UK PASSPORT SERVICE BIOMETRICS ENROLMENT TRIAL

Report

May 2005

Atos Origin

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Management Summary

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Contents

1 Management Summary

1.1 Introduction

1.1.1 Background

The Trial, commissioned by UK Passport Service (UKPS) in partnership with the Home Office Identity Cards Programme, Driver and Vehicle Licensing Agency (DVLA) and implemented by Atos Origin, is part of a series of Trials contributing towards the plans for a national identity cards scheme, and the international drive for increased document security. More than 10,000 participants were involved during the Trial period (from April to December 2004). The results from the Trial are intended to help inform the Government's plans to introduce biometrics to support improved identity authentication and help prevent identity fraud.

1.1.2 Objectives

The goal of the UKPS Biometrics Enrolment Trial was to test the processes and record customer experience and attitude during the recording and verification of facial, iris and fingerprint biometrics, rather than test or develop the biometric technology itself – it was not a technology trial. A one-off, integrated solution, which used the latest technologies available at the beginning of the Trial, was designed to address the specific objectives of the Trial.

The Trial covered:

- testing the use of biometrics through a simulation of an application process
- inclusion of exception cases, e.g. people who may have difficulties in enrolment
- measurement of the process times
- assessment of customer perceptions and reactions
- testing fingerprint and iris biometrics for one-to-many identification and testing facial, iris and fingerprint biometrics for one-to-one verification

The purpose of this report is to document the key findings of the UKPS Biometrics Enrolment Trial. The report does not investigate the reasons behind the findings, nor does it suggest technology fixes for any of the issues encountered – these may be addressed in further trials.

Evidence contained within the report has demonstrated that the above objectives have been successfully achieved.

1.1.3 Trial Conduct

The Trial prime contractor was Atos Origin whose responsibilities included the overall project management including the design, build and support of the Trial equipment and software, and analysis of data collected during the Trial. UKPS, Home Office Identity Cards Programme, DVLA and Atos Origin would like to thank all contributors to the Trial especially the participants, the staff from UKPS, DVLA, the Post Office, Newcastle Registrar's Office, MORI, Disability Matters Limited (DML) and the technology partners of Atos Origin.

The Trial had originally been scheduled to run for 6 months starting on the 2nd February 2004, but actually began on the 14th April 2004. Testing the enrolment system outside of ideal laboratory conditions, with people unaccustomed to interacting with biometric devices identified some technical / interaction problems. Such problems are not unusual when using emerging technology, but had to be overcome before the Trial of 10,000 people could commence. The Trial ran for 8 months instead of the scheduled 6 months. This was due to the difficulty of recruiting the required diversity of people for the biometric sampling.

At the end of the Trial, all personal biometric data was destroyed.

1.1.3.1 Trial Samples and Recruitment

The participants were recruited in three different sample groups with10,016 participants being recruited against an original target of 10,000.

The three sample groups recruited were:

- a Quota sample of 2,000;
- an Opportunistic sample of 7,266 (original target 7,000) and
- a Disabled participant sample of 750 (original target 1000).

Each of the three sample groups had a different recruitment strategy.

A nationally representative quota sample of 2,000 participants was chosen to match the population. A 2,000 sample is commonly used in survey research as it provides robust data (accurate to within +/- 2.2 percentage points) at the aggregate level while also allowing for robust demographic and other sub-group analysis of the results. As a result, for this survey, a sample of 2,000 was considered the optimum.

The Opportunistic sample was recruited from the area around the centres and within the centres themselves. Recruitment of Opportunistic participants was not based on any demographic factors.

Although, initially a target of 1,000 members of the disabled community were to be invited to participate in the Trial, this was reduced to 750 part-way through. A sample size of 750 is sufficient to undertake major demographic and other sub-group analysis. The impact of this reduction on the accuracy of the results provided by this group is marginal. The level of accuracy in the results among the achieved sample of 750 participants is +/- 3.6%, compared to +/- 3.1% for 1,000 participants. Disability Matters Limited are satisfied with the approach taken and have stated "The biometrics trial has taken comprehensive

consideration of the needs of the disabled community by encompassing a pan-impairment approach. We have been impressed with the way that disabled people have been actively involved in this project. Now there is only a small amount of further work needed to implement the final approach necessary to ensure a barrier free service to the UK's 9 million disabled citizens".

All of the data has been analysed by a range of socio-demographic and other factors. This analysis is presented, in full, within the charts in the report. Where comparisons have been drawn in the report between population groups, they are statistically significant. Some sample sizes for sub-groups were not statistically significant and no comparisons have been drawn between them, nor should those results be used for comparative purposes.

The Trial participants consisted of volunteers and are therefore self-selected so their expressed views may not be wholly representative of the UK population.

1.1.3.2 Enrolment Process

Enrolment initially took place at four fixed centres: London, Leicester, Newcastle and Glasgow and one mobile enrolment centre which visited 23 different locations. Towards the end of the Trial, two further enrolment centres were established at Swansea and Newcastle (Longbenton).

The biometrics booth was a purpose built oval booth containing the biometric enrolment devices. The camera was mounted on the wall of the booth above a desktop surface. On top of the desktop was an electronic signature pad and sunk into the desktop was the fingerprint device. The participant sat on a standard office chair within the booth while being enrolled, or in the case of wheelchair users in their wheelchair in the booth. The operator sat just outside the booth, but still maintained visual contact.

The enrolment process covered the following stages: Registration; Photograph participant (head and shoulders); Record facial biometric; Record iris biometric; Record fingerprint biometric; Record electronic signature; Print card; Post-enrolment questionnaire; Verification; Post-verification questionnaire.

1.1.4 Terminology

This report recognises that people who comply with the Disability Discrimination Act (1995) definition of disability prefer to be called either a "person with a disability" or a "disabled person". This report has adopted the term "disabled people" or "disabled participants" as it mirrors the terminology used in the Cabinet Office Strategy Unit publication "Improving the life chances of disabled people" www.strategy.gov.uk published in 2005. The term "person with a learning disability" has also been used. However this could equally be interchanged with "learning difficulty". In some tables and graphs it has been necessary to make an abbreviation where BME has been used for Black and Minority Ethnic People and "disabled" for disabled people without any intention of causing offence.

Throughout this report, where a difference is stated (e.g. those aged 18 - 34 against those aged 35 - 54), the differences are statistically significant, unless stated otherwise. In this case, statistically significant means that 95 times in 100, the results compared represent a true difference between the two groups and are not simply the effect of enrolling and interviewing a sample of, rather than the whole, population.

Where an observation is stated it is not implying a causal relationship but it is nevertheless a valid finding.

1.2 Key Findings

1.2.1 Biometrics Process Findings

1.2.1.1 Introduction

The testing of the biometric technology itself was not one of the objectives of the Trial, rather the Trial aimed to test and measure the processes around the recording and verification of biometrics through a simulation of an application process. The Trial results quoted below are a sample of the key findings and many more findings are described in the body of the report. They are specific to the particular software and hardware configurations used in the Trial. The Trial databases were pre-loaded with 118,000 irises and 1 million fingerprints. Although the findings give results for each of the three biometrics, comparisons should be made within each biometric and not between biometrics. The Trial was set up with no attempt to compare the accuracy of the different biometrics.

1.2.1.2 Enrolment & Verification Timings

Enrolment times

- Overall enrolment times were calculated from the point at which the operator retrieved the participant's details from the system in order to start enrolment, to the point at which the operator accepted the participant's signature. The enrolment times that follow also include the time taken for a one-to-many database search which took on average 90 seconds.

- For Quota participants, successful enrolment on all three biometrics took on average 7 minutes 56 seconds. All attempted enrolments took on average 8 minutes and 15 seconds.

- For Disabled participants, successful enrolment on all three biometrics took on average 9 minutes and 43 seconds. All attempted enrolments took on average 10 minutes and 20 seconds.

Verification times

- The average times for Quota participants were 39 seconds for facial verification, 58 seconds for iris verification and 1min 13 seconds for fingerprint verification. The average times for Disabled participants were 1min 3 seconds for facial verification, 1min 18 seconds for iris verification and 1min 20 seconds for fingerprint verification.

1.2.1.3 Enrolment Success Rates

General

- The majority of participants from all sample groups successfully enrolled on all three biometrics. The success rate was higher for Quota participants than Disabled participants. All Quota participants were able to enrol successfully on at least one biometric. A small percentage (0.62%) of Disabled participants failed to enrol on any of the biometrics.

Facial enrolment success

- The majority of participants in all sample groups successfully enrolled their facial biometric, with success rates of nearly 100% for Quota participants and 98% for Disabled participants. Analysis showed that the factors which most affect the success rate are environmental, in particular the lighting conditions at different locations.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for the Quota participants.

- Maintaining the correct position for facial biometric enrolment was a problem for some Disabled participants with a physical impairment or with learning disabilities.

Iris enrolment success

- The majority of participants in all sample groups successfully enrolled their irises. There were success rates of around 90% for Quota participants and 61% for Disabled participants. Enrolment operators felt that the lack of feedback from the iris camera made it difficult for them to establish reasons for enrolment failure and to advise corrective action.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for Quota participants.

- Iris enrolment success varied according to the participant's ethnic group and age. Asian and White participants had higher success rates than Black participants. Participants that were aged under 60 had higher success rates than participants that were aged 60 or over.

Fingerprint enrolment success

- The majority of participants in all sample groups successfully enrolled their fingerprint biometric, with success rates of nearly 100% for Quota participants and 96% for Disabled participants.

- The enrolment success rate for Disabled participants was much lower than the enrolment success rate for Quota participants.

- Participants with a learning disability and participants with a physical impairment had lower fingerprint success rates than other Disabled participants and than Quota participants.

1.2.1.4 Verification Success Rates

Facial verification success

- Of the three biometrics, the lowest verification success rate occurred with the face. The success rates were 69% for Quota participants, and 48% for Disabled participants, however disability was not a factor. The majority of Disabled participant verifications took place in the mobile enrolment centre where lighting conditions adversely affected all facial verifications.

- Changes in the participant's appearance also caused verification to fail.

- The facial verification success rate was higher for participants aged under 60 than it was for those aged over 60.

Iris verification success

- The majority of participants who verified on iris were successful, however the success rate for Quota participants (96%) was significantly higher than that for Disabled participants (91%).

- It was observed that although many participants who wore glasses and who verified on iris did not have a problem, a small number of participants with glasses failed verification when they wore their glasses and passed when they took their glasses off.

- The iris verification success rate was higher for younger participants than it was for older participants.

Fingerprint verification success

- The majority of participants achieved successful verification on fingerprint, with rates of 81% for Quota participants and 80% for Disabled participants. One of the factors influencing failure was that the single fingerprint device used for verification occasionally did not record sufficient detail from the fingers.

- Younger participants had a higher fingerprint verification success rate than older participants.

1.2.2 Customer Perceptions and Reactions

1.2.2.1 Introduction

A key objective of the Trial was to assess customer perceptions and reactions. The aim was to understand areas such as *how comfortable* or *how private* participants felt and *how quick* the process was compared to expectations. The Trial results quoted below are a sample of the key findings and many more findings are described in the body of the report.

They are largely a feedback of a participant's direct experience of the process and 'user friendliness' of the enrolment and verification stages - but also their experience of the whole process and its individual components.

The opinions expressed by the participants may not be wholly representative of the UK population.

1.2.2.2 Customer Experience

All Participants

- In general the experience results from all groups follow very similar patterns in the balance of positive responses to negative responses for all of the main questions.
- Across all three biometrics, the vast majority of participants found their expectations of the overall experience to have been either met or bettered.
- Given the Trial booth locations and environments, generally booth privacy was not an issue
- The level of intrusion across all three biometrics, in relation to participant expectations, was not an issue.
- Across the three biometrics, participant experience of 'positioning' for iris enrolment was the only concern – with 31% of Disabled participants finding the positioning for the iris recording 'very' or 'fairly' difficult.
- Iris was selected as their preferred biometric by Quota participants. The iris biometric was tied first choice – with the fingerprint biometric – for Disabled participants.

Quota Participants

- In general the younger age groups had a better than expected 'level of intrusion' experience of enrolling their biometrics.
- The 55+yr age group found it more difficult to position themselves for the fingerprint biometric than the 18-34yr and 35-54yr age groups.
- The top two reasons for a participant's overall experience of the iris enrolment being worse than expected are 'time taken to record' and 'the need to stay still'.
- Iris was the preferred biometric for both males and females. For males this was a clear preference, but for females, many also preferred fingerprints. The two sectors were closely tied on their preference for the facial biometric.

Disabled Participants

- The recording of the iris biometric scored lowest, compared with the other biometrics, for participant experience of 'time taken' (against expectations).
- The iris biometric scored lowest for the participant booth positioning experience being 'very' or 'fairly' easy.
- The iris biometric scored lowest for 'overall experience' being 'much' or 'a little better' than expected. Hearing impaired participants gave the least positive response to the question about iris biometric overall experience.
- Participants with three of the four impairment types, visual and hearing impaired and learning disability, opted for the fingerprint biometric as their preferred biometric.

1.2.2.3 Customer Attitude

As a follow up to their experience of the Trial, participants were asked about their attitude towards the concept of biometrics as part of an individual's passport, as well as the general concept of biometrics and their potential contribution to key national questions.

All Participants

- Whilst the majority of participants were 'not very' or 'not at all' concerned about having their biometrics recorded prior to enrolment, there was more concern felt within Disabled participants and in particular for the iris biometric.
- Across all three biometrics and all three groups, the total number of participants 'fairly' or 'very' concerned about having their biometrics recorded after enrolment dropped when compared with pre-enrolment.
- The majority of participants felt biometrics would help with passport security, preventing identity fraud, preventing illegal immigration and are not an infringement on their civil liberties.

Quota Participants

- The BME and the 18-34yr sectors were most concerned about having their biometrics recorded prior to enrolment.
- Post enrolment the level of concern in the BME and 18-34yr sectors fell but was still higher than for other sectors.

Disabled Participants

- Prior to enrolment, of the four impairment types, participants with visual, learning or hearing impairments scored iris as the biometric they were most concerned about.

- Post enrolment, the level of concern amongst those with a visual impairment has dropped most dramatically across the three biometrics when compared with pre-enrolment levels.

1.2.3 Process and Environment Findings

- While booth design permitted all wheelchair users to enter the booth, it did not allow large wheelchairs to get close enough to the camera.

- Environmental design is a factor in successful facial enrolment. Lighting needs to be bright enough that the face is evenly lit but must not be reflected from the skin or glasses.

- Lack of feedback from the iris camera to the operators made it difficult for them to establish the reason for enrolment failure, and to take corrective action.

- The process did not allow successful fingerprint enrolment for participants who had some fingers that passed the quality checks within fingerprint enrolment and some that failed the quality checks.

- The enrolment failure of some participants could have been a temporary one e.g. where the participant had an eye infection or had a bandaged finger.

- Facial verification was affected by location because of the different environmental conditions in each enrolment centre.

- The actual time taken to go through the enrolment process and the customer perception of whether the process was quick or slow did not always correspond.

1.3 Recommendations

Valuable lessons have been learned from the Trial and there are some specific recommendations which need further consideration:

Recommendation 1 The camera should be manoeuvrable enough to allow it to be positioned to accommodate wheelchair users and others for whom the current arrangements limit access. Environment design needs to ensure that the camera height can cater for full height range found in the UK population

Recommendation 2 Applicants need to remove any headwear before facial biometric enrolment. If removal is unacceptable, then the applicant must arrange the headwear so that it does not obscure the face or forehead.

Recommendation 3 Consideration needs to be given to the process for enrolment where one of the biometrics may not be fully available but only on a temporary basis e.g. the applicant could have a bandaged finger or an eye infection.

Recommendation 4 A number of measures need to be put in place for the enrolment of disabled people. Operators need to receive disability awareness training and an understanding of assessment techniques as they impact upon disabled people. Consideration needs to be given to having some specially trained operators to enrol certain disabled people. It would not be immediately apparent when someone is attempting enrolment that they need a specially trained operator. A management plan is required to ensure that the service being offered is not a lower standard service for disabled people by requiring them to visit again for assessment to meet a specially trained operator, as this is liable to contravene Part III of the Disability Discrimination Act 1995.

Recommendation 5 A further trial is needed specifically targeted towards those non-disabled groups where enrolment difficulties occurred because of environment design. The targeted groups should include participants of differing heights, and for lighting issues, those participants where lighting seemed to affect facial biometric enrolment.

Recommendation 6 In the same way as applicants can enrol on fingerprints even though some fingers are missing, applicants need to be able to enrol even though some fingers may provide unacceptable prints, for example because of scarring.

Recommendation 7 The verification process should allow a limited number of further attempts to pass verification when the first attempt fails.

Recommendation 8 A large single fingerprint scanner platen for verification is required. It was observed that the single fingerprint scanner platen used in the Trial was at times too small to scan a sufficient area of fingerprint from participants with large fingers.

Recommendation 9 A test rig should be developed to allow different biometric devices to be tested to ensure effective and efficient biometrics enrolment and verification. It is important that tests are performed in laboratory conditions prior to commencing further trials.

Recommendation 10 Consideration needs to be given to targeted education initiatives to address some of the specific results from the customer experience and attitude questions.

1.4 Areas for Further Investigation

The Trial results have highlighted several issues that require further investigation or work, which will further inform Government plans to introduce biometrics.

- Further trials are needed, specifically targeted towards those disabled groups where enrolment difficulties occurred because of environment design, or because of the ergonomics of the biometric device design. These trials should test out different types of environment design (from recommendation 1) and different designs of biometric device. The trials need to capture the participants' experience and feedback, possibly through the use of focus groups.

- Further trials are needed, specifically targeted towards those groups where enrolment difficulties occurred but they did not appear to be related to ergonomic factors. For example, black participants and participants aged over 59 had lower iris enrolment success rates. Further work is needed in this area to identify the reasons for this, and to identify solutions. This may then lead to further trials of the identified solutions which could entail using a range of different devices.

- A further trial is required to determine the effect of glasses on iris and facial verification – whether the failures are due to reflections or due to lens prescription. There were indications in the Trial that glasses, particularly those with vari-focal or bi-focal lenses, could cause iris verification to fail. However, this needs to be confirmed by a specifically designed trial.

About Atos Origin

Atos Origin is an international information technology services company. Its business is turning client vision into results through the application of consulting, systems integration and managed operations. The company's annual revenues are more than EUR 5 billion and it employs over 46,000 people in 40 countries. Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and has a client base of international blue-chip companies across all sectors. Atos Origin is quoted on the Paris Eurolist Market and trades as Atos Origin, AtosEuronext, Atos Worldline and Atos Consulting. For more information, please visit the company's web site at www.atosorigin.com