

The Different Approach Toward Social Centrifugal and Social Centripetal Designed Public Seating in International Airports

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Abstract.

From the Universal Design's point of view, effective public seating in airports should accord with equitable use and flexibility, cater to different sizes of passenger groups and provide size and space for easy access and use.

This study examines the departure lobby in Terminal 1 of Taoyuan International Airport and compares the pod-shaped seating of social centrifugal design and the Y-shaped seating of social centripetal design. Through unobtrusive observation, we recorded the number of groups, luggage, passengers' postures and behaviors in both seating. Using behavioral linguistics to explain the significance of postures and behaviors to understand what seating passengers in international airport need.

The results of the study showed that often one to two people occupy pod-shaped seating and they tend to rest for a longer period of time. Behavior wise, the occupying passengers sleep or gaze more, they are also in more relaxed postures, such as stretching out their legs and reclining on the chair. The passengers in this kind of area mainly use handheld luggage, which are often placed on the seats or on their suitcases. On the contrary, the Y-shaped seating are often occupied by two or more passengers for a shorter period of time. As it is used more often, passengers tend to be in nervous postures, such as leaning forward and closing their legs. As more luggage carts and backpack are placed around Y-shaped seating and the lack of back rests, passengers will place their backpacks behind them to adjust the space between them and the others. The two seating have their pros and cons, if Y-shaped seating can add backrests and the pod-shaped seating can increase the amount of clusters, passengers will have a more pleasant experience using the airport's public seating.

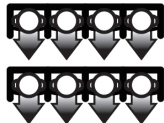


Keywords. Universal design, Seat design, Behavioral comparison

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Introduction

From the angle of environmental psychology, public seating is in direct contact with the human body, thus the design and arrangement will influence human behavior (Sommer, 1969). This study references the social environment theory of Sommer (1969) and Osmond (1957), public seating is divided into two groups by arrangement, social centrifugal designed seating and social centripetal designed seating. Among the two, typical seating will also be compared in Table 2.1

Table 2.1 The comparison between three different seating
(The arrows signifies the passengers' point of view)

Typical seating	Social centrifugal designed seating	Social centripetal designed seating
		




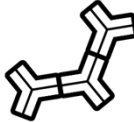
When the seating is arranged back-to-back, the passengers are unable to face their companions directly, which makes having conversation less comfortable. Therefore, as we referenced from Sommer (1969) and Osmond (1957), this type of seating that renders difficult in conversing is called "social centrifugal designed seating." This type of seating oppresses the communication between passengers, the volume of the place and the stability of order (Lin, 2010). When the seating is arranged facing inwards making the passengers gaze meet the others, this type of seating that encourages talking and discussion is called "social centripetal designed seating" by Sommer (1969). From how passengers place their luggage, public seating in airports has more need to consider the placing of luggage than other public seating areas. Territory originally explains the idea of animal ethology of how animals occupy certain piece of landing as their own. "Territory" is visible, relatively fixed and can be drawn clearly through objects, which restricts who can interact in the space (Sommer, 1969). In this study, luggage serves as the marking items that draw the boundaries of the territory. According to Meng-Cong Zheng's (2012) study on Song Shan Airport in Taipei, regardless of individual or group passengers, they will place their luggage around them to maintain their individual territory. Therefore, when designing public seating, we should take territoriality into account in order to fully use the available seats and make the passengers feel comfortable.

Aside from offering seats for travelers, we should take personal space and territory into consideration when designing public seating in terminals (Lin, 2010). These are two different types of social boundaries and also two ways of adjustment for people to make interaction (Yang, 2003). The study aims at comparing social centrifugal and centripetal designed public seating by observing and recording the number of marked objects in territory and territorial behavior, to define the indispensable conditions for designing public seating in international airports. Offering equitable use and flexibility in use for groups with different amount of people goes with the purpose of Universal Design. Offering proper size and space will optimize the applicability and efficiency of public seats for groups with different amount of people.

Methods






The study chooses Taiwan Taoyuan International Airport for observation and as the study's subject. Passengers' need for seats becomes particularly important after they arrive at the airport and before checking in their luggage. Thus, the study chooses the departure hall in Terminal 1 as the observing location. As the study aims at comparing passengers' behavioral difference between social centrifugal design and social centripetal design, the ones that fit most with both types of design would be selected for this observation in order to compare their functions. The study has named them as Pod-shaped (PS) seating area and Y-shaped (YS) seating area and we made a table according to their photos, introductions, arrangements and examples.

Table 2. Comparison chart and introduction of the five types of seats in Terminal 1

Name	Pod-shaped seating area (PS)	Y-shaped seating area (YS)
Picture		
Introduction	Assembling three pod-shaped sofas, with backrest in the middle. Belong to social centrifugal designed seating.	Composed of three Y-shaped seating, passengers of the same group will sit on the same side facing each other, which belongs to social centripetal design.
Arrangement		

After several observations done at Taoyuan International Airport Terminal 1's departure hall, passengers' luggage is classified into five types, as shown in Table 3:

Table 3. Comparison chart and introduction of the five types of luggages in Terminal 1

Name	Handheld	Backpack	Hand-towed	Trolley	Superimposed
Picture					
Introduction	Passenger's handheld luggage	Passenger's backpack	Passenger's hand luggage	The trolley that the airports provide	Passenger puts the handheld luggage on top of the hand luggage

The different type and quantity of luggage passengers carry influence the type of seating they choose. The study adopts unobtrusive observation that is without participating to undergo record observation, from the surveillance videos filming the departure hall in Terminal 1 from the Taoyuan International Airport Management Unit.

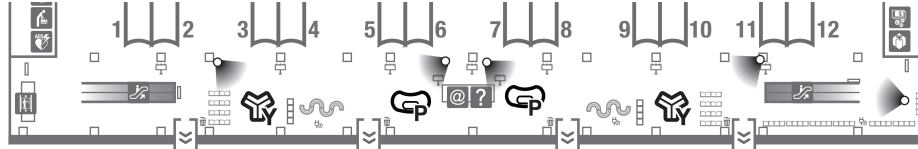


Figure 1. Demonstration of shooting angle

The observation started from Dec 1st, 2013 12:00 a.m. to Dec 1st, 2013 11:59 p.m., 24 hours in total. The study draws the location of the cameras, shooting angle, and the location of the seats as shown in Figure 1. We selected rush hour during day, mid-day, and night and recorded how groups of people use two types of seats by video cameras. Passengers that use the seats for less than thirty seconds, in groups over fifteen people, or with implicit observation were excluded. In total, we had 258 valid samples. Then, we put the people in the group in order and by simple random sampling; we selected 15 people from each group as observed participants in the three rush hours. The study targets groups as unit for observation. As it is impossible to record the age and nationality of the observed from unobtrusive observation, we only note the gender of the observed. Lastly, we apply the work on behavioral linguistics of Desmond Morris (1979) to explain passengers' postures and behaviors to understand the public seating passengers in international airports need.

Results

1. Comparison Between Passengers

In the 80 observed groups, children and elderly people were the minority. Female users were the majority, approximately 57%, in both pod-shaped seating (PS) and Y-shaped seating (YS).

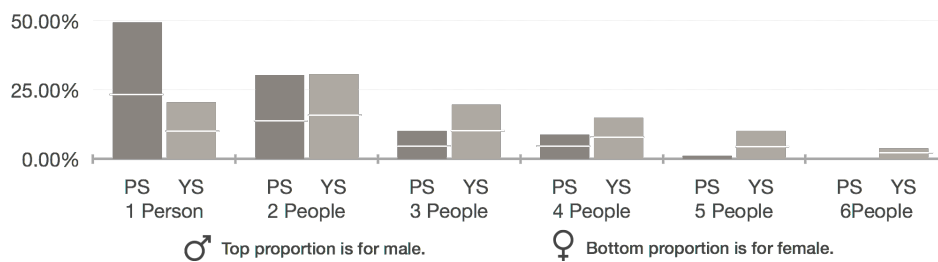


Figure 2. Comparisons of Different-sized Group of Passengers

No apparent difference between the choices of male and female. Every single passenger used the pod-shaped seating (PS) for 1425 seconds on average, which is higher than the average of 1005 seconds of Y-shape seating (YS). The disparity is approximately seven minutes and shows that passengers stay longer in pod-shaped seating (PS). We find that most small groups, of single or two passengers, choose pod-shaped seating (PS) and stay longer on the seats. Y-shape seating (YS) is suitable for bigger groups of more than 2 passengers, for it provides passengers a short period of time to rest, more flexibility which in turn has higher utilization rate.

2. Comparison of Luggage

In the 90 observed samples, every group of passengers will carry 2.978 pieces of luggage in average no matter which kind of seating they choose. There is no absolute disparity of luggage number between passengers in different types of seating. Nevertheless, there is significant difference in the luggage types, as we can see in Figure 3.



Figure 3. Comparisons of Passengers' Luggage Amount

It shows that despite social centrifugal or social centripetal design, handheld luggage is the most common for passengers. Almost every group of passengers will carry handheld luggage. However, in this study, luggage which is placed in the trolley is labeled as trolley. Handheld luggage which is placed on trunk is labeled as superimposed luggage. As a result, the detailed division of luggage type caused the hand-towed luggage appears less in this study. Due to its lack of backrests to separate the territory in Y-shaped seating (YS), backpacking luggage in Y-shaped seating (YS) is more than pod-shaped seating (PS). The major difference between the luggage choice of male and female is that male has a higher percentage of carrying backpacks.

In social centrifugal design seating, there is a great need of space to put trolley and superimposed luggage. Therefore, we should provide more open space for passengers to put their luggage in front of their seats. While in social centripetal design seating, passengers need more space to place their trolleys and that causes inconvenience for them to talk and move.

3. Comparison of Upper-body Posture

Table 4. Upper-body Coding and Position Description

Code	Position Description	Code	Position Description
CA	Passengers crossing arms	HP	Passengers putting both hands in the pockets
HA	Passengers holding objects in the arms	BH	Passengers holding hands on the back of the head
LF	Passengers leaning forward	HK	Passengers putting hands on the knees
RB	Passengers reclining	CH	Passengers resting chin in the hand
TA	Passengers turning aside	HL	Passenger holding the luggage

Through observing 45 groups of passengers in both two types of seating, we had 76 passengers in pod-shaped seating (PS) and 115 passengers in Y-shaped seating (YS). Then, by recording the time of each upper-body posture took and dividing it by the total period of time passengers spend on the seating, we concluded the results and manifested it as the following Figure 4.

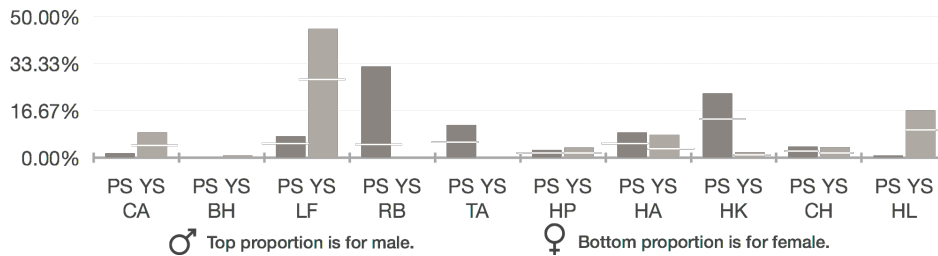


Figure 4. Comparisons of Upper-body Postures

Behavioral linguistics is applied to explain the significance of upper-body postures. Leaning forward is a sign of self-protection, which implies a sense of insecurity, as seen in 45.69% of passengers in Y-shaped seating (YS), which is higher than those in pod-shaped seating (PS). Y-shaped seating (YS) has the highest proportion in this seating area because there is much more passengers within groups in social centripetal seating and they sit much closer to each other. Because there is no backrest in Y-shaped seating (YS), most passengers lean forward to protect their personal territorial space. Leaning backward and stretching are relaxed postures, meaning people feel safe in their personal territory, as seen in 32.36% of reclined passengers in pod-shaped seating (PS). It is mainly because there are backrests in pod-shaped seating (PS) and passengers relied on these objects to protect their territory due to the open position of their body. Worth mentioning is that only 13.62% of female engage in relaxed postures, it shows that female are more modest in public places. Lastly, Holding one's personal items is a sign of declaration, it also shows that one is nervous and insecure (Morris, 1979). 16.81% of passengers in Y-shaped seating (YS) engage in such posture, which is higher than those in pod-shaped seating (PS). It shows the more people are in the seating area, the less impact territorial marked objects will have because passengers would worry about whether their luggage would be moved.

4. Comparison of Lower-body Posture

Table 5. Lower-body Posture Coding and Position Description

Code	Position Description	Code	Position Description
CL	Passengers crossing legs	SS	Passengers standing beside the seat
LS	Passengers spreading legs	SK	Passengers squatting and kneeling beside the seat
LC	Passengers closing legs	SL	Passengers stretching their legs

Through observing 45 groups of passengers in both types of seating, we had 76 passengers in pod-shaped seating (PS) and 115 passengers in Y-shaped seating (YS). Then, by recording the time of each lower-body posture took and dividing it by the total period of time passengers spend on the seating, we concluded the results and manifested it as the following Figure 5.

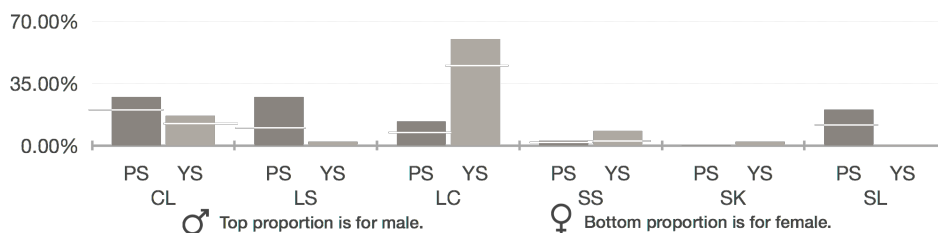


Figure 5. Comparisons of Lower-body Postures

Behavioral linguistics is applied to explore the significance of lower-body posture. Stretching the limbs and letting them spread naturally are relaxed postures, it also means not wanting to be disturbed (Morris, 1979). Thus, the posture shown in 20.17% of passengers in pod-shaped seating (PS), which is higher than those in Y-shaped seating (YS). 27.27% of passengers in pod-shaped seating (PS) spreading legs (SL) are much higher than 2.21% in Y-shaped seating (YS). Retracting the limbs to protect the body is a kind of posture that shows unease, often seen in one and two passengers in pod-shaped seating (PS). As a result, difficulty for companions to converse and more spacing between the seats causes passengers to have more space to cross, stretch, and spread legs (CL, SL, LS). This is why the rate of closed legs (LC) in Y-shaped seating (YS) takes 60.03%, which is much higher than 13.54% in pod-shaped seating (PS).

5. Comparison of behavior

Table 6. Behavior Coding and Description

Code	Position Description	Code	Position Description
OL	Passengers organizing luggage	GA	Passengers gazing without a specific position
PS	Passengers sleeping	PE	Passengers eating
TO	Passengers talking to each other	PR	Passengers reading
UE	Passengers using electronic devices	PW	Passengers walking around the seat
TP	Passengers talking on the phone	LT	Passengers leaving the range of observation range temporarily

Through observing 45 groups of passengers in both types of seating, we had 76 passengers in pod-shaped seating (PS) and 115 passengers in Y-shaped seating (YS). Then, by recording the time of each behavior passengers took and dividing it by the total period of time passengers spend on the seating, we concluded the results and manifested it as the following Figure 6.



Figure 6. Comparisons of behavior

Behavioral linguistics is applied to explain the significance of passengers' behaviors. Only an environment that provides enough sense of security can let people fall asleep naturally (Morris, 1979), as Y-shaped is without backrest, no passengers are found sleeping (PS) during the rush hour observation. However, 22.12% of sleeping behavior can be found in pod-shaped seating (PS). Also, only 26.77% of female are found sleeping, which shows that female's reserved behavior in public places. Because the pod-shaped seating (PS) design represses passengers' interaction and communication, 31.02% of passengers talk in Y-shaped seating (YS), which is much higher than 6.81% in pod-shaped seating (PS). Moreover, the rate of gazing (GA) is 20.38% in pod-shaped seating (PS), which is higher than 12.83% in Y-shaped seating (YS). The result echoes Sommer's (1969) idea related to the differences between social centrifugal and centripetal seating design.

Discussion

Through my observation, I found that except for passengers' postures and behaviors, when certain particular behavior occurs, it will affect the time the passengers spent on the seating. Therefore, I have classified four situations in my study, as shown in Table 7. I try to find why these situations will affect the passengers through the angle of environment psychology.

Table 7. Code for particular behavior and situation description

Code	Particular behavior description	Code	Particular behavior description
ML	Percentage of having moved luggage	LT	Percentage of having left temporarily
OL	Percentage of having organized luggage	CS	Percentage of having changed seats

With 76 people in the pod-shaped seating (PS) and 115 people in the Y-shaped seating (YS), I note down whether any particular behaviors occur, and divided the occurred number by the total number of the passengers into percentage form, as shown in Figure 7.



Figure 7. Frequency of particular behaviors of the passengers

In Y-shaped seating (YS), 36.22% of passengers have changed their seats (CS) and 42.58% of passengers have moved their luggage (ML). These kinds of situations usually happen when too many people is around the seating; passengers without seats will choose the seats between the crowds and ignore the territorial marked objects. Lyman, S.M. and Scott, M.B. (1967) divided the encroachment of territory into three types, with intrusion being the most common (Lin, 2010). Thus, for the occupants who feel violated, their most common defense is to leave or move further away. As for the public seating in airports, changing seats (CS) and moving luggage (ML) signify the intrusion of the passenger's personal territory. Regardless of the type of seating, female occupy 68.65% of the seats, meaning female have a stronger sense of territory and have faster response to intrusions. Y-shaped seating (YS) has a higher percentage of intrusion than pod-shaped seating (PS). Since Y-shaped seated (YS) passengers in a group worry that their companions can't maintain the group's territory, they rarely leave their seating (LT), thus the percentage of leaving temporarily (LT) is 16.13%. As for the less intruded passengers in the pod-shaped seating (PS), they attempt to leave temporarily and 75.38% of the passengers organize their luggage (OL) in their seating. If a strong territory does not exist, organizing the luggage (OL) is hard to occur naturally. Thus, we can speculate that social centrifugal designed seating compared to social centripetal designed seating has more territoriality and privacy, which makes passengers feel safer and subsequently, spend more time on the seating.

And with the average, we are able to get the percentage of the passengers' two seating time periods. The occurred time period is shown in the respective figure below as Y-shaped seating (YS) and pod-shaped seating (PS) in Figure 8.

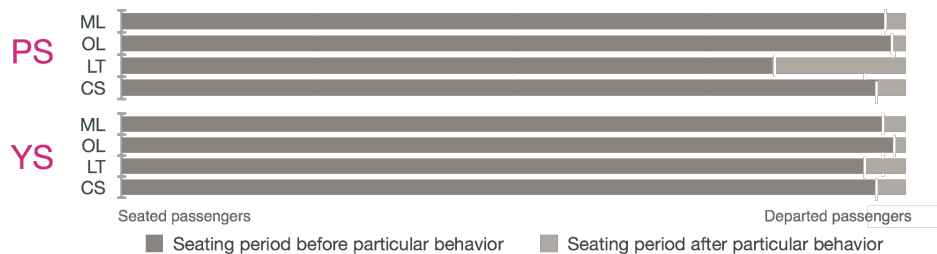


Figure 8. Effect of particular behavior on pod-shaped (PS) seating and Y-shaped seating (YS)

Passengers will change seats (CS) or move their luggage (ML) as their territory is intruded. After these situations happen, passengers in both types of seating will leave immediately. After leaving temporarily (LT), the subsequent time period spent on Y-shaped seating (YS) is 5.37%, compared with pod-shaped seating's (PS) 17.02% is much less. It could be that when passengers leave temporarily (LT), the rest of the companions find it hard to maintain the territory in highly-used Y-shaped seating (YS). Thus, when passengers come back to their original seating, they leave within a short time. The subsequent time period is less than 4% in both types of seating after passengers organize their luggage (OL), this shows that no matter what kind of seating, passengers will organize their own luggage (OL) before leaving.

Conclusions

This study brings up 4 suggestions towards the pod-shaped seating (PS) and the Y-shaped seating (YS) in Taoyuan International Airport.

1. Seating placement

Different passengers have different needs for seating, in order to fit the equitable use and the flexibility in use principle of different sizes of passenger groups, this study maintains that both types of seating should be used in the airport. Passengers sitting in pod-shaped seating (PS) are more likely to stretch their legs (SL), so it is suggested to add clusters of seating and widen the space between them so that people can stretch their legs (SL). Meantime, because of the large amount of passengers that tend to gaze (GA), it is suggested that their looks should be avoided to prevent awkwardness. As a large number of airport trolleys are often placed around the Y-shaped seating (YS), it should be considered to reduce the length of the seating clusters and instead of connecting them all together, they should add small clusters in different locations all around the airport. By doing this, it provides a more private atmosphere for passengers to converse in and the angles of the seating would provide a more private space. This study maintains that Taoyuan International Airport should include these two kinds of seating to manage passenger flow and to achieve better usage.

2. Backrest

This study maintains that a backrest can secure a passenger's back, reducing the space when a backpack is placed behind the chair. Thus, it should be considered to place backrests on the Y-shaped seating (YS). Meantime, it also

increases the passenger's privacy and avoids restrictions from other passengers. The users of the pod-shaped seating (PS) have a high frequency of reclining (RB) on the backrests, so if it is possible to increase the height of the backrest and provide proper size and space for approach and use, it can prevent taller passengers from inconvenience when they stretch. It is also suggested that the width of the backrests to be extended to provide better privacy when passengers take a nap.

3. *Seating size*

If the width of the pod shaped seating (PS) can be shortened, then there can be more seats available. By doing this we can still have the privacy of the seating and have higher usage. The Y shaped seating (YS) are usually occupied by larger groups of passengers, so it need to follow the "Flexibility in use" principle, it should be lengthened to let larger groups of people to talk in corners and let the smaller groups of people to rest on the seats in line.

4. *Seating equipment*

This study suggests that the lightings around the pod-shaped seating (PS) should be soft and that more clusters should be provided to separate the passengers for better resting space. On the other hand, the passengers occupying the Y-shaped seating (YS) have a higher possibility of using electronics (UE), so it should be considered to combine plug holes with the seats. Both seating have the possibility of passengers organizing their luggage (OL) before they leave, so platforms should be included to prevent inconvenience when organizing on the seats. Smaller groups of people could rest on the seats in a single file. By doing this provides a wider area for luggage carts which increases the flexibility and the applicability of the seating.

This study gives suggestions from the Universal Design's point of view; the seating in airports should accord with equitable use and flexibility in use principle of different sizes of passenger groups and provide size and space for approach and use. I hope that the results of this study can affect the designing of public seating in airports to consider proportion of placing social centrifugal designed seating and social centripetal designed seating to achieve the most effective use.

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