Railway Station Design

Activities and research from the Dutch National Railways (NS) for distribution among Public Transport operators in Europe
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1. Introduction

This is a resource pack for improved (train) station design, compiling lessons learned and knowledge gained from activities and research from the Dutch National Railways (NS) for distribution among Public Transport operators in Europe. The NS wants to share the benefit of its research and experiments with other rail networks.

Customer satisfaction is very important for service organizations since it is a determinant for loyalty and consequently for a healthy financial situation. Customer satisfaction largely depends on the evaluation of the product or service. In the Railway sector, the company’s efforts are often focused on accelerating the speed or reliability of the train journey. Less attention has been paid to passengers waiting at the station and how they experience this wait, i.e. the subjective waiting and travelling time. Based on extensive research on the valuation of train passengers’ door-to-door journeys we conclude that as the main customer of the station area he benefits most from an area which gives a fast interchange, offers many different facilities and provides a pleasant environment to be in. These wishes can be translated into three strategies for redevelopment: acceleration, concentration and enhancement. These strategies can in turn be translated into practical steps by making a clear distinction between the fast and slow sub-areas of a station area. The fast area comprises the transfer space and transfer related services. The slow area offers commercial activities not directly related to the transfer and long-stay urban functions, such housing, offices and leisure facilities.

In order to find out how much time passengers spend at a station and how they experience the time and the wait, a field study was conducted whereby observations of behaviour were combined with structured (self-reported) questionnaires. The results show that passengers spend on average 7 minutes at a station, the majority of which is on the platform. Passengers generally appear to overestimate the length of the wait at the station. The shorter the wait, the greater the overestimation of the waiting time. Passengers particularly overestimate the waiting time when they have nothing to do and when they are delayed.

It also appeared that passengers attach importance to a pleasant waiting environment. It is advisable to limit the waiting time to a minimum and to organize and design the service environment in such a way that irritation and stress be prevented as much as possible. This can be realized by a specific deployment of atmospheric elements. Pleasant surroundings are conducive to passengers’ forgetting the time and being more positive in their evaluation of the wait. Improving the waiting environment on the platform can be achieved by stimulating the senses in such a way that passengers experience a maximum level of comfort.

Depending on the circumstances, waiting for a service can evoke a wide range of negative reactions, such as boredom, irritation, anxiety and stress. These negative emotions influence the customer satisfaction and the evaluation of the service quality.
The longer one thinks (s)he has had to wait, the more dissatisfied one is about the service.

Besides minimizing the objective waiting time, the NS considers it therefore also essential to invest in a qualitative impulse to train stations, to positively influence the perceived (subjective) waiting time. The purposeful deployment of specific environmental elements (such as colours and lighting or advertising and infotainment) can work as a distractor and as such influence the emotions and the subjective estimation of time. The NS hopes to increase the satisfaction of its existing customers and to attract new customers. Since the train is a sustainable mode of transport, expanding its customer base is not only in the interest of the railway organizations but also of the local and national governments of a country.

This ‘incentive’ resource pack starts with an analysis of customer wishes, based on the customer-wish-pyramid. Furthermore, the value of experiences is explained, the three main dimensions of experiences: pleasure, profit (usefulness) and meaning (being memorable) are elaborated and the differences between the fast area and the slow area are identified.

In the second part, the choice between a ‘middle of the road’ or a segmented approach is discussed and recommendations regarding atmospheric elements at train stations are given. Results from two virtual experiments with colour and light are explained and other elements such as music, art, scent and plants will be touched upon as well.

To change the modal split towards more sustainable travel behaviour, more people need to be attracted to public transport. Existing and potential travellers need to feel their journey is as pleasant as possible. This resource pack identifies tools that contribute to that.
2. Customer-wish-pyramid

Research shows that travelers base their choice for the car or for public transport not only on price, but mainly on differences in safety, reliability, travel time, comfort, convenience and experience. These aspects of quality can be put in a schematic pyramid (see below). For a satisfied customer, all aspects are important, but not all are equally important. The pyramid shows that the quality aspects on the lowest levels are considered most important by travelers. Based on previous research, quantitative values can be attached to the customer-wish-pyramid. A striking result is that all quality dimensions are of importance, without a real peak. The dimensions (social) safety and reliability (cleanliness and punctuality) determine half of the values (50%). The satisfiers count for over 20% when calculating the satisfaction of travelers about a train trip (experience 9%, comfort 12%). The dissatisfiers “ease” and “speed” each count for around 15%.

**Customer-wish-pyramid: transfer / move**

![Customer-wish-pyramid diagram]

*Source: Van Hagen, August 2003*

The importance that a traveler gives to these customer wishes depends on how often a person travels, and with which goal or travel motive. A clear distinction can be made between ‘must’- and ‘lust’-motives. Must-travelers can mainly be found during
morning rush hour. Must-motives have a mandatory character and the location, starting time, travel time and regularity are often fixed. Must-travelers attach much value to speed and reliability of their familiar journey.

Lust-motives take place in a traveler’s spare time and the location, starting time and regularity for these activities vary. Lust travelers relatively attach more value to comfort and experience. The relatively unknown trip is often an experience in itself, and the time pressure – which is a notable characteristic of must motives – is mostly absent. Must- as well as lust-travelers appreciate convenience when they travel, especially in the form of clear and up-to-date travel information.

The above has indicated which quality dimensions are important and to what levels, for people who are on the move or who are transferring. But people also stay somewhere for a (longer or shorter) period during their trip, for example in a wagon or at a station. During this period of sojourning, different customer wishes prevail. Train stations have somewhat of an ambivalent character, because it is a place where moving and sojourning come together.

A customer-wish-pyramid illustrates the relative importance of the wishes of the travelers (the customer), based on the aim of the movement (move or sojourn). A schematic can also be made for travelers that temporarily sojourn at a train station. The longer a traveler stays somewhere, the more important comfort and experience become. A traveler expects more convenience in an intercity train than in a stop train, because he or she normally spends more time in the intercity. When people have to sojourn at a train station or for example in a wagon, comfort and experience are such central issues, that these have become the dissatisfiers. People expect the service provider to pay a lot of attention to these aspects. The satisfiers are speed and convenience/amenity. If it turns out to be very easy or fast to consume services during a stay (for example no waiting times in an amusement park), people are pleasantly surprised. If people have to wait, they are not immediately dissatisfied (the experience amply compensates this). So in short, the order of importance of customer’s wishes when they sojourn is the previous pyramid upside down.
3. Valuation of the journey

3.1 The value of time

The evaluation of a station area by the train passenger is a combination of the quality of the transportation opportunities and the level of facilities available when passing through. The evaluation depends on the added value a traveller experiences and can be expressed clearly and simply by using time as a measure.

In addition to the actual time involved, every activity can be assigned a “value of time”. Not every experience is a pleasant one, and unpleasant experiences appear to last longer than pleasant ones. Thus, time spent in a dentist’s chair seems to pass more slowly than time spent chatting sociably with friends. One of the assumptions of prosperity theory is that in a fixed amount of time, an individual can achieve a maximum return. He is only willing to deviate from this optimal state of affairs when some form of compensation is certain; for example, in the form of increased earnings. On the other hand, it may be assumed that he is willing to make some sort of sacrifice to optimise the use of his time expenditure. Fundamental to calculating the value of time in prosperity theory is the assumption that the marginal benefit of time spent travelling (transportation) is normally negative: extra travel time means that an individual has less time to do the things that he or she would rather do - for example to stay longer in bed before the morning rush hour, or to arrive home earlier. The more value - in the sense of enjoyment - that people attach to these additional objectives, the more they are prepared to pay for shorter journey times.

Transforming the waiting time at the station into useful, enjoyable or pleasant time adds value to the train journey. By providing activities that people appreciate at stations, passengers can gain time while travelling. Research has shown that people can ‘save’ about 13 minutes at a station by doing things there that they would otherwise do somewhere else on the same day, such as shopping or eating. This means that the actual journey time is apparently reduced and a train journey can compete better with the car.

Research shows that how people’s value time varies between the different stages of a journey. For example a distinction can be made between “in-train” time, time in access and egress modes (cycle, bus, tram, metro), and transfer time. The in-train time is valued twice as highly as access and egress time and three times more highly than transfer time.

The figure below illustrates the value given by passengers between their origin and destination to the various stages of a journey, such as access and egress, transfer and a train travel. The vertical axis shows the time value given to each stage of the journey. The product of time spent and the value of time is the value assigned to the time spent. This value can be expressed in terms of usefulness and enjoyment.
3.2 The value of experience

When the strategy is to make the journey more pleasant for a customer (traveler), the accent mostly needs to be on the ‘softer dimensions’ of quality: not so much safety, reliability or speed, but rather comfort, convenience ad experience. What is the quality of an experience and how can that be increased?

Two megatrends, economic prosperity and individualization, lead to an ‘experience economy’. In the Western countries, there is a large market for consumer goods and services. Most material needs are fulfilled and the need for non-material experiences grows. Emotion, affection and values become more and more important and the society transforms to a place where experiences are essential and every event is a potentially special occasion. The extra value that is awarded to a special experience often compensates the sometimes (very) high financial costs of this experience.
Patterns in the ‘experience economy’ are:
- the aim is to let people be part of ‘the script’, which is experienced as an unforgettable or unique experience;
- anticipating the individual wishes of customers;
- the customer as well as the employer/entrepreneur improvise within the larger framework of the script;
- the experience happens in a suitable setting or decor;
- the script is determined by personal control and guaranteed freedom;
- other ballast: behind the scenes!

Experiences at train stations
Travelers value a high-quality station environment. The perception of the customer ranges from highly negative to highly positive impressions. The key in designing a train station is to first eliminate the negative elements and then stimulate the positive elements. There is a link with the customer-wish-pyramid for movement: the dissatisfiers need to be taken care of, while the satisfiers are stimulated. If a traveler is confronted with a negative experience, they are not open to positive impressions at that moment. So if people do not feel safe at a train station, they are not open to the architectonic beauty of the building, for example.

As said, fulfilling individual wishes has become more and more important in our ‘experience economy’. This means that when people travel by Public Transport, the trip can get extra value when their individual needs are met on their way. This means that a transport provider need to make sure that travelers should be able to spend their time as useful, pleasant and/or special as possible.

The appreciation of time that is passed at a train station can be divided in to three groups: usefulness (‘profit’), pleasure, and meaning (being memorable).

- usefulness (‘profit’)
  the time spent at a station is regarded in a positive way because the traveler can fill some needs. These needs do not have to have anything to do with the trip itself, but it gives the traveler the feeling that he/she can spend the time at the station in a useful way. It is time that the traveler otherwise should have spent on another moment during the day. Lost time turns into productive time.

- pleasure
  the time spent at a station is regarded in a positive way because the traveler is being amused. There are opportunities for relaxing or distraction: the traveler is diverted from the stress situation in which he/she is. It can be a pleasant surprise for only a
short period of time, or a can take the character of sojourning. Lost time turns into nice time.

- meaning (being memorable)

the time spent at a station is regarded in a positive way because the experience contributes to the transformation of the personality of the traveler. The art of live, living with time, the art of traveling, experiencing society. The train station as a stage or décor of a valuable memory. Time at the station turns into quality time.

Some examples of each value in and around the train station:

<table>
<thead>
<tr>
<th>usefulness (‘profit’): combined goal, efficiency, benefit, purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>- office hotel</td>
</tr>
<tr>
<td>- station secretariat</td>
</tr>
<tr>
<td>- conference centre</td>
</tr>
<tr>
<td>- business lounge</td>
</tr>
<tr>
<td>- internet café</td>
</tr>
<tr>
<td>- fitness space</td>
</tr>
<tr>
<td>- fastfood service</td>
</tr>
<tr>
<td>- small groceries</td>
</tr>
<tr>
<td>- kiosk</td>
</tr>
<tr>
<td>- snack wall</td>
</tr>
<tr>
<td>- infotainment</td>
</tr>
<tr>
<td>- postbox</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pleasure: entertainment, escape, impulse, purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>- hip hotel</td>
</tr>
<tr>
<td>- museum</td>
</tr>
<tr>
<td>- casino</td>
</tr>
<tr>
<td>- penny arcade</td>
</tr>
<tr>
<td>- library</td>
</tr>
<tr>
<td>- restaurant</td>
</tr>
<tr>
<td>- fastfood service</td>
</tr>
<tr>
<td>- grand café</td>
</tr>
</tbody>
</table>
- ice-cream parlour
- shop for neckties&socks
- Champaign bar
- Bookshop

meaning (being memorable): unique experience, pride, recurrence

- Theme hotel
- Travel library
- Theme restaurant
- Theater
- Exhibition
- Entertainment
- Architecture
- Champaign bar
- Boxes of delight
- Infotainment
- Art
3.3 Strategies for redevelopment

After this analysis of the wishes of the main customer of the station area, the train passenger, we have now come to the point of asking how these wishes can be incorporated into the redevelopment process. In other words, we are looking for redevelopment strategies based on customers’ wishes. The evaluation of the door-to-door journey makes a good starting point for the development of these strategies.

There are three ways to increase the product of time spent and value of time during the door-to-door journey, namely acceleration, concentration, and enhancement.

4.1 Acceleration

The first way to add value to the transportation chain is to shorten journey times. This can be done by increasing the average speed of the trains and by reducing waiting times. This is illustrated in figure 3. Acceleration is the most traditional way of improving the value of the travel chain and large amounts of investment are often involved in speeding up the transport system.

Figure: Acceleration: adding value to the journey by reducing travel and waiting times.
4.2 Concentration

Secondly, urban facilities such as housing, places of employment and leisure centres can be situated closer to the station, and/or at a greater density. Figure 4 shows that on both the arrivals and departures side, the need for the use of access and egress modes can be eliminated - and with it a lot of inconvenience. In addition to reducing journey times, the poorly valued transfer time is reduced. Transfer becomes simply a matter of getting on and of the train. The added value is achieved by focusing on speed and convenience in the pyramid.

![Diagram showing concentration: adding value to the journey by developing origins and destinations in the vicinity of stations.]

4.3 Enhancement

The third way to add value to the rail passengers’ journey is to enhance the value of time of the least-valued elements. Figure 5 shows that by making waiting and transferring pleasant and beneficial experiences, the intrinsic value of the transportation chain increases. This is achieved by offering opportunities - both in the train and at the station - to take part in activities that are valued highly. In this way we address, the need to provide comfort and a pleasant experience as illustrated in the pyramid of customers’ wishes.
It appears that the evaluation of the door-to-door journey can be increased by acceleration, concentration and enhancement. These strategies, when applied to station areas, can be compared to the three criteria used by Bernick and Cervero to distinguish successful transit villages in the US from less successful ones: density, diversity and design. They concluded that the combination of a higher than average housing density, the presence of facilities, and a pedestrian friendly design of public space result in a higher use of the train and turn the station area into a pleasant area and centre for the village.
4. The fast area and the slow area

How to translate experience to a station design? At a station transferring/moving and sojourning come together and travellers often switch between speed & convenience and comfort & experience. If a traveller is looking for a public transport connection, he/she is in the ‘stress mode’ and can hardly think of anything else but the connection. Only when the traveller knows where and when the next transport mode leaves, he/she will shift to a ‘relax mode’. If it turns out that there is some time left, the traveller will notice the services that are available and will be open to new impressions. Comfort and experience will become more important.

The core of the train station consists of transfer-related activities and the accent is on speed and convenience. Around this core, sojourning-related activities become more important and the accent is more on comfort and experience. Both domains should be designed differently. The challenge is to increase people’s appreciation of the time they spend on the train station. Research has shown that people feel good at a certain level of stimulation by our surroundings. Too many or too few sensations need to be avoided: too few is boring or scary, too many can lead to irritation or stress.

The different values a train station wants to establish need to connect to the mood that travellers are in, in their various travel phases. The station area can be divided in to two parts, each more suitable for different experiences:

- the fast area: movement > transfer
  In the fast area there need to be short walking distances, a transparent open space with clear (natural) guidance and a minimum of unnecessary stimulants. Information and signposting are recognizable and predictable and the space has a nice balance between width and height. The fast areas are ideal places for commercial quick-services, but visual presentation and special design need specific attention.

- the slow area: sojourn, rest > shop / meet / activities
  The slow area is designed to give travellers a pleasant, memorable and/or useful time. A different palette of services needs to be offered, stimulation of the senses can be high and the space can be cosy and lively. Where necessary, the presence of dynamic travel information will increase the sense of control and with that also the sojourning time in the slow area.
Interfaces between the fast and slow area:
- the fast area is an attraction or amusement for slow functions: an attractive spectacle
- some spaces can have a ‘slow’ as well as a ‘fast’ character (platform, meeting point)
- slow functions near the fast area can increase the feeling of social safety

This all means that slow and fast areas need to be designed in connection to each other, and the travellers need to be given a clear choice between the two. See for a graphic overview the picture below.

Conclusions
- Besides traditionally shorting the transfer time, the intrinsic value of the trip can be increased by targeted investments in quality (to make the journey more pleasurable). This way, the train station can become the ultimate connection between moving and sojourning.
- The value of the experience of a train station can be translated to three dimensions that are relevant for travellers: usefulness (‘profit’), pleasure and meaning (being memorable).
- The train station is divided into two ‘experience areas’: fast and slow. The fast area corresponds with the transfer area. The experience is aimed at predictability and being recognizable, so travelers can move around efficiently, faster and easier.
- The slow area corresponds with the sojourning areas and the experience here is aimed at spending a useful and/or pleasurable time. Useless waiting time can be transformed into a nice, useful or special time or activity.

- The complete formula for an individual train station requires a strong direction, a strong vision. Elaborating the three experience-dimensions is not an issue by itself, it always needs to be seen in relation to the travelers’ journey. Formula for a useful or profitable experience need to be reliably fast and easy. Formula for a pleasurable experience need to be able to let the traveler escape from the stress, but never decrease the personal control. Meaningful or memorable experiences always need to guarantee a level of safety.
5. ‘Middle of the road’ or segmented approach?

The NS, and train stations in general, are confronted with a wide variety in travellers (young, old, lust- and must travellers, etc.), that represents a reasonable average of Dutch society. This makes a simple positioning based on design of the surroundings not easy. Design is partly a matter of taste, and it’s not unthinkable that preference for and experience of style and design show strong differences between the different traveller-segments. The question is if it’s preferable to have a station design based on a ‘middle of the road’ approach, or a more segmented approach.

The middle of the road approach can be preferable when regarding financial aspects (when redesigning station areas). On the other hand, this approach often gives less than optimal solutions for station experiences. Furthermore, this approach is sensitive to the regular changes in trends and in fashion. Initial advantages of a standard design are overshadowed by the huge costs involved in the integral adaptation of a train station based on the trend of that moment. A segmented approach will be more cost efficient and more targeted. When considering a design of several areas in a train station where multiple types of users need to feel good, the desired upscaling (modernising) of the surroundings does not necessarily entail changing the whole station. Changes can consist of details that were designed for a specific target group. This also allows changes to be implemented in different phases.

Whichever choice is made for station design - the middle of the road or the segmented approach - it is important to know the preferences and expectations of travellers regarding the surroundings where the service take place. It is essential to know what elements of the interior of a train station are valued highly or not so high by the public. Getting to know the taste of the public and the effectiveness of the measure is essential for an organisation such as the NS.

Literature study can partly provide a solution for this lack of knowledge. However, many studies on this subject are difficult to generalise, because they were carried out for a specific location such as a hospital or supermarket, which is not one-on-one comparable to a train station area (station hall and platforms).

An important conclusion that can be drawn is that the level of coherence between the different elements in a station environment determines the success of the manipulations. Different interventions in the design of a train station can strengthen or weaken each other, so the effects of the various measures that are described below always need to be considered in connection with each other.
6. The influence of colour and light on the experience at and satisfaction with a Dutch railway station

Color and lighting are important aspects of the environment and can sort effects on mood and behavior. The effects of color and lighting in a station environment have been studied by the Dutch national railways.

It has been identified earlier in this resource pack that customer satisfaction is very important for service organizations and that this largely depends on the evaluation of the product or service. Perceptions of service quality are influenced by such factors as environmental cues or staff encounters. Service providers should thus focus more explicitly on the experience qualities of the service to generate satisfied customers. From this perspective, the physical environment can be considered an important instrument to enhance customers’ satisfaction. Color and lighting are important aspects of the environment and known for the effects they can sort on mood and behavior. Consequently, we propose that these two aspects have a significant impact on the overall evaluation of the service. This especially goes for the Dutch Railway (NS) where travelers experience the quality of the service in the environment in which the service process takes place (i.e. the station and platforms they wait in, walk and travel through).

The impact of ambient factors such as color and lighting has been widely researched. Most of these studies were conducted in experimental laboratory settings or in field studies directed at retail environments or restaurants. Results of these studies often reveal the positive effects of short wave colors like blue on pleasure, dominance and arousal. Blue also has a positive effect on feelings of safety and waiting time perception while long wave colors (i.e. red) will increase feelings of tension. This higher state of arousal negatively affects the perception of control and, in turn, feelings of safety, crowding and mood. Results on studies of lighting reveal a more diffuse vision with positive effects of bright light and negative effects of dim light and reverse effects in other studies. The literature suggests that people need some basic level of luminance. Levels that are higher or
lower than this basic level are perceived as unpleasant.

**Three experimental studies**
The literature offers some suggestions what color and lighting might do with travelers in a railway station. Because of the obvious differences between a restaurant/retail store and a railway station, effects must be interpreted with care, however. To measure the effects of color and lighting on customers’ mood and customer satisfaction of railway travelers, three methods have been used.

1. First, a virtual lab was used to measure some of the effects of color and lighting in relation to crowding and waiting time perception.
2. Secondly, a virtual train station was developed which was sent to the online panel of the Dutch Railway. In this online experiment, we were able to reach a large sample of respondents and a variety of variables such as perceived control, orientation and perceived safety as well as crowding and waiting time perception was measured.
3. Finally, these variables were measured in a real railway station (city of Leiden, www.mijnproefstation.nl) where lighting and color were manipulated.

The results of the three studies helped identifying what color, lighting and combination of the two should be used in a railway station and with what effect. Secondly, the three studies were compared to observe the differences in results between a virtual lab, an online virtual station and an actual and realistic station. The results can be used in further research investigating the impact of several aspects of the service environment on satisfaction with the service.

**Results and conclusions**
The two experiments in the virtual train station of the Dutch city of Leiden show that although colour and light are perceived subconsciously, the combination of the two does in fact have significant effects on both a number of affective aspects and the perception of the wait. Significant differences were found with regard to

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Figure 1. Interaction effects between colour and light for pleasure (A), attitude to the platform (B), attitude to the waiting time (C) and orientation (D)
reactions to colour and light between men and women, between those in a hurry (i.e. must passengers) and those who were not (i.e. lust) passengers.

Although passengers have a definite cognitive preference for the colour blue in a well-lit environment, it appeared that only one third of the respondents could indicate which colour was dominant on the platform. In all situations the colour one thought to have seen most often was grey. Despite people indicating they also preferred well-lit surroundings, the results particularly show effects with dimmed situations. Apparently, passengers cling to the image they have of a platform. This confirms that colours and intensity of light are perceived subconsciously. For station evaluation, affective effects are thus more important than cognitive ones.

After analysing the results per scenario, the preference for colour appears not to depend on the location but on whether one is a must or lust passenger (and thus in a hurry or not). The second experiment showed that lust passengers are more receptive to environmental stimuli than must passengers. They particularly prefer warm colours in combination with dimmed lighting and estimate the waiting time as being shorter than when cooler colours and a more intense lighting are used. The evaluation of the wait and how useful passengers experience the waiting time determine both their attitude to and their opinion of the platform.

The findings from this research support the Theory of Psychological Reversals of Walters, Apter and Svebak (1982), which alleges that people under pressure prefer cool colours and in a relaxed situation incline towards warm ones. Needing a colour thus appears to be dependent on the demand for stimuli, whereby lust passengers prefer warm colours and must passengers cool ones. Also apparent from both experiments is that women react differently to colour and light than men. This concurs with findings of other studies (Yildirim, Akalin-Baskaya & Hidayetoglu, 2007; Knez, 1995; Knez & Kers, 2000).

Both experiments also show the strong influence of waiting time perception in a station environment. Most people tend to overestimate the waiting time on the platform, as was also found in earlier research (Hornik, 1984; Moreau, 1992, Maltha 2006; Van Hagen, 2007). How the wait is rated and how useful passengers find it determine both the attitude to the platform and the impression thereof. In most situations, time in dimly lit surroundings appears to pass more quickly than when the lights are brighter. This confirms the results of Baker and Cameron (1996). In contrast to results found in the literature, time in a blue environment appears to pass
more slowly than in a red one. One explanation might be that passengers who feel stressed not only desire cooler colours but also pay more attention to the time, which makes it seem to pass more slowly (Zakay, 1989). From the second experiment it appeared that the perception of waiting time closely approaches the basic emotions as defined by Mehrabian and Russel (1974). These researchers state that the three emotions 'pleasure', 'arousal' and 'dominance' can adequately measure 'a large variety of emotional states' (Mehrabian & Russel, 1974). In the case of the station environment, feelings or emotions evoked by the waiting time can be added to these basic emotions.

The results show that manipulations in a virtual retail environment successfully allow effects with colour, light, crowding and time pressure to be demonstrated. These findings offer an initial insight into the way colour and light work in a station. However, both experiments were conducted in a virtual station, which might influence the outcome. The question arises whether these findings would also be found in a real station. The disadvantages of a virtual environment, such as navigating through the space with a mouse and projecting oneself into a scenario, would thus be prevented. Further research in a real-life situation in which colours and light are manipulated can hence verify the findings.
7. Recommendations regarding other atmospheric elements at train stations

In general, make sure that intangible atmospheric elements (such as music or scent) are at an optimal stimulation level. It is, for example, better to choose music with an average volume level than loud music. The same applies to colours, scents and temperature. What is considered ‘optimal’ is difficult to answer. This needs to be researched per station, per target group, per country or per PT location. Furthermore, it is important that the different elements in the station interior form one coherent whole.

7.1 Music

- In every situation where music is used, the coherence and traveller characteristics should be taken into consideration. Music needs to be adjusted to the preferences of the target groups, to the situation and the environment.

- Tune the music to the situation. Crowding asks for nice relaxed music, while waiting situations require more stimulating music.

- Music with an up-tempo beat can shorten the perception of waiting times. There should be a special file with upbeat music available for waiting areas or in case of delays. Fun and average stimulation are still central.

- When music is played in combination with scent, the stimulation levels of both need to be equally high. The advice is: calming scents with calm music and invigorating scents with stimulating music.

7.2 Scent

- The presence of a nice smell often decreases the perception of waiting times. It is recommendable to spread scent on platforms.

- The scent needs to be nice and neutral (ambient) and not be incongruent with the surroundings (so no bread smell).

- Tune the level of scent stimulation to the situation (crowding, waiting). Relaxing scents can for example best be used in stressful situations.

7.3 Spatial and functional design

- Functional design needs to be both facilitating and comfortable
- When social interaction is desired and pleasant, this can shorten the perceived waiting time. Designs that facilitate interaction (for example a set-up of benches that encourages (eye)contact) is in that case desirable.
- Dependant on the message that the train operators wants to give, use either modern or traditional design. Modern design with rounded corners is often associated with flexibility, tidiness and comfort. Traditional design is mostly associated with structure, strength and stability.
- Remember that personal design radiates values like involvement and care of the organisation. Make sure that you have a personal, distinguishing touch in the design of the waiting areas and platform furniture.

7.4 Visuals and art
- Art can be a positive distraction and can radiate positive values such as commitment and competence. In general, pictures of nature are appreciated more than abstract or surrealistic art.
- Art and symbols can often be interpreted in multiple ways. Take this possible ‘misinterpretation’ by travellers into consideration when choosing the art.
- Train stations are places where many people pass and stay on a daily basis. It is a distinct place for a temporary exhibition. And because the art is periodically replaced, it keeps giving the art a positive attitude.

7.5 Green
- Plants can be used as a positive distraction, thereby shortening the perceived waiting time.
- Plants also reduce stress levels, possibly diminishing frustrations and irritations.
- Place, choose and maintain green in such way that the overview and visibility of/at train stations is not lost.

7.6 TV-screens
- Just like art and plants, tv-screens have an ‘entertainment’ level and can be placed as a positive distraction of time and crowdedness.
- It is important that a certain level of personal control remains in place. Travellers who do not like the tv-images should be able to distance themselves from it, without being interrupted.
- An other important advantage of placing tv’s is that they can be a source of information. TV’s can very well serve to provide up-to-date travel information.
8. Waiting becomes fun: the influence of advertising and infotainment on the waiting experience

At train stations, passengers are regularly confronted with waiting times, which is no fun but often inevitable. Depending on the circumstances, waiting for a service can evoke a wide range of negative reactions, such as boredom, irritation, anxiety and stress. These negative emotions influence the customer satisfaction and the evaluation of the service quality (Pruyn & Smidts, 1998). The longer one thinks (s)he has had to wait, the more dissatisfied one is about the service (Durrande-Moreau & Unsunier, 1999; Hui, Dube & Chebat, 1997). In order to shorten the objective waiting time and prevent delays as much as possible, Dutch Railways has been making some considerable investments in new trains and in optimizing the schedule. The question remains what else Dutch Railways can do – besides minimizing the objective waiting time – to positively influence the perceived (subjective) waiting time.

The answer to this question may lie in the correct attention to the role of the service environment when processing information during the wait. The purposeful deployment of specific environmental elements (such as advertising and infotainment) can work as a distractor and as such influence the subjective estimation of time.

To discover how the Dutch Railways can purposefully deploy station advertising and infotainment to positively influence the waiting experience, two experiments we conducted in a virtual station environment. Study 1 explored whether and how advertising in a station environment influences the experience of both the station and the wait. Study 2 investigated whether and how infotainment in a station environment influences the experience of both the station and the wait.
The method that was used consisted of a virtual station, where respondents were put in a scenario in which they imagined that they had to take the first train to Amsterdam. They were given a walking route to the appropriate platform.

**Study 1: Whether and how advertising in a station environment influences the experience of both the station and the wait**

Method: Screen changes
- Design: 4 x 2 x 2 between subjects
- Screen changes (no ads vs frozen screen vs slow vs fast changes)
- Crowding (crowded/peak vs not crowded/off-peak)
- Passengers types (must vs lust passengers)
- Respondents: Members of NS customer panel
- N = 489

Results study I:
With a short objective waiting time:
- Passengers feel more pleasure
- Passengers value the waiting time better
- Passengers find waiting more useful and more agreeable
- Passengers experience more control
- Passengers are in a better mood

Interaction-effect tempo x crowding shows that:
When it is not crowded at the platform passengers experience more pleasure with a slow screen change of ads compared to a crowded platform

With advertisement:
- Passengers experience more pleasure
- Passengers experience more control
- Passengers find waiting more useful and more agreeable
- Passengers show more approach behaviour (return, recommend)

**Study 2: Whether and how infotainment in a station environment influences the experience of both the station and the wait**

Method:
- Design: 4 x 2 x 2 between subjects
- Type programming (No program vs informative program vs news vs railaway)
- Crowding (crowded/peak vs not crowded/off-peak)
• Passenger types (must vs lust passengers)
• Respondents: Members NS customer panel
• N=898

Results study II - Interactions type of passenger x type program:
Programming and attitude: evaluation of programs differs for must and lust passengers: lust passengers want information, must passengers want news.

Results study II - Interaction crowding and x type program:
Experienced control: With news, compared to a quit situation, more control is experienced when it is crowded at the platform.

Conclusions and recommendations
The pattern of results emerging from both studies is quite subtle and in some cases unexpected. It would seem that in study I the appraisal of the platform wall advertising was negative, whereas positive behavioural effects did indeed occur as were also the possibilities to influence the time perception with the image tempo convincingly demonstrated. True, subjects made it known that they were not interested in advertising, nor did they find platform advertising suitable, but they did allow themselves to be influenced by it nevertheless. The presence of platform wall advertising moreover produced positive affective reactions. Subjects indicated enjoying themselves more during the wait and experiencing the waiting time as more useful and more pleasant when platform wall advertising was present. These results suggest that one can consciously express a negative opinion of such forms of advertising (i.e. when explicitly asked), yet still affectively and unconsciously react to it positively.

Passengers reacted with greater enthusiasm to infotainment on the platform screens (study II). In their opinion, infotainment offers a more positive contribution to the appearance of the station and actually leads to more positive reactions and higher marks. It would seem, however, that the positive effects on the behaviour (the time estimations) can be predominantly expected during peak hours on the platform and not when the platform is quiet. This suggests that the 'Attentional model’ of time perception particularly applies when there is already some environmental interference present. In such a condition, infotainment apparently distracts the
attention away from the internal clock.

The premise on designing the virtual station environment and the task assigned to the subjects, was that of a ‘normal’ situation at the station, in which the passenger arrives and has to catch a train within several minutes. The standard protocol did not incorporate delays so there were no exceptionally long waiting times. This might well be the reason why reactions to the waiting times and the waiting experience were quite positive in both studies. Of course one can wonder whether the subjects’ reactions would still be the same if they had had to wait longer after arrival at the station (due to delays and such).

Despite the fact that there is little mention of irritation with waiting, the passengers’ perceived waiting time does differ from the actual waiting time. On scrutinizing the subjective time factor, it appears that (particularly in study II) the waiting time is generally overestimated. So there is a considerable difference between the clock time and the perceived time. Both studies moreover reveal that the duration of the wait (long/short) influences the assessment of the waiting time, emotions and the state of mind. Passengers have a strong preference for, and feel better with, a short wait.

It is apparent from both studies that looking at the clock significantly lowers the subjective time factor. That is to say, the perceived waiting time of subjects who did look at the clock is closer to the actual waiting time than for those who did not. We thus recommend increasing the accessibility to the objective time, for example, by placing extra clocks on the platform or by showing the time on the screens.

As this research was carried out in a virtual, simulated station environment, the effects should be replicated in a realistic field experiment before implementing the conclusions of these studies. Our procedure, however, appears to be a highly appropriate method for estimating subtle changes (such as tempo of screen change or programme content) in a relatively cheap way without actually having to organize these conditions in a real-life setting. Moreover, this method had the advantage that for each subject the ‘journey through the station’ took place under the same conditions and that the findings cannot (therefore) be attributed to ‘experimental interference’ and coincidences that occur per definition in realistic field experiments.
Summarizing: the findings reveal that the presence of platform wall advertising or screens with infotainment do not influence the perceived waiting time or the subjective time factor but that they do positively contribute to the waiting experience. Adding advertising and infotainment make the wait more pleasant. Passengers indicated being more satisfied during the wait, that they experienced the waiting time as being more useful and that they would have no problem returning to a platform with advertising and infotainment. As the objective waiting time cannot be shortened and passengers spend the largest part of their wait (65%) on the platform, the NS recommends that the waiting environment be as pleasant as possible by offering passengers distraction in the form of infotainment. When doing so, be sure to:

1. Make sure the content of the program is a good mix between: advertisement, information and entertainment
2. Improve access to time information: Peak hours: News & Entertainment (W8-tv), Off peak: Information related programs
3. Be aware of the differences between must and lust passengers: Lust passengers travel in off-peak hours, Must passengers travel during peak hours.
9. Used literature

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