theoretical concept (the position of the points are relative to each other rather than 'real' measures). Figure 2 shows how each of the cases were (theoretically) away from the risk efficient frontier. Due to the lack of formalised project risk management, the risks experienced in Case 1 for instance were largely still apparent for Case 2, etc. This paper contends that on-going risk analysis has a role in making the CAA enterprise more risk efficient. Consider what might have been achieved had the CAA analyses described here been run iteratively: risks evident in Case 1 could have been analysed with the Case 2 team and thereby largely avoided using Simon *et al*'s (1997) model. In the same way, new risks uncovered in

Case 2 would inform the execution of Case 3, and so on. Although four out of the six applications ran successfully, we might have had a wholly successful outcome if the discovered risks had been fed back into successive applications. In effect, the adoption of project risk management could have migrated each subsequent CAA closer to the risk efficient frontier (see Figure 3), and ideally towards point 'x'.

Figure 3: Risk efficiency migration due to project risk management



Key:
A : Minimum risk x : Desired risk efficiency
B : Maximum return C_{1...6} : Cases 1 to 6

With the benefit of hindsight, it is suggested that the CAA pilot project should have used a formalised project risk management process throughout. As well as the risk efficiency argument, the benefits of a PRAM process (adapted from Simon *et al.*, 1997, p.46, in the context of CAA applications) are given as:

- Enables better informed and more believable plans, schedules and budgets
- Increases the likelihood of a project adhering to its plans
- Allows a more meaningful assessment of contingencies
- Contributes to the build-up of statistical information to assist in better management of future projects
- Enables a more objective comparison of alternatives

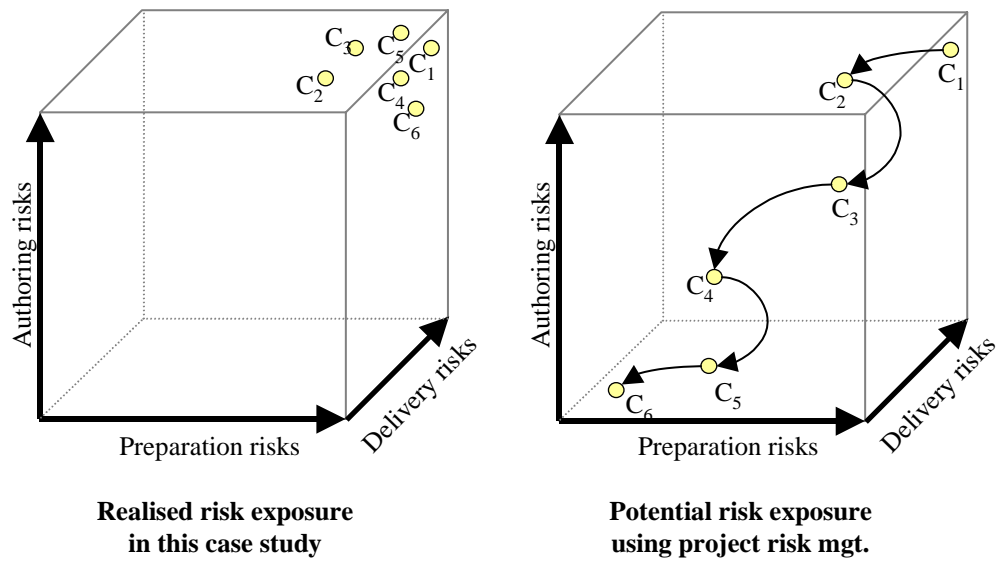
- Identifies, and allocates responsibility to, the best risk owner
- Improves general communication
- Leads to a common understanding and improved team spirit
- Assists in the distinction between good luck / good management and bad luck / bad management
- Helps develop the ability of staff to assess risks
- Focuses attention on the real and most important issues
- Facilitates greater risk-taking, thus increasing the benefits gained
- Demonstrates a responsible approach to customers

Hillson (1997) provides a useful concept of modelling an organisation's level of risk maturity. The output of the model comprises of four levels of risk management maturity: 1) naïve, 2) novice, 3) normalised, and 4) natural. Reflection on this case suggests that current risk management maturity for CAA implementation is progressing to level 2 as a result of the developments in this paper. Along with being able to identify the current level, Hillson (1997) also suggests that the model can assist an organisation to identify areas for improvement thus a gradual progression to higher levels of risk management maturity.

Conclusions

The six cases presented here are of 'first time' applications of Perception to replace existing assessment practices. As such, they are deemed inherently more risky than repeat applications of subsequent tests. This paper argues that an iterative approach to formalised project risk management would enable a corpus of risk knowledge relating to introducing CAA to be built up within the institution. Over the lifetime of the pilot study, learning from one case to another, the trend of total risk exposure should thereby move progressively from being risk inefficient to more risk efficient (see Figure 4) so that a full-scale system could be released that already catered for the greatest risks. In doing so, the institution would become more risk mature (Hillson, 1997).

Figure 4: Decay of risk exposure through iterative risk management



This paper then draws a new link between the *project* risk management and CAA literatures. Some examples of actual risks (technical, administrative and authoring) experienced when introducing CAA are provided. Some risk scholars argue though that risk 'check-lists' are inappropriate since risks are context specific, others see that it is the process of generating the list of possible risks that adds value rather than the risks *per se* (Carter, 1972). Despite these reservations, the risks identified here should provide a good starting point for those who are implementing a large-scale CAA system. The risks identified in this cross-case analysis also resonate well with those found by Zakrzewski and Steven (2000). An additional benefit of the iterative risk analysis approach advocated here though is that it would apply lessons learnt immediately to the next CAA application rather than waiting for the annual 'round up' (2000, p.213).

Ultimately, the shift from 'traditional' to computer-assisted assessment is conditional on tutors being convinced that the new risk: return relationship in doing so is personally acceptable. We conclude that the application of formalised project risk management will enhance the risk: return relationship, thereby increasing the adoption of CAA within an institution.

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