

Co-production of Actions and Activities at Airport Security Screening

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Abstract: In this paper we will examine passenger actions and activities at the security screening points of Australian domestic and international airports. Our findings and analysis provide a more complete understanding of the current airport passenger security screening experience. Data in this paper is comprised of field studies conducted at two Australian airports, one domestic and one international. Video data was collected by cameras situated either side of the security screening point. A total of one hundred and ninety-six passengers were observed. Two methods of analysis are used. First, the activities of passengers are coded and analysed to reveal the common activities at domestic and international security regimes and between quiet and busy periods. Second, observation of passenger activities is used to reveal uncommon aspects. The results show that passengers do more at security screening than being passively scanned. Passengers queue, unpack the required items from their bags and from their pockets, walk through the metal-detector, re-pack and occasionally return to be re-screened. For each of these activities, passengers must understand the procedures at the security screening point and must co-ordinate various actions and objects in time and space. Through this coordination passengers are active participants in making the security checkpoint function – they are co-producers of the security screening process.

Key words: *Airport security, co-production, observations*

1. Introduction

Over the last century airports have grown from small airfields into large entities that incorporate restaurants, retail and a myriad of other services. Airports of today are complex systems comprised of a large number of stakeholders. Airports are becoming increasingly customer focused [16] and there is recognition of the need for more research on passenger experience (e.g. [4,10]) but there has been limited research on passenger experiences [3,5,8,15,16].

One important aspect of the passenger experience is passing through the security checkpoint to the airside of the terminal. Research on security has often focused on improving the detection of prohibited items [7,12] or satisfaction with the process [2]. There is little research on the activities that passengers do when passing through security. This paper provides new knowledge on how what passengers do as they move through security.

A further motivation for this research are recent advances in service science [1,14,20,21] and service design [19] that have pointed towards understanding customers as co-producers of service experiences. However, these new models of service experience do not account for the contribution of non—human actors to the service

experience. As airport security is necessarily a negotiated interaction between people and things, it is an ideal case to empirically apply these insights.

At a typical airport security checkpoint passengers are required to unpack personal items (usually into a plastic tray) for an x-ray scan, walk through a metal detector, collect their personal items, repack and then move on. While these general activities are common to many airports, there are variations in security checkpoint spatial organisation and in legislative regimes that influence the activities passengers undertake. For example, passengers flying from Australia to foreign countries face restrictions on the amount of liquids, aerosols and gels (LAGs) they are allowed to take through security. Domestic air travel in Australia does not have the same restrictions. With ever greater security measures being put in place, such as the full body imaging scanners found in some American and European airports [7], it is important to understand how passengers pass through security. A greater understanding of how passengers “do” airport security will lead to improvements in efficiency by showing how current actions and the design of current security services could be improved. Understanding how passengers negotiate security-screening checkpoints could also lead to improvements in passenger experience by showing how the current experience is structured. Finally, by understanding the actions of passengers at airport security checkpoints it will be possible to achieve better security outcomes.

One step on the path to achieving these outcomes is to observe passengers to document and understand the “program of action” [6] of the security checkpoint.

2. Methods

Field studies were conducted at both one domestic and one international Australian airport. Observations were made of security screening at both airports. Security at the international airport was recorded on the 23/12/2010 while security at the domestic airport was recorded on the 10/2/11. The international airport had four security checkpoints open when observations were made. The international airport has six screening points in total, arranged in pairs. Figure 1 shows the plan of two of the four screening points. The domestic airport has one screening point, shown in Figure 2. Recordings were made over a period of approximately two hours at each airport that encompassed busy hour and quiet periods.

Video data was collected from the two airports using consumer-grade Canon HD video cameras mounted on tripods. Two cameras were used at each airport. One camera was positioned to capture the landside, or pre-security side, of the process and the other was placed to capture the airside, or post-security side. Data capture was timed to occur during the transition from “busy hour” – each airport’s peak time for passenger numbers” – to a quieter period. We consulted with the management of each airport to ensure that data was collected at appropriate times.

Viewing the videos showed that during periods of extreme busyness, analysis could not be completed as passenger actions were frequently obscured. During extremely quiet periods, several minutes with no passengers moving through the screening point could occur. As the purpose of analysis was to understand passenger actions during busy and quiet periods, the video from each airport was segmented into two 15 minute periods. The segments included one busy period and one quiet period. The busy segment was selected to include the greatest number of passengers observable without the mass of passengers obscuring observation. The quiet period was selected to include the minimum number of passengers before queuing was observed but not so quiet as to have no

passengers. The four segments, each of which included a landside and an airside view, were imported into Noldus' The Observer [13] for analysis. The two views of the screening point at each airport were synchronised so that both airside and landside views were observed simultaneously. This allowed tracking individual passengers as they moved through the screening process from airside to landside.

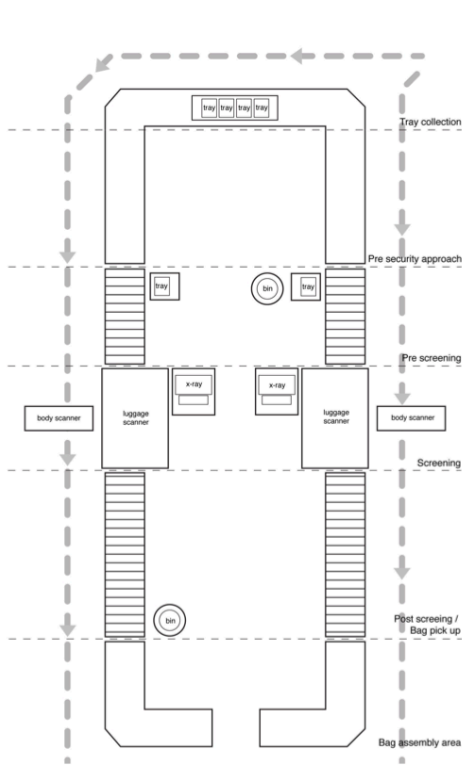


Figure 1: International airport security screening layout

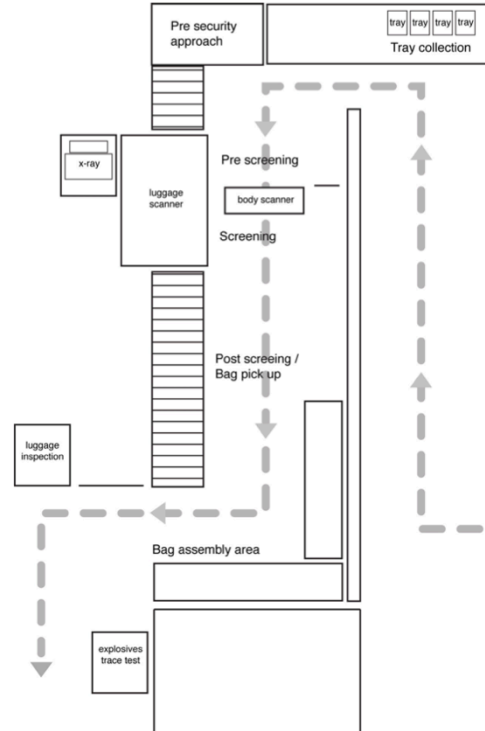


Figure 2: Domestic airport security screening layout

Analysis took the form of “coding” observed passenger activities. The activities coded were: Unpacking, Waiting in line, Walking through the metal detector, Waiting for luggage, Repacking and Waiting for others (Table 1). These activities were based on those that were seen in previous analyses of passenger activity at airport security [15]. These activities provide a consistent overview of what passengers do while passing through the security checkpoint. Two research assistants coded the videos independently.

Table 1: Coding scheme describing basic passenger activities at security screening point

	Code name	Description
1	Unpacking	Passenger is unpacking their luggage in the unpacking area of security screening point.
2	Waiting in line/queuing	Passenger is passively queuing at the security screening point
3	Walking through metal detector	Passenger is walking through the metal detector
4	Walking back through the metal detector	Passenger has failed the metal detector and is walking back through in order to be scanned again
5	Waiting for luggage	Passenger is passively waiting for the luggage to emerge from the x-ray scanner
6	Repacking	Passenger is repacking their luggage after it has emerged from the x-ray scanner
7	Waiting for others	Passenger remains in the security screening point security screening area and is waiting for companions to complete the screening process

Following coding of the videos, three passenger interactions were selected for a further analysis. These three videos were selected for further analysis by consensus between the coders. While it was agreed that the coding scheme captured the majority of the activities that passengers commonly perform, there were many instances of passengers performing activities that did not fit into one of the coding categories. The three interactions described in section 4 were selected as examples where the passengers performed several activities that could not be adequately described by the coding scheme. Together, the results of applying the coding scheme to the all activities observed in the videos and the detailed descriptions of the selected observations demonstrate that passengers play an active role in making airport security screening work.

3. Passenger Activities at Security Screening

This section describes the results from the two sets of data that were gathered. Because the two airports use different regulatory regimes, we do not present average times for passenger activities across both airports.

A total of 196 passengers were observed in the collected data. Table 2 shows the different numbers of passengers observed in each busy and quiet period at each airport.

Table 2: number of observed passengers in quiet and busy periods

Observation	Throughput in 15 minutes
International Quiet	18
International Busy	48
Domestic Quiet	45
Domestic Busy	85

3.1 International Airport

The data show that some activities take longer at the International airport when the security screening area is busy and some activities take longer when it is quiet (Figure 3). Unpacking and queuing activities take noticeably longer, on average per passenger, when the International airport is busy. Unpacking took 45 seconds on average when the airport was busy and 32 seconds when it was quiet. Passengers queued for 01:28 minutes and seconds during the busy period and 01:03 minutes and seconds during the quiet period. Walking through the metal detector

took seven seconds in both the busy and quiet states. Walking back through the metal detector took 4 seconds during the busy time and 3 seconds during the quiet time. The small number of passengers observed who had to walk back means that this specific result is indicative only. Passengers waited far longer for their luggage to emerge from the x-ray scanner during the busy period (20 seconds) than during the quiet period (7 seconds). Repacking took a similar amount of time during both periods 39 seconds during the busy state and 43 seconds during the quiet state. A small number of passengers waited for other people, for a typical time of between 20 and 22 seconds.

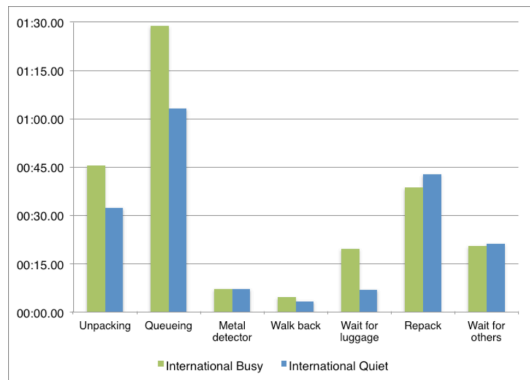


Figure 3: Average times per passenger at the International airport during quiet and busy times.

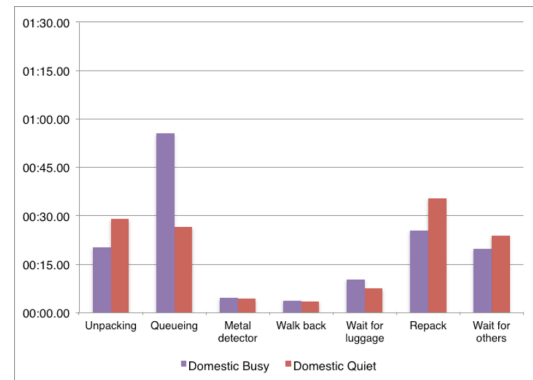


Figure 4: Average times per passenger at the Domestic airport during quiet and busy times.

Increased busyness at the International airport seems to most affect the times for unpacking, queuing and waiting for luggage with other activities showing only minor differences between the busy and quiet states.

3.2 Domestic Airport

At the Domestic airport, some activities took noticeably different times during busy and quiet periods (figure 4). Queuing took noticeably longer during the busy period at the domestic airport, with passengers in the queue for 55 seconds on average compared with 26 during the quiet period. Passengers also waited slightly longer for their luggage during the busy period, 10 seconds compared with 7 seconds during the quiet period.

Other recorded activities took longer on average during the quiet period. Passengers took longer to unpack (20 seconds busy; 28 seconds quiet), and longer to repack (25 seconds busy; 35 seconds quiet). The few passengers who waited for travel companions and wavers waited longer during the quiet period, an average of 23 seconds compared with 19 seconds during the busy period.

3.3 Summary of Passenger Activities

During the busy period at the domestic airport queuing time and the time that passengers wait for luggage but seems to increase while other activities take less time during the busy period, compared with the quiet period.

The main difference between the international and domestic airports was that unpacking activities took longer on average during busy times at the international airport and were faster during quiet times. Conversely, at the domestic airport, unpacking activities took longer when it was quiet than when it was busy.

This analysis offers a highly process-centered view of the activities of passengers at airport security. Other analyses of airport security processes arrive at a slightly different set of activities [17]. In presenting these seven

activities, or any activities, arranged in a sequence it is easy to consider them as indivisible and occurring in a fixed order. However, as the next section will show, these activities are interwoven with each other, and with other activities unrelated to the strict process of airport security, as passengers move through the security screening area.

4. Passenger Actions at Security Screening

The purpose of this section is to enrich the picture of passenger activities at airport security screening provided by the quantitative data in section 3. The purpose of presenting these ethnographic accounts of passenger activities at security is to demonstrate that the seven security activities described in the previous section are not indivisible but are complexly interwoven with each other and with other activities.

In the sections below we describe three cases. First, that of a woman who was initially prevented from passing through security because she had something that contravened the rules regarding liquids, aerosols and gels (LAGs). Second, we present the case of a man who had several large carry-on bags. Third, we describe how a family of four moved through the security screening point.

4.1 Young woman passenger

The time the screening point was transitioning from a quiet period to a busier period. A young woman with one large bag and one handbag arrived at the screening point at 19.01 mins (Table 3). She placed both bags on the unpacking table and arranged them for screening. She went through the metal detector and was asked by a security officer to return to the pre-screening area. A security officer brought one bag back to the pre-screening area. The passenger had a brief interaction with a security officer and then her second bag was also brought back. The passenger searched through one of her bags. The security staff member spoke briefly with the passenger while she was searching in her bag. After a short time the passenger briefly interacted with a security staff member, then closed up the luggage and walked away from the pre-security area, back to the back to the landside of the airport, taking her luggage with her. The passenger returned later, this time with only her handbag. After queuing again for security, the passenger had minimal interaction with security staff, put her LAGs in a clear bag provided by a member of security staff and proceeded through scanning without incident.

Table 3: Security interaction for young woman passenger

Action	Time (minutes and seconds from the start of video recording)
Arrives	19.01
Interact with gate staff	20.31
Go through screening	21.31
Re-enter pre screening	21.56
Walk away from security area	29.37
Return to security with only handbag	39.10
Goes through scanner for the second time	39.28
Walks away from post security area	40.45
Total Time Spent	21.44

When this passenger is told that she has a prohibited item that cannot be taken through the screening point, she chooses to completely abandon the security process and return to the check-in point. Clearly she returned to check-in and had her bag added to the checked-in luggage. This strategy seems to be a drastic measure but, if there is sufficient time remaining, this may be a preferable choice for a passenger than simply discarding a prohibited item. Having abandoned her initial pass through the security screening point, she returns after 20 minutes. On this interaction, having been made aware of the rules, she passes smoothly through the screening point.

4.2 Young man passenger

A young man with three large bags arrived at the security processing area during a quiet processing period (Table 4). He placed the bags on the pre-approach bench where he removed several items from them. He had quite a long interaction with a member of the security personnel as he unpacked his bags. He showed some objects to a security staff member while he was unpacking. He completed his unpacking and walked through the metal detector. His bags passed through the metal detector. He was then asked by a security screener to return to the pre-screening area. A member of security staff brought two of the young man's bags back, leaving one unattended at post screening. The man unpacked a laptop and then proceeded to interact with the security screener and his luggage for a long period of time (from 2.17 to 6.37). The security screener placed an item into the bin. The passenger continued to interact with 2 security officers. It appears that an item is placed into a clear plastic bag (possibly 2 bags). Security staff places an item into a blue tray. One of the security staff placed an item in the bin. The second security staff member placed another item in the bin. The man presented another item to the security staff (5.56). The security staff were then satisfied with the man's bags so he again went through the metal detector but was again required to go back. On returning again to the pre-screening area, he was required to take off his jacket and belt. He then interacted further with staff in the post-security area while appearing to sort luggage before proceeding to the passport checkpoint.

Table 4: Security interaction for young man passenger

Action	Time (minutes and seconds from the start of video recording)
Arrive at security	0.31
Hand media to security guard (gate security)	1.15
Go through scanner for the first time	1.29
Re-enter pre security area	2.14
Interact with luggage	2.17
Deal with LAGs	4.28
Hand item to security	5.56
Finish interacting with luggage	6.37
Go through scanner for the second time	6.55
Take off jacket and belt	7.08
Go through scanner for the third time	7.37
Walk away from post security	10.51
Total Time Spent	10.20

This passenger's relatively large bags, and his persistence in getting through security, even though two of his three bags were opened and manipulated, shows that his main goal was to get his bags through and that he was willing to wait and be inconvenienced in order to achieve his goal. The security officer actively helped the man to explore the boundaries of what could be brought through the screening point. The young man was unwilling to leave the screening point and allowed two of his belongings to be thrown away. The security officers performed their job professionally but the young man was able to make their actions part of his efforts to move through the checkpoint. This shows that a security officer's role can be shaped through their interaction with a passenger who is willing to take the time to explore the limits of the rules of security.

4.3 Family of four passengers

A family of four approaches security (at 43.47) with a woman leading, a younger girl, then an older girl followed by a man (Table 5). The woman places luggage on a tray before pushing the tray along. On the approach to the x-ray machine the woman searches the group's baggage (from 44.35 to 45.35). Both girls are responsible for sliding a tray along on the approach to screening. As the man approaches the tray collection area he is filling the out going passenger cards for the group. He also picks up a tray, places the tray on the bench and continues to fill out the forms while approaching the head of the queue. Before going through security screening the woman appears to hand something to the security guard standing in post security (46.08). She passes through the security screening checkpoint, and appears to collect something from the security guard (46.13). It was not clear what the item was. She then collects her luggage, and walks away with the younger girl (46.43), towards the waiting area. The older girl stays with the man. He interacts with a security staff member before the metal detector. Once he is through, a staff member moves a piece of luggage to the repacking area. The woman returns to the repacking area (47.00), though not directly next to the man, and places her luggage on bench. The older girl walks over to where the woman and younger girl are standing. The woman removes an object from her luggage, walks around other passengers and hands it to the man. She then interacts with a security staff member and the man's luggage. Both girls walk away from the security area towards the waiting area. The man then resumes filling out a form while woman interacts with security. Security disposes of something that was in the man's luggage. The woman re-packs the bag and the man and woman walk away from security.

Table 5: Security interaction for family passengers

Action	Time (minutes and seconds from the start of video recording)
Mother arrives at security	43.47
Searches bag for something	44.35
Hands item to security staff	46.08
Staff return item	46.16
Leaves security for waiting area	46.43
Returns to security for inspection	47.00
Walk away from post-security area	48.18
Total Time Spent	4.31

In this brief interaction, the family of passengers was involved in three concurrent interactions. First, they are negotiating the security screening point. Second, at least one of the family, the man, is actively preparing for the next upcoming processing point, passport control. Finally, they are also engaging in group interaction which is sometimes relevant to the task at hand but at other times is for other purposes. It was not clear from the video what the items were that caused the man's bag to be inspected, though as security disposed of it, it seems likely that it was a LAGs item.

4.4 Summary of Passenger Actions

These descriptions of passenger actions show how the seven passenger activities identified in section 3 can be enacted differently. They also show how different non-passenger elements in the complex network of people, rules and things at security can all mediate a particular passenger's airport security experience.

The description of the young woman passenger's actions shows that abandoning the security process for an earlier processing stage can facilitate moving through security.

The young man's actions show that passengers and staff can be work as partners to get passengers through security. In the young man's case, because of the relative quietness of the security checkpoint, he was able to involve the security staff in his efforts to get all of his bags through the screening point. If the checkpoint had been busy, the young man's would have received far less assistance from the security staff.

The family's actions, if described with the seven security activities from section 3, are the closest to the standard process for moving through the checkpoint. However, as the description also shows, the members of the family are also concurrently dealing with other activities such as preparing for upcoming passport control point. They are also interacting with each other as a family unit with the adults helping the younger child. In this case, aspects of the family's actions at security are shaped by their group interaction. The mediated actions observed are consistent with earlier models of passenger activities at airport security [16].

5. Discussion

These two approaches to understanding passenger actions, coding general activities and rich descriptions of specific activities can be used together to create new knowledge about airport security that has significant implications for the design of screening points and staff procedures in the future.

Coded activities show the basic components of the process of moving through an airport security-screening checkpoint. The activities can be modeled as a sequence or business process model that can provide a high-level overview of the work at the checkpoint.

However, as the rich descriptions of action show there is more that takes place as passengers move through the checkpoint than is described by the sequence of activities. Some actions, such as the young woman who abandoned the screening point to check her bag in, could be included in a more detailed process model. Other actions, such as the young man who persisted in taking his bags through the screening point, are only partially captured by the model of activity. The specific actions of searching in a bag need are not modeled as they can be assumed to be part of a passenger's everyday knowledge. The young man's persistence cannot be modeled as it is an approach to the process and is not represented in any one action.

Other actions that are everyday knowledge, or everyday practice, play a role in how passengers move through the checkpoint. The interpersonal actions taken by the family as they moved together through the checkpoint

mediated how they used the checkpoint. The parents supervised the children, as well as allowing them to have their own trays for their belongings and each of the children stayed with a parent rather than action completely autonomously. All of these actions influenced how the family used the screening point.

Together, coded activities and rich descriptions of action show that a step-by-step process does not fully capture how a checkpoint operates. If a new checkpoint were to be designed based on a linear process description, it would require that staff and passengers draw on their own experience of similar situations to make the checkpoint work effectively. The linear process inscribed in the security screening point acts as a set of constrained possibilities for action, rather than a rigid series of activities. Some activities must be performed before others, but there are gaps between these activities which passengers and staff work together to fill in. Because passengers and staff must work together, at least in some cases, passengers can be considered as co-producers [1] of the security screening point process.

The view of the security screening process as constrained possibilities for action, rather than rigid activities, allows recognition of the knowledge that passengers draw on to complete the screening process. For example, in the family interaction, the man was filling out paperwork during the screening process. This paperwork was for the next processing step in the airport, the customs passport inspection point. By anticipating this upcoming action, and preparing for it [5], he was smoothing the family's path through the airport. Similarly, the young woman demonstrated awareness of the possibilities for action by leaving the screening process for an earlier processing stage.

5.1 Implications for the design of future airport security screening points

This analysis, with passengers shown to be co-producers of effective security screening and effective airport processes generally, has several implications for the design of future security screening points. First, screening points that are largely similar to those that already exist and that a majority of passengers can be assumed to have experienced before could be installed without concern for passenger experience. This is because passengers will draw on their previous experience to interact with staff and co-produce an effective screening point. However, this only applies when a majority of expected passengers are familiar with existing processes and technologies. Importing new technologies that are already in use elsewhere but have not yet been experienced locally requires a different approach. In countries or communities where the stock of experience is different, a different approach would be required.

The second implication is that new technologies that replace one element of the familiar process can be adopted but will have a period of adjustment as passengers and staff interact to fill in the new gaps in the documented process. For example, this adjustment occurred when the various types of passenger x-ray machines were introduced in Europe and the United States as replacements for walk-through metal detectors. This also applies to new technologies that are brought into the screening point by passengers. For example the first ultra-thin laptops caused delays at security as their solid-state storage confounded expectations that computers have spinning platter hard disks [11].

The third implication is that radical redesign of airport security checkpoints, technologies and processes cannot be done through a process model alone. Because the effectiveness of a checkpoint depends on passengers and staff filling in the gaps in the process with their experiential knowledge, new checkpoints that do not draw on existing experiential knowledge will be ineffective.

Many design proposals for new screening points emphasise novel technologies and processes but these proposals do not have strategies to build or draw on passengers and staff members' existing experiential knowledge. Our results suggest that new screening point designs will only be effective when they are designed with an awareness of how passengers and staff work together in the process embedded in the design of the screening point.

Some new screening point designs remove staff from the process all together, whether through a desire for cost-saving or through the belief that passengers prefer a disintermediated airport experience [9,18].

The results we have presented complicate this move to self-service for airport security. A complete self-service model of security is necessarily based on a linear process model. However, as we have shown, every passenger interaction with the current security process is a series of actions constrained by the process but also negotiated within it. Passengers ask questions of security staff that require immediate and careful interpretation and application of rules. They leave the process without penalty and try again once they have divested themselves of inappropriate items. And they can take items through the process that at first seem contraband but are revealed to be allowed. All of these actions are necessary for the smooth running of the current system and all are co-produced between passengers and staff. None of this is possible in self-service security systems.

6. Conclusions

In this paper we have described our collection of video data from two Australian airports and our analysis of the video using two approaches. The first approach looks for common activities among passengers, "coding" each passenger's activity according to a scheme derived from earlier research. This approach allows comparison in aggregate between security regimes at the domestic and international airports and between busy and quieter periods at each airport. These comparisons show that the addition of more rules seems to slow security processing and suggests that passengers change their enactment of the different activities as the relative busyness of the security checkpoint changes. The second approach takes an ethnographic approach, describing specific interactions of passengers and security staff in detail. The purpose of this approach, in this paper, is to make clear what is overlooked by classifying common activities.

By combining these approaches we have shown that passengers do more than simply being passively screened at security checkpoints. Instead we have argued that our results show that passengers are co-producers of the security screening process. We have further argued that co-production of the screening process occurs even when the process is closely proscribed. This implies that the vital resource of passengers' experiential knowledge is omitted from process-oriented re-designs of airport security screening and that such re-designs will be at worst unsuccessful or, at best, extremely problematic to implement and use.

These results are significant for airports and the airport industry as they could open new avenues for research and development in co-production of airport experiences.

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