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# Technologies for Integrated Assessment and Selection Systems

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## Introduction

This paper looks forward from the last Nato review of computer-based assessment (CBA) of military personnel (Burke and Van Raay, 1993; see also Burke, 1993, and Burke et al., 1995). At the time of that report, research and development among Nato nations could be summarised according to three areas of work:

- Desktop systems delivering traditional tests and questionnaires as well as more dynamic tasks developed from paradigms from cognitive psychology, using LANs and WANs, and from which the principle gains were the increased reliability and reduced costs from automation of the assessment process. Systems characterising this approach included those developed by the Royal Air Force (RAF) in the UK for officer and aircrew selection (Burke, 1992, and Burke et al., 1994), Project A in the US, Taskomat in the Netherlands and the ESPACE system in France.
- Simulation-based assessment (SBA) systems for delivery of sophisticated work sample measures usually administered after prior screening using paper-and-pencil or desktop tests and questionnaires, and developed for selection to high risk/high cost roles such as aircraft pilot. Systems characterising this approach included the CAPSS system in Canada and the GUTS in Belgium, as well as a range of systems developed in Germany. The primary focus of these systems was increased validity and reduced training costs against which the substantial costs of SBA development and administration could be recovered.
- Adaptive testing systems that sought to exploit capabilities unique to CBA in delivering tailored testing (i.e. measurement geared to an individual's level of ability). The US CAT-ASVAB programme stands as the most

substantial work in this area to date. As well as adaptive testing, the late 1980s and early 1990s also saw the advent of item generation techniques in which item engines contained in the test software produce the item or task on-the-fly during a test administration. The UK British Army Recruit Battery (BARB) system was the first item generative system to go live in military assessment, though the same methodology was also used to produce fixed parallel forms of paper-and-pencil tests for the Royal Navy (the ABC test battery).

The driver for the development of these systems was the expectation of gains in the utility of military selection processes. Utility is defined as the financial gain from a selection process and, as shown in Equation 1, is dependent on a number of factors:

- The validity of the process in predicting the outcome of interest (e.g. training success, job performance, turnover) as represented by  $r_{xy}$  in Equation 1.
- The selection ratio or average quality of those selected as shown in the equation by  $\bar{Z}_x$ .
- The variability in performance as represented by  $SD_y$ .
- The numbers selected or  $N$ .
- The cost of the process as represented by  $C$ .

$$U = (\bar{Z}_x \cdot r_{xy} \cdot SD_y \cdot N) - C$$

**Equation 1: Utility of a selection process**

The driver of greater utility still stands and, while specific numbers will not be quoted, what follows in this paper is the outline of a process that seeks to maximise  $U$  by ensuring the attraction of applicants, the sifting of those applicants through an integrated framework, and the management and

harvesting of data through the backbone offered by the model suggested.

### Technology today six years on

Bartram (1999) has recently provided a summary of developments in the technologies underpinning CBA that serves to update the field of play since 1993. Among the most significant developments are:

- Widespread availability of inexpensive high-powered computers either at work, home or places of learning (e.g. colleges, universities, libraries).
- Greater reliability in software and hardware, critical to CBA systems.
- Improved user interfaces and facilities such as sound and video cards.
- Greater connectivity with the advent of the internet and e-commerce.
- Greater convergence towards common standards for hardware and software, which has brought with it the capability to deliver more sophisticated applications over networks and the internet.

To these can be added ever increasing connectivity such as surfing the web from home television sets (or, for that matter, any place in which a person is sedentary for any period such as their car), and ever increasing transportability as offered by access to the internet or company intranets (or, indeed, extranets) via mobile phone and palmtop technology, technologies by the way encouraged by military requirements such as battlefield communications.

It is also worth mentioning some of the statistics now being quoted for the internet to give a sense of the real impact this is having on the recruitment and selection market (again, I am grateful to Dave Bartram for these statistics):

- There are currently estimated to be 130 million internet users world wide, and this is expected to double in the next five years.
- By 2002, predictions suggest that 98% of large companies, 85% of medium sized and 45% of small companies will be online.

In relation to the recruitment market, the launch of the LAI Compass site by SHL in the USA resulted in 40,000 hits within the first few days, far greater

than expected. In the UK, the launch of the Korn/Ferry site drew 10,000 hits within the first six weeks. A recent Institute of Personnel Development report issued in the UK shows that the use of internet recruitment had grown to 32% of UK companies by May of this year (IPD, 1999). The most frequently visited sites in the US are those with the word *career* in their URLs.

Today, then, the biggest contrast with what was CBA state-of-the-art in 1993 is the advent of distributed assessment and this will be the focus of the model described next.

### A model for a distributed assessment system

Figure 1 below shows a template for a process supported and delivered by a Distributed Assessment System or DAS. What this template shows is, in fact, a process that will be familiar to those operating in recruitment and assessment. However, as shown by the vertical arrow, what differentiates this as a DAS includes:

- The component parts of the system are integrated in that each stage generates data that feeds into a rolling profile of the individual applicant. The assumption is that the system is constructed to capture data related to a clear competency profile or library of such profiles. Thus, rather than, let us say, an application form stage and a subsequent CBA stage operating as discrete elements with different rules and types of outputs, they are parts of an integrated system using a common assessment framework into which all data flows.
- That the cost of the assessment transactions at any stage of this process are actively managed by a systematic approach that also adapts the breadth and depth of the assessment dependant on the volumes handled at any one stage. So, breadth rather than depth of the assessment are the focus at the initial stages where volumes are high, while depth and breadth of assessment are introduced at those stages where they become more cost effective.
- At each stage, data can be mined to deliver a risk analysis to support decision making. At the first stage, decisions might be made using a minimum standards approach (in UK language a minimum competence approach), eliminating those falling into the higher risk categories. This *select-out* focus can be changed at the later stages to a *select-in*

principle, and issues such as placement (i.e. which role or career track should the person be assigned to) can also be actioned (indeed, this could be an aspect of the system built in at the earlier stages).

- Data is available for transmission within the organisation so that geographical spread of decision-makers is no longer a problem. For some organisations where geography is not a problem, it is the geography of the applicant that is catered for. For those organisations where the geography of decision-makers is an issue, then the geography of both applicants *and* decision-makers is catered for.
- The added value of the data culled and mined through this process does not end when a selection decision is made. When the person selected enters service, then the data gathered on their competencies, their strengths and development needs, also enters with them. As such, the DAS shown in Figure 1 is effectively the front end of a Human Resources Information System (HRIS) which is populated with data by applicants, and which the organisation can then mine for training and development purposes as well as making selection decisions.

The added value of DASs to public relations, fairness and diversity, and to extending the reach

of psychological assessment. The most obvious candidate as an assessment tool for the first, high volume stage of this system is biographical data (biodata). However, the potential for such a tool is greater than simply capturing data. As will be shown in the presentation, while *e*-recruitment is growing fast, it is also dominated by CV (or resume) machines which vary in their sophistication from electronic forms (i.e. simply replacing a paper form) to text search machines. Yet, neither actually seize the benefits of either automated processing (the electronic forms have to be read by someone either on screen or on hard copy, so the grunt work remains) or of a valid psychometric backbone (while resume machines are in use in the UK, the IPD report mentioned earlier also cites the issue that companies are finding the quality of those recruited via the internet to be moderate to poor).

The extension of the biodata component of a DAS serves a number of very important purposes. First, research consistently shows that softer items (such as those tapping competencies) are as, if not more, valid predictors of performance than harder items about qualifications, education etc (see Stokes et al., 1994, for examples). So, building on the competency profiling that gives the DAS its shape and purpose, biodata feeds directly into the rolling assessment described earlier (indeed, in the US, harder biodata items generally only serve to operate as gross negative disqualifies or GNDs in

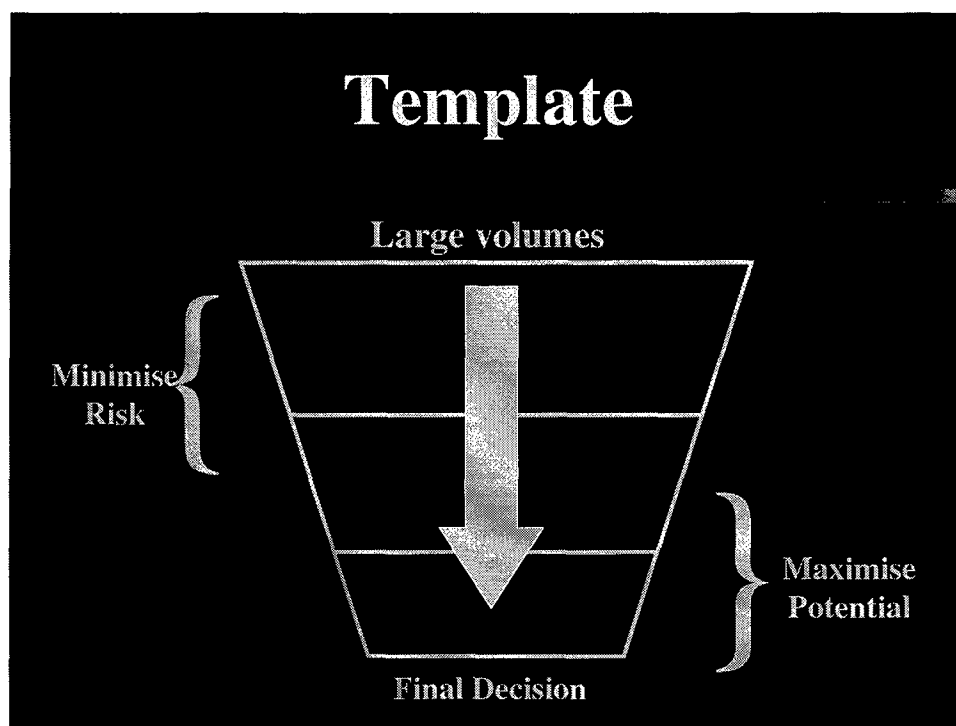


Figure 1: Model of a Distributed Assessment System for Selection

terms of the absolute must-haves for a job such as driving license or absence of a criminal record). Second, research also shows that biodata has minimal adverse impact on minority applicants. As such, the inclusion of competency based biodata instruments in the DAS, and rolling this data into other data collected at later stages, not only improves the cost management of recruitment through the DAS, but also adds to the validity and fairness of the final selection decisions.

The third aspect of the DAS at the front end that competency biodata can serve is that of public relations. First, on-line support can be provided to those coming onto the recruitment site (the *whats* and *whys* of the job, role or career track, as well as the *how* of the application process), but also feedback on the outcome of this first assessment can also be provided. Thus, applicants get a faster turnaround to their application, but they also get added value in a diagnostic against the competencies for the job and not just a well-done or goodbye letter. What is more, assessment serves as a vehicle for attraction in an increasingly competitive employment market.

Much of the latter functionality (though not the competency based biodata assessment) can be found on the British Army recruitment site (one that has won many awards for its innovation). Another aspect of that site also feeds into one future aspect of a DAS that will serve to close this paper. The British Army site has the Army Challenge that comprises a series of screens through which the applicant engages in a battlefield problem. This serves to give the site life and to inform the applicant's decision to apply or not (i.e. an interactive realistic job preview). It also demonstrates that other forms of assessment can be deployed at the very earliest stages of the DAS. In the presentation, I will describe dynamic assessments currently being developed that incorporate elements of the situational judgement (Motowildo et al., 1990) and naturalistic decision-making (Klein et al., 1993) paradigms in psychological assessment. To this can be added the possibility of also including elements from the assessment centre approach at any stage within the DAS. Thus, the capability of a DAS to provide a range of assessments at any selection stage is considerable.

### Some concluding comments ...

I hope that this paper has served to convey the potential of the DAS concept with which SHL and

others are now actively engaged, and that DASs represent a new threshold for assessment and selection systems for military officer. The driver in terms of utility that was there in 1993 remains today, and rightly so. However, the potential of what was being offered in 1993 can now be extended within distributed assessment to an effect that was not imaginable when RSG 15 drew up its report. Furthermore, the term system becomes all the more powerful with a DAS that has a valid psychometric backbone and that operates as the front end of a HRIS. With tomorrow's world already upon us, one of the key challenges for officer selection must be the development of DASs today.

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About the author. From 1980 to 1993, I served as a research psychologist through to project manager on various RAF and UK MoD projects developing and validating both paper-and-pencil and CBA systems. From 1986 to 1988, I had the fortune to serve for two and a half years as an exchange psychologist with the then Air Force Human Resources Research Laboratory (AFHRL). Since leaving the MoD, I have authored the Pilot Aptitude Tester (PILAPT) system in use with several European military and civilian services, as well as other CBA systems for organisations such as the London Fire Brigade. In 1998, I was appointed as UK R&D Director for SHL with responsibility for developing assessment systems. Since 1995, I have also served as Chair of the British Psychological Society's Steering Committee on Test Standards, and was elected as a Council Member of the International Test Commission in 1998. My e-mail address is [eugene.burke@shlgroup.com](mailto:eugene.burke@shlgroup.com).