



# SOLUTIONS

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This document is a working document.

It has not been approved by UITP nor the participating organisations.

The final document will be released in the forthcoming month.

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Feelings of insecurity in public waiting or transfer areas are common despite adequate technical levels of security.

We found considerable knowledge and technical know how available in safe, secure environments but little if anything was being documented on the perception of security and the emotional reactions to sensory stimulation through the use of form, function, sound, smell or colour. The research team of YellowdesignFoundation developed a methodology to elicitate and analyse links between social interaction and space for different user profiles.

Certain elements, such as public art, water, colour, sound, temperature and light, all contribute to the experience of traveling and have an influence on emotions and the perceived feeling of well-being and security.

Regarding different areas of human perception, our team developed a research program looking at the system from a passengers point of view and with human sciences approach first, next giving these insights to designers and architects and eventually now come up with guidelines for urban planners, real estate developers or transport and mobility professionals.

All through the research, findings were submitted to the operators and companies involved in the program. The participating operators, authorities and other organizations have been:

STIB, Brussels (Belgium), VVM de Lijn (Flanders, Belgium), Flemish Community of Belgium, RATP, Paris (France), Sporveier, Oslo, (Norway), Metro do Porto, Porto (Portugal), Storstockholm Lokaltrafik, Stockholm (Sweden), Lanstrafiken Jonnköping (Sweden), Istanbul Ulasim, Istanbul (Turkey), IBM, Clear Channel, Schreder (Liège, Belgium).

We thank them for their support, input and involvement.

*Anne Leemans  
Secretary General  
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# 1. Role and Mission of public transport

Anne Leemans

## The Challenges:

To promote perceived security in urban Public Transport stations we should face and solve a number of challenges, amongst which:

- *eliminate the negative perception of Public Transport stations as insecure havens overcrowded by criminals, homeless and have-nots*
- *reduce the cycle of fear thanks to a whole journey approach*
- *conceive and/or renovate stations in a way they can be easily adapted to changing needs and facility requirements*
- *create and develop a wider service offer developing synergies with third parties*
- *develop a positive dialogue with the media*
- *upgrade the level of service and marketing of Public Transport to seduce drivers to opt for Public Transport and leave their car home thus increasing the number of passengers*

## From functional to human space

1. Public Transport stations used to be seen as merely functional spaces

- *Stations that were built in the 1960s and 70s today look outdated and unaware of modern city life*
- *Other Public Transport stations such as in Moscou from the 1930s are still perceived in a positive way by locals, commuters and foreigners.*

Anthropologists suggest we look at PT-stations the same way as we look at a public space hence as a heterotopia (Michel Foucault, 1967) instead of as a non-lieu.

A non-lieu?

*Is a space without history, identity, relations nor suggested emotions*

*It is a space that is just functional and necessary*

A heterotopia?

- *a space in the city that has a role in its own right that serves passengers to meet, connect, pause that offers information, retailing, entertainment*
- *a heterotopia is multifunctional, diverse and serves as an independent 'cultural' place as a space in its own right*

In a heterotopia we observe different types of behaviour which we could broadly classify in front&back region behaviour or prescribed/standard behaviour and non-standard behaviour.

Equalling front region behaviour to socially acceptable behaviour it follows suggested and prescribed public use of the place is associated with – perceived – security and control.

Consequently design can and should encourage and facilitate social control and positively channel front region behaviour. Areas where front region behaviour is preferred should be designed 'with public use in mind', laid-out with convex spaces offering clear overviews, unhampered by vending machines or kiosks of different shapes and kinds as well as unambiguous indications or semantic clues on the space's intended use.

However, breaking down back region behaviour into 'ruse' and 'abuse' also acknowledges the changes in social behaviour that occur in society. Understanding that a Public Transport station is a heterotopia, implies the station is as sensitive to social, cultural and other triggers, trends and changes as any public area in the city. Like other public space rather than stay blind to this evolution it should join it and welcome innovations and other positive changes in society and adopt them. Public Transport operators should and can reveal themselves ahead and in control of change as well as innovators and incubators of life and creativity in the city.

As mentioned changes in social behaviour also respond to material or technical innovation (eg the widespread use of mobile phones, growing use of bicycles in inner cities, passengers with shopping carts, prams, luggage)

Though RUSE-behaviour may cause irritation, it can trigger new ideas to designers and architects to conceive the space in zones: waiting, meeting, retailing, transaction areas each suggesting particular behaviour to passengers, and passers-by, bearing in mind however that the combination of waiting, meeting, retailing and more activities also allows for an improved social control and perceived security.

*(see article on Front&Back Space Behaviour, Greg Nijs&Martijn Vogelzang)*

## Mobility affects space

Given that mobility affects the organization and lay-out of space and that public transport challenges car dependency and car urbanity it follows we can conclude that Public Transport fosters social inclusion & cohesion.

As mentioned earlier we should see Public Transport stations as public spaces and sensitive to changes in society hence they are crucial components of urban citizenship. The Public Transport network provides access and service to the different neighbourhoods. Using Public Transport we promote communality instead of car cocooning. We use it together with other people and in most cases according to an explicit and implicit body of rules.

The Public Transport network should therefore be considered as the true communication and culture backbone of the city. This also implies that next to the basic transportation mission of operators they should in their stations also allow for information and communication technology applications that stimulate both the identity of the operator and identification by passengers.

As examples we can refer to the integration of art, to images or projections on the walls that refer to the neighbourhood, neighbouring circumstances, to the neighbourhoods' current or former inhabitants, to its famous buildings, etc.

*(see article Leonhrad Coreth, Nilufar Ashtari & Martijn Vogelzang as well as Vincent Eaton)*

## Prevent to strengthen or enforce to heal the perceived security?

Given transport tickets are paid for and used by passengers, passengers have a shared responsibility to respect the facilities as well as right to use them.

This should be regularly explained and communicated to passengers involving using a wording involving 'your' network, together we, asking for participation, ideas for improvement or initiatives, rather than an 'us versus you' dialogue.



Public Transport operators should on the other hand be strong on enforcing the duty of public civility. The character of enforcement should not only be repressive in order to catch the offender but also focussing the victim and intended to comfort him/her explaining what they will undertake to help and possibly avoid reoccurrence of the facts.

### Space is not empty

The quality of space is determined by location and local identity. The challenge is to distinguish between the local identity and the global identity that are both under constant evolution.

Space is also about identity.

It is affected and defined by different cultures, constructed and serving political, cultural, religious, social...goals and eventually results from history, values, proximity, bonding

To authorities Public Transport is a planning and communication instrument, a tool to guide flows and activities. If successful, stations can become centres of development, deserted spaces can again be filled with flows and activities and integrated in a greater community.



Therefore urban Public Transport

- *guides and fosters urban development*
- *improves the quality of life*
- *encourages accessibility, inclusion and cohesion*

Its strengths as a communication and cultural backbone should therefore not be neglected. (see also article by Leonhard Coreth)

Let's go back now to the Public Transport station as a heterotopia. Given the diverse character of requests, the growing need of multifunctionality and the pressure for densification of space, and provided the operator concerned can remain in control and direct it the offer of urban Public Transport stations is expected to provide:

*A safe travel, trustworthy service, good value retailing, and smart entertainment.*

But passengers are citizens in the first instance, not all are customers. The commercial function of the PT space should never prevail on the community function of multifunctional interchange stations:

*A different and sometimes also unexpected range of activities or service offer releases tension, and often allows to temper extremely felt behaviour.*

*A very good example of a facility reducing tension with passengers and passers-by is the Tropical Garden at Madrid-Atocha station (see also article on Art by Nilufar Ashtari and Martijn Vogelzang)*

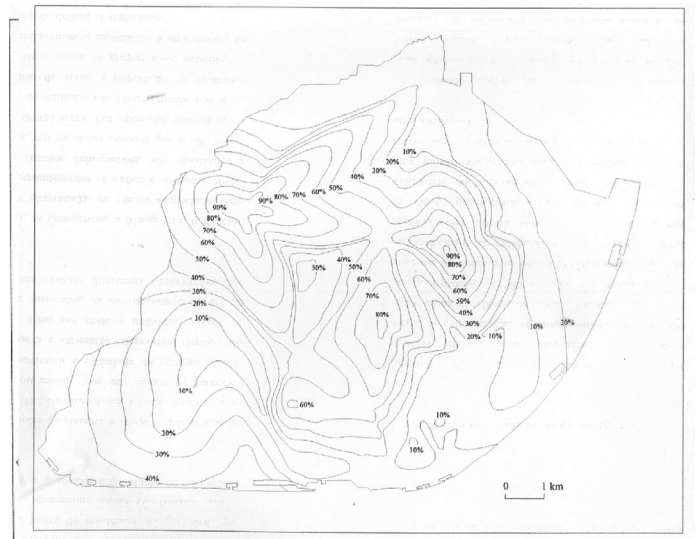
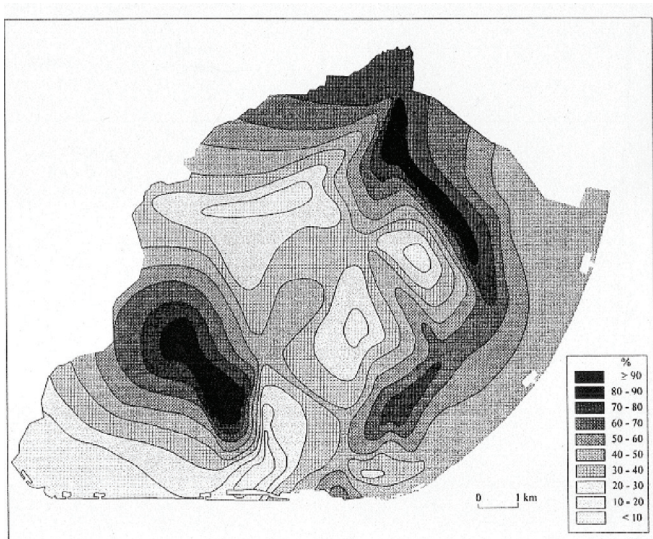


In short, urban Public Transport stations are about atmosphere, identity & identification.

As a centre of activity they reveal front&back space behaviour and should offer room for play and chaos, provide community 'bonding' through a mix of services such as shopping next to public services as post office, national health service, public library, ticketing agency (travel, entertainment).

Urban Public Transport operators should therefore reposition themselves and move from transporters to mobility&community service providers. Next to offering a safe travel and trustworthy service, develop good value retailing, and produce and/or allow for smart entertainment

But always Deal with passengers as citizens in the first place, as customers next, Since negatively perceived stations do not always collide with Police records, they could falsely direct Police efforts.



Investing in Public Transport is a decision o

- *Open up the city to initiative and development*
- *Communicate with citizens, develop identification & ownership*
- *Improve perceived security & control*





## 2. Front and Back Region

Greg Nys

In the dramaturgical view of social life (as proposed by Goffman) the front region and the back region play an important role. As stated earlier, modern behaviour (with the emergence of modern society – approx. early 19th century) was structured according to the setting. The divide between public space and private space was clear and when in public one behaved accordingly. The public realm could be seen as the front region. In this front region people would be on stage as it were. They would conform to the ruling norms of society because on stage, in the spotlight, they were under constant scrutiny of other people. So not wanting to perform deviant behaviour (fearing sanctions through social control), people performed their public role which was socially acceptable. Goffman coined this kind of behaviour front region behaviour.

Front region behaviour thus supposed a structural (auto-)control of one's conduct. Not being able to keep the performance up (as this would lead to enormous stress), there was a sort of 'back stage'. Contrary to the front region, the back stage or back regions were places where one could release the tension as it were. In general we could say that the back regions were private spaces. The most obvious example here is the private living space, people's homes. At home people could put down their public role and behave in a more relaxed manner/ way. They could lay down on the couch to take a nap, or put their feet up on the living room table, and so on. Another example of a back region – in the professional sphere – was the back office or coffee room of clerks. Having to deal with customers all day, they played their role as clerk in the front desk. Once in the coffee room or back office, they could put down their role and « be themselves » for a minute. The behaviour corresponding to the back region – back region behaviour – therefore was more informal in nature, but without offending other people (as it was conducted in private, not in public).

In the theoretical part of this research program (BILAN) we discussed the contemporary status and changes of public space. We saw that the distinction between public and private space is blurred nowadays and that there is a societal shift towards (more) private behaviour in public places. One example could be youngsters using seating facilities like they would use it at home. They put their feet up upon other seats, seats that have to be used by other travellers afterwards. This kind of demeanor causes friction or even conflict with other users of the seating.

Another important example of a different subset of behaviour is the use of all sorts of mobile technologies such as mobile phones, Mp3 players, PDAs, etc. Using these objects in public – and especially in smaller and confined spaces such as PT infrastructures – creates a small private sphere (or private 'bubble'). Unfortunately this private sphere is not physically apart from the surrounding space. So people using mobile technologies in public contribute to the blurring of the public/ private divide as well as to the spreading of private behaviour in public. Overhearing a conversation while waiting for the next metro can cause people to feel uneasy. In some cases it can even give rise to feelings of agitation and as a consequence lead to conflicts. Mobile music technologies and videostreaming devices have the same effects ; they cause (unvoluntary) obtrusion. Obtrusion is seen as a « territorial offense » and was defined by Goffman as follows :

*« I refer here to the capacity of a claimant to press territorial demands into a wider sphere than others feel is his due, causing them to feel that they themselves could be seen as functioning intrusively, even though they feel that this is not the case. »*

*(Goffman, 1971 : 51)*

He immediately adds some examples that could easily be applicable today :

*« The standard example occurs when an individual makes what are taken as overextensive claims to personal space, incidentally encroaching on the personal space of those to him or on areas felt to be public in the sense of a not being claimable. 'Offensive' loudness which sustains an encounter over a long distance is another common case. »*

*(ibid.)*

Next we should acknowledge the importance of the setting and the role it can play. Acts are posed and claims (e.g. on space or furniture) are made. Claims and acts that are not accepted by everyone, and as a consequence lead to conflicts. In the above mentioned examples we can see parallels with present-day problems in the public realm. The incident on bus line 23 of De Lijn in Antwerp whereby a man lost his life started in a very trivial way, too (a group of youngsters was talking about last night's football game too loud, thereby causing agitation with another man who then got into conflict with them).

It does not have to be negative overall, however. Sometimes individuals are conscious of the difference/ division between public behaviour and private behaviour. Observations show that there are people who use the setting('s resources) to create a kind of back region. This can be done literally (people physically isolating themselves behind a wall or a corner to make a phone-call), but it can also be done rather symbolically. Specific/ Certain objects in the setting will serve as symbolic means to seclude

oneself from other people in the setting. In other words people seclude themselves from the front region to create a small back region. Barry Brown endorses the importance of artefacts in a given setting. Artefacts that are used to facilitate the symbolic partition of the setting and the interactions taking place in it. It is important to note that the artefacts concerned are not as such made as a partition device for interactional purposes.

*« Considering the constrained nature of this interaction and the environments they are in, it is perhaps not surprising that the interaction makes use of objects which have another purpose. In an otherwise sparse environment these objects have come to be essential resources. Although the objects in both these settings are not designed for these purposes they have been appropriated to help manage the interaction by those involved. Objects are not simply distributed to customers in these settings but their position and movement is seen, recognised and understood as interactional events which are used to control and manage the interaction. »*

*(Brown, 2004)*

Now that we have pointed out the importance of artefacts in a given setting – and by extension the configuration of the setting itself – we can link up this information with the earlier stated tripartite of use, ruse and abuse. Front region behaviour runs parallel with the use of a place. By this we mean the occurrence of socially acceptable behaviour, of behaviour as foreseen in the design of the setting. At the same time there is a possibility for conflict when there is a contrast between the front region and back region behaviour in it. In other words : when there is abuse in the front region, this can either result in conflict (a bystander tries to reprimand the abuser(s), or in feelings of unease (when bystanders do not dare to reprove or reprimand the abuser(s). Back region behaviour runs parallel with both ruse and abuse. Back region behaviour as abuse can be understood as those types of activities usually associated with objective (fear of) crime – e.g. criminal acts. Back region behaviour as ruse on the other hand, is less prone to induce conflict. On the contrary, people will de-conflict certain situations by adapting the resources of the setting to isolate their private activities from the front region.



This active adaptation of the user could and should be studied in depth, as it produces ideas and concepts designers can integrate in refurbishments or new design. As stated in other parts of this report, the role design can play is the legitimising or facilitating of such ruses through a transformation and integration of design solutions based on these ruses.

- *Front region behaviour is socially acceptable behaviour in accordance with the intended public use of the place. Front region behaviour is conventional and associated with security. Design can encourage and facilitate social control and positively influence front region behaviour. Areas where such behaviour is preferred can be designed 'formal', with public use in mind, clear overview and unambiguous indications / semantic clues on the spaces' intended usage.*
- *Discerning back region behaviour into 'ruse' and 'abuse' as mentioned acknowledges the changes in social behaviour that have occurred in our society. While ruses are not always positively appreciated in the front-region, it is at the same time true that ruses can not only be regarded as non-conformist behaviour that needs to be avoided. At second glance, ruses can actually expand the perception of security; ruses are personal strategies to relax and to release tension, and can be used to de-conflict situations by isolating private activities from the front-region (through use or adapted use of the location). People displaying 'deviant' behaviour or activities can retreat and lower their direct imposition on other travellers.*
- *As the location and its artifacts indeed influence if or how travellers can execute their 'ruse' of the space, this means that design can play a role as facilitator. We challenge and encourage designers to come up with new approaches towards (positive) ruses in the back region of public space. Design can legitimise and accommodate positive ruses through a transformation of the setting; the creation of spaces that make more ways of usage possible that ultimately improve the perception of security.*

- *As examples one can think of the following spatial interventions: sitting objects that allow / invite for multiple ways of sitting, and / or allow group-seating, areas dedicated to relax or where people can stand with back cover that allow them to observe the situation, areas where people having private phone conversations can 'retreat' (psychologically / acoustically, etc.*
- *The following scheme recaptures again the different approaches towards ruse. We have to distinguish between positive and negative behaviour when accommodating ruses in the back region:*

|              | USE        | RUSE              | ABUSE  |
|--------------|------------|-------------------|--------|
| Front Region | +          | -/+               | -      |
|              | Facilitate | Reduce/Facilitate | Reduce |
| Back Region  | +          | +/-               | -      |
|              | Facilitate | Legitimate/Reduce | Reduce |



Figure.1 Back region behaviour in front region

As we can see in figure 1 there is a young man lying stretched out on the seating. According to our observation, this was no homeless man. He wasn't drunk nor did he seem to be under influence of any drugs. What we have then is a completely 'normal' individual except for his laying about. The reason why his behaviour seems out of place is because his behaviour is out of place. Would he be lying elsewhere – at home for example – there would be no problem. The problem here is that his behaviour is from another register, and so it contrasts with expected behaviour.

Although it is clear that this man poses no threat to the man next to him, this does not mean that this sort of ruse is to be accepted. His behaviour causes obtrusion towards the man next to him. Not only does he make an overextensive claim on the available space, the man next to him is confined in his movements/ behaviour as not to 'disturb' his temporary neighbour. And although this is not a threatening situation in itself, such a display can be indexical for other behaviour. As we explained above, people tend to associate the absence of small conventional courtesies with other inappropriate behaviour. One element being out of place in the young man's demeanor can cause people to think other elements could also be, some of which could be threatening.





## 3. Art and Culture

Nilufar Ashtari & Martijn Vogelzang

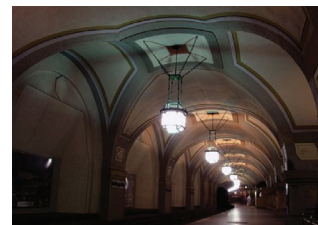
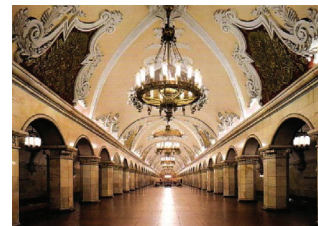
### 3.1. Art and culture in public transport

It is widely accepted that a commitment to art, culture and (environmental) design are intrinsic components of a qualitative and competitive transport service. All over the world, transport operators employ art and culture to transcend the functional into a richer experience for their daily customers.

Metro stations in particular have developed an important relationship with the arts, as if the utilitarian, artificial underground required a natural counterpoint. Simultaneously, large crowds of travellers formed new audiences, and stations became a democratic platform to present art to a 'general' public. With opinions on the role of art in society being subject of change over time, the appeal to 'democratise art' has repeatedly influenced the debate, and over the years has inspired many artistic interventions in metro stations.

*Even if the centrally orchestrated and politically driven station design in Moscow hardly serves as a contemporary role model, its heritage of 'palaces for the people' still offers daily travellers a unique atmosphere. Parallels can be drawn with Berlin, or – in a different manner – Stockholm, where a broad support of integrating art in public life has produced the 'longest art gallery in the world'. Still today, these large and profound artistic interventions reward the public with important environmental qualities, inspiring travel experiences and higher levels of pride and security.*

*By today's standards, the downside of these large-scale interventions is mostly practical. An ever changing and expanding transport system is easily 'captured' by historic interventions, and its heritage simultaneously becomes an obstacle for evolution or modernisation.*



Everywhere, millions of travellers appreciate art interventions –as well on small scales– and welcome their diversion and inspiration along generic transport environments. Art that –as a matter of fact– just as radically changed as society itself, today covers an extensive choice of (permanent and non-permanent) cultural expressions. These range across fields as diverse as sculpture,

music, poetry, performances, photography, applied arts and design, conceptual-, landscape-, light- and audio/visual arts, and several integrations of the new media. New creative fields will continue to surge, and each creative intervention will add a new experience to the world of public transport.

## 3.2. Positive security strategies through art

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Before focussing on the arts and their potential contribution to enhance perceived security, we should start with acknowledging that, for art, increasing security is not a primary occupation or ambition, nor should it be. The many faces of art provoke an array of personal reactions – from bad to possibly delightful, inspiring or thought provoking. The added value of art and culture becomes apparent through the impact on the travelling community; being a direct or indirect, momentary or lasting, shallow or profound influence on the mindset of a person. Albeit 'secondary', 'indirect', 'soft' or 'psychological' measures, creative or cultural interventions fit many environmental strategies that effectively or ultimately reach our goal: to change the travelling state of mind. In order to initiate, manage or evaluate their impact, creative interventions have to be embedded in wider strategies.

Without possibly being exhaustive, artistic interventions can be used to obtain different objectives mentioned hereunder. Art and culture can offer:

- *Identity*
- *Diversion*
- *Atmosphere*
- *Diversity*
- *Quality and Aesthetics*
- *Respect*
- *Connecting the local / community*
- *Interaction*
- *Nature / natural connotations*

This overview will be briefly illustrated further on. Before, as many of the strategies above are linked, we will recapture their application as centralised in the concept of heterotopias.

Art and culture can play an important role to integrate stations as part of the urban realm. Introduced in chapter one of the Bilan, the concept of 'heterotopia' signifies the re-invention of mono functional (transport) spaces as meaningful public 'places' in society, widely accessible, and democratically available. Apart from all other qualities, well- functioning heterotopias provide many natural strategies that correspond with a secure perceived environment, on different levels and dimensions.

Heterotopias offer places with key environmental qualities that provide positive ground to better understand 'the other'. In this respect, heterotopias can be regarded as a reaction to (and opposite of) anonymous and mono-functional (transit) space, that are – at their worst, but still not the exception– socially dysfunctional, and the opposite of our ultimate aim: inductors of xenophobia. Heterotopias on the other hand are places that communicate an open atmosphere through which different groups are not seen as threatening. Heterotopias promote interaction, new perspectives, support the learning of social processes or 'reading' behaviour, and offer vast possibilities for social control (and the willingness to intervene), or even democratic values.



The approach towards heterotopias is to create synergy between different actors that all cultivate and prosper by a 'healthy' public domain. The importance of this task cannot be underestimated: to reach its customers, public transport is, above all, heavily dependent on an attractive, secure and accessible public domain. Throughout the system, as well as the urban surroundings used by the travellers, day and night.

*Heterotopias already exist, are revitalised or created spontaneously, or can be formed through 'multifunctional' partnerships with for example art, culture, commerce or nature. Common denominator is the understanding of human behaviour, scale or preferences. Examples can be a vegetable market doubling as a bus station at a scenic waterfront site (Place Pirmil, Nantes), the botanic gardens in Madrid's Atocha station, a cultural center requiring an audience and accessibility, joins forces with a S-bahn station benefiting from atmosphere, a wider public and off-peak life (Steinebach, Germany). Generally, the beneficiary activities are not related to transport. Many partnerships are developed creatively through common sense, but few operators look beyond the more obvious commercial partnerships.*

Understanding and creating heterotopias would benefit from a multidisciplinary approach. Its conception requires, next to technical and functional understanding, the ability and talents to understand environments and human behaviour. Besides architects or design disciples, artists and other creatives are among those who understand and create qualitative environments and atmospheres.



## 3.2.1. Identity

Art is an excellent way to enhance or define the identity of the station or its spaces. It can provide subtle characteristics, a recognisable style, or a strong orientation point (landmark). Its attraction serves as a natural meeting point, co-constructs the identity of the operator, or is subtly embedded in a way-finding strategy.

Station identity can enhance the perception of security in multiple ways. The familiarity or sympathetic peculiarity of a station offers anchors, where our attachment to and appreciation of the place can grow. In more functional terms, references can be created that serve the important issue of way-finding. Station identity can help to 'naturally' finding one's way in the transport system. It is helpful if the identity of the station pays reference to the locality where it is situated, sometimes even providing references between surface and sub surface levels.

Even more important is the embedding of the visual identity in the transport systems' way-finding vocabulary and strategy. At different levels and places, identification points need to be created that however respect the way-finding concept and approach practised by the operator. We can for instance discern between different levels (hierarchies) that organise visual interventions:

*1st level: MODE: The identity of system mode (bus, tram or metro) or operator. This can be obtained through signage and the creation of a corporate identity.*

*2nd level: LINE: The identity and uniformity of a (metro) line (common visual clues between stations readable as stations of one line that belong together). This can be obtained through signage, colour, material, etc.*

*3rd level: STATION: The identity of specific stations. This can be obtained through art, colour/material, reference to landmarks at the surface, etc.*

In order to adhere to a clear visual concept, it is important that these levels are properly related and the hierarchy is respected. For instance, an important part of the station -the entrance- should be recognisable but simultaneously obey to the universal language of the line or system.



Unique station identity while maintaining the whole line identity (the stations share the same industrial concept).

- Easier identification of each stop
- Local identity
- Whole line identity
- Clear shelter and service/info point

S-bahn, Hannover

In the "bilan" we referred to the different approaches to metro station design. One can approach the station as a functional space and opt for a generic design or one can treat the station as a specific cultural entity and design a unique identity for it. Clearly, the history of the station plays an important part and has to be taken into account. If the main metro lines in London and Paris are good examples of generic design, those of Brussels and Stockholm are distinguished by their unique design, realized in cooperation with a large number of artists.

Due to their historic legacy, transport systems are often a combination of generic design characterized by standardized architecture and particular design. The metro station Louvre-Rivoli in Paris is a good example of particular design in an otherwise generic metro environment



### 3.2.2. Diversion

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Not all stimuli a traveller encounters when taking public transport are positive. While many factors induce stress or anxiety, the dominant overall experience is often plain boredom. As most environmental cues are an insult to the taste and intelligence of the traveller, many travellers look for diversion during their journey or waiting times, often in vain. Art and culture are excellent tools for fighting monotony and biding time, and serve to keep travellers minds occupied on something positive. Music, performances, installations or a 'simple' poem can bring enjoyment and animation, and enhance the travelling experience.

### 3.2.3. Atmosphere

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In a positive atmosphere security is likely to be perceived higher. Resulting from many variable factors such as smell, scale, light etc., we can focus on situational factors that promote the sense of well-being and comfort. We can choose to influence the atmosphere from reassuring till vibrant. Especially in an underground station, light for example is an influential and useful instrument to create atmosphere. Many art forms use light as a key element.

Generally, light in a metro station should be in accordance with the functional requirements, the safety regulations and the needs of the partially sighted. However, different ways of illumination and light temperatures can provide atmosphere and enhance perception while specific use of colour can enhance identification and orientation.

### 3.2.4. Diversity

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Diversity is an indispensable ingredient for a heterotopia as described above. Diversity applied means welcoming and appealing different travellers (an open atmosphere to accommodate needs, cultures, ages, genders, ...) as well as spatial diversity (natural hierarchy as opposed to monotony).

The personal and unique nature of art provides ample possibilities to represent and appeal to the wide human diversity. Spatially, artistic interventions can differentiate and diversify the space, to provide direction, hierarchy and social structure.

### 3.2.4. Quality and aesthetics

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Quality (valuable experience/perception) and aesthetics are indispensable and universal human needs to obtain a positive experience –obtainable through art.



### 3.2.6. Respect

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As we saw in chapter one of the Bilan, it is through creating a sense of identification and stirring people's sense of ownership that people take pride in their surroundings, take better care of them and may stand up to defend them. Vandalism and graffiti may even be discouraged. Before respect can be obtained, respect has to be shown to the customer, who likes to be treated humanely and personally. Art is a sign of respect and shows interest for the customer.

### 3.2.7. The local / community

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Actively pursuing bonding towards the (local) community obtains to earn respect and loyalty of those who directly surround (and benefit) the transport facilities. Re-inventing the stations as inspiring public spaces at a human scale, and by organising community events, residents have proved to 'take back the streets' and to transcend from passive audiences into an active, responsible creative population. Once again, art can be a great mediator to achieve this goal, representing the neighbourhood but ultimately contributing to the cultural life of the entire city. Public transport as a site for cultural activity contributes to the local economy and the development of cultural industries, besides boosting the public perception and image of the public transport operator.

Those involved in the design process of the interchange station should evaluate functional purposes in community/citizen terms (not only in commercial/customer terms).

### 3.2.8. Interaction

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Art can stimulate interaction, with and among the public. An artistic intervention can function as a social catalyst. An corporate website containing art besides travel information contributes to the traveller's cultural experience of the transportation system, as well as satisfying the interactive demands of our modern community.

Similarly, extending the heterotopia in the virtual domain by creating a forum where the traveller can give feedback on his/her travelling experiences, reduces the anonymity of the transportation system and in turn may alleviate the insecurity associated with it.

### 3.2.9. Nature or natural connotations

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As we saw in chapter one of the Bilan, it is through creating a sense of identification and stirring people's sense of ownership that people take pride in their surroundings, take better care of them and may stand up to defend them. Vandalism and graffiti may even be discouraged. Before respect can be obtained, respect has to be shown to the customer, who likes to be treated humanely and personally. Art is a sign of respect and shows interest for the customer.





### 3.3. Policies, implementation and requirements

Most operators consider art as an integral part of their responsibility towards the travelling public. And as became evident from the interviews conducted during the course of this project, travellers from different countries unanimously stated their appreciation of art in the transport environment.

Many operators acknowledge that a station need not be merely functional, and define a policy regarding art and culture. For some, public transport is a platform for cultural activity, to enhance the image of the public transport operator, as well as contributing to the local culture and economy.

Some operators have even created a special department within their hierarchy to deal with cultural matters in specific. The Design and Cultural Projects Unit at the RATP (Régie Autonome des Transports Parisiens) is probably the best example of an operator that embraced cultural branding and positioned itself as cultural actor in the urban field.

#### *RATP, Paris*

*Besides maintaining its premises to ensure durability and levels of comfort, which were part of the Metro Renewal scheme, the RATP obtained cultural branding through placing oval notices and illustrated displays accentuating the premises' architectural and historical qualities. Poetry events, heritage days, street artists, musicians, actors and jugglers further aim to attract passengers and bolster the company's image.*



The effort the operator puts into design or art may initially lead to high investments but it will return –directly and indirectly– through addressing and attracting more passengers. Some operators employ a percentage for art principle. Metro Rail (LA) policy allocates 0.5% of rail construction costs to the enhancement of the rail system through the arts. Essex employs a 1% for Art principle, while Stockholm has typically reserved up to 2 percent. As construction costs tend to trespass their budgets, care should be taken that public art projects will not be lost by the pressure of other demands.

Commissioning art and culture can be a specific task for the operator. Some have a special art commission, while others prefer to use multi disciplinary teams or make use of peer- to-peer reviews.

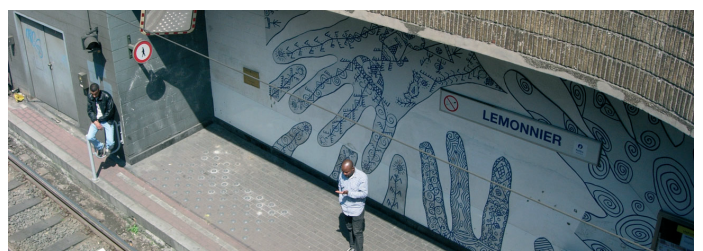
#### *MIVB/STIB, Brussels*

*Many of the artworks that adorn the metro stations of Brussels date back to the 1970s and 1980s, and several are starting to feel 'outdated'. However, also some of the newly installed artworks are problematic; difficult to upkeep, are not vandal proof, or simply don't evoke a universal feel. The aesthetic criteria by which to judge an artwork and determine its public value are always subjective. Given that age, gender and culture all influence our aesthetic vision, no artwork will please everyone.*

*Here the operator is faced with a dilemma. How to evaluate the public value of a work of art? Which artist to contract? Since 15 years, a special art commission of transport infrastructure (ACVI) successfully screens and selects the artists it wishes to work with, taking into account their international reputation and the relevance and cost of their work. In the past world famous artists such as Pierre Alechinsky (metro station Delta) and Paul Delvaux (metro station Beurs) were engaged.*

*Today, attention is paid to the social relevance of the artwork and the connection it makes with the city and/ or the residents living around the station. (e.g. Marin Kasimir (station Coovi/Ceria), Marie-Francoise Plissart (station Park), Hamsi Boubeker (station Lemonnier). Cultural branding is further obtained by the publication of an illustrated booklet of the stations with a short letter of intent or biography of the artist who contributed to the station's development.*

*One can download the booklet (available in French and Dutch) on the operator's website.*



During the conception of a metro station, artists should be engaged in the larger picture of the station's evolution. In case of a new site, artists favour to be involved from the start. Many have argued that a multi-disciplinary approach would improve the station's conception, and the improved result would logically benefit the user-perception. A sound interaction between architecture, industrial design and art improves concept and execution, and avoids patchiness or ad-hoc interventions.

#### *Los Angeles, Metro Rail*

*Metro commissions artists to incorporate art into a wide array of projects throughout Los Angeles, and all works are created especially for their transit-related sites. Metro is also recognized for its innovative and successful community involvement, and in return received over \$1.5 million in municipal and corporate contributions.*

*Known for its interdisciplinary approach, artists, design professionals and community members are brought together in the design of rail transit facilities. Many of these rail projects have involved artists as members on interdisciplinary station design teams. Artists are selected through a peer review process with community input.*

*A lead artist participated with the design team to incorporate art enhancements into the Metro Orange Line. In contrast to many transit systems with singularly designed stations, the Metro Orange Line stations are uniform throughout but artworks individualize each station. Station artwork was included as a seamless part of construction, and station artist opportunities opened up to artists with a variety of media.*

While we can discern between permanent and non-permanent interventions, more appropriate is to review time in accordance with the evolution of the station. Some stations appear simply outdated by its art. Many stations face reduced length in service life due to changes in use, expansions, and even deliberate short cycle refurbishments strategies. Alternatively to more integrated approaches, temporary interventions can seem an attractive proposition.

#### *Los Angeles, Metro Rail*

*The Metro Art Lightbox Program (Initiated in 2001) provides photography exhibits that involves a broad range of daily commuters. Artwork from hundreds of photo-based artists is rotated throughout the year.*

*More than one million daily travellers read 60,000 poetry placard of Poetry in Motion/LA™ (launched in October 1998) on the interiors of Metro Buses. The program also sponsors live poetry readings at busy bus stops and rail stations during the national Poetry Month.*

#### *Nexus, Tyne on Wear*

*'Tag wall' Artist teams up with graffiti artists and incorporates tags on metro tiles.*

*Nocturne, the biggest light artwork in Britain illuminates the 'blue bridge' from dusk to dawn. The 360 metre creation by artist Nayan Kulkarni spans the Tyne from Newcastle to Gateshead. The launch of Nocturne follows an ambitious 18-month £300,000 project to create a new landmark for North East England. The public can influence the colours it makes over the next 15 years by sending images through the website [www.metro nocturne.com](http://www.metro nocturne.com).*

*Metro station gives passengers film shows from from March 2007 on. A series of short films are to be projected onto the walls of the busy station as part of Nexus' Art on Transport programme. Metro passengers will be treated to a film show as they pass through Gateshead Interchange*

The success of artistic interventions depends on many more factors than available funds or policies. Introducing art in complex transport infrastructures requires respecting various conditions. Many functional requirements or physical restrictions of the space limit the interventions. What follows next are basic guidelines that concern the implementation of art in the transport environment:

- *Not conflict with demands for security or safety; transparency, physical dangers or flammability.*
- *Make use of easily maintainable materials and surfaces to foster a clean station.*
- *Be fabricated of durable materials (vandal resistant).*
- *Not impede the readability and clarity of transport lines (and the existing spaces).*
- *Respect existing functional 'interfaces' for the transport user (signs or other facilities)*
- *Respect the (lack of) space (for example not to impede passenger fluxes).*







## 4. Public Transport is the blood in the veins of cities.

Leonhard Coreth

### 4.1. Preamble

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I believe that public transport is the blood in the veins for the city as a living organism.

The city's economic future and growth depends on this network as well as the life- (and air-) quality of today's metropolis. Furthermore, it is a great opportunity to create a city's 'corporate identity' through public transport with its omnipresent vehicles and urban spaces.

As an architect and urban planner this is a highly interesting topic, which has gained even more attraction due to the latest security discussions and the emerging demands on public transport in the near future.

In the following I give my brief comments on the study especially from the architectural viewpoint but also as a daily passenger in the Paris metro network.



## 4.2. Introduction

Public transport groups individual locomotion and is therefore very closely connected with a city's road network and its facilities. The interdependency of Paris and the RATP creates a high potential for both of them to develop. Since the beginning of the metro system they have been tightly knit together. Due to a strong concept and the creation of identity, the metro managed to become a landmark.

Today you can't draw Paris without having in mind its metro. With nowadays positive image it's easier to attract passengers and pull them into the system, though one should not neglect the increasing demands of both, the passengers' and the city's.

Public transport oxygenates the city and offers complementary functions with a high potential for the future.

Densifying the city around public transport nodes is the logic consequence for future growth of a sprawling city like Paris. The RATP can (has to) focus on down town interconnections instead of further (additional) extensions of suburban lines. Strategic plans have to be developed together with the city well in advance. Scrutinise the current strategies and the openness for new concepts and models helps to develop the system.

Furthermore I strongly believe it is important to see Public Transport spaces as an addition to the public realm, well connected to the city pattern. People should get attracted not only by their main purpose, the transport (independent of street congestions), but also by their additional activities.

In the following I want to point out some concepts to strengthen the existing achievements and show some additional ideas.

## 4.3. Concept of Identity

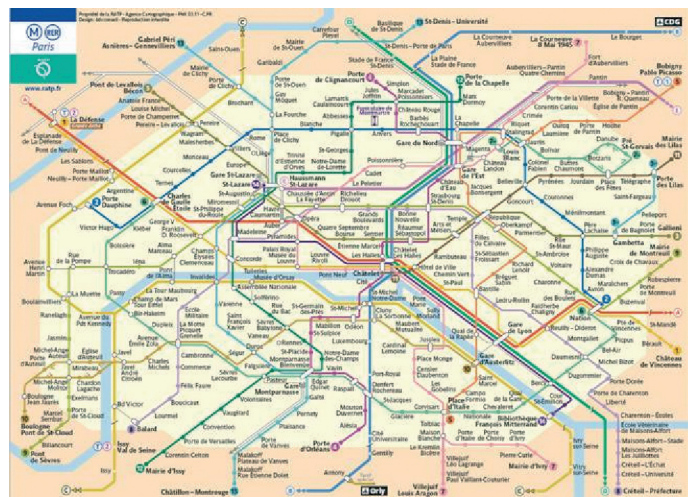
A company's identity is created by a uniform and coherent occurrence with recourse to its available segments.

The RATP with its omnipresence due to its large fleet, kilometres of routes, tunnels, semi-public spaces and large number of entrances integrated to the city pattern, has plenty of possibilities to appeal to a large amount of people.

In order to develop and strengthen the RATP's identity we can have a look at the several parts which form their network by breaking them down as follows:

- *The network* (as a source of life for the city)
- *The line* (linking the neighbourhoods)
- *The station* (as connection to the urban layer)

Regarding the first category, the network, its logic has to reflect to the city pattern and has to be readable and comprehensible to their users. It covers large parts of the city and offers for the city, the operator as well as the passengers and neighbourhoods.



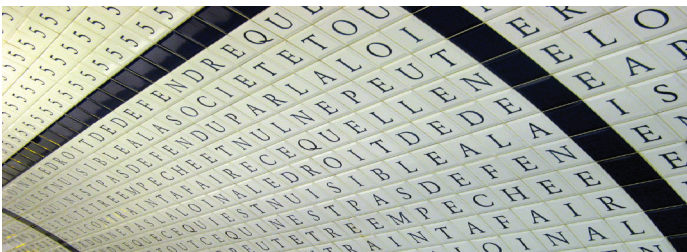
The dedication to a corporate identity with its common signage and fittings, a colour code for metro lines, common fittings like seats or waste bins, as well as common concepts (e.g. lighting concept...) contributes to the creation of identity.

Stepping down in hierarchy to the second category, the metro line, which links specific parts of the city and which reputation depends on the 'performance' of specific stations (or landmarks). Here I would suggest the commitment to a specific theme (e.g. cultural vein through city; garden line...) or to unify them by a common space conception (e.g. same tunnel or station forms, all with natural light...).

To define the uniformity of a line I would like to hark back to the analogy of considering a metro line as a bracelet. Like all the gems on a necklace, stations of one line belong together and should be readable like this. Within this logic it is feasible to accentuate specific stations for a special reason. This can be done by referencing to visual landmarks at the surface (e.g. Louvre Rivoli, Arts et Metiers...), or by something similar (e.g. through art).

It is important that this decoration happens in a cautious way and doesn't take over hand. It shouldn't dilute the clearness of a concept and be well balanced with the remaining stations.

Wherever possible on surface, the route should refer to something that happens and which helps applying the natural orientation underground.



Coming down to the last and most specific category, the stations, we have to keep in mind, that they are the most individual representation of the network. Stations connect the whole underground system to the urban layer and should represent the neighbourhood in some way, even if only by the the name which refers to it.

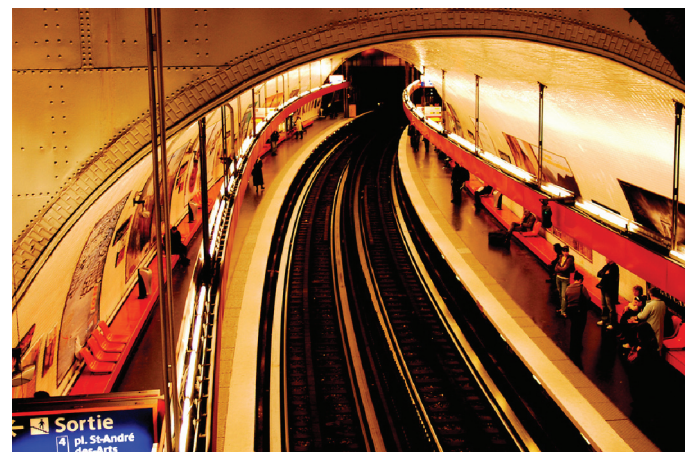
All predefined strategies in order to create identity are achievable through following methods:

- *Architecture, the conception of space (layer 1)*
- *Interiors in terms of functional layout (layer 2)*
- *Auxiliary measures to create atmosphere, phenomenological perception (layer 3)*

## Structure of the Space:

In my opinion architecture is the strongest and most sustainable instrument to form identity. I want to show briefly why this is, even if it's not the prior aim of this document.

The built environment shelters the users, interacts with them and is capable to communicate a message in an understandable and coherent manner. The Paris metro entrances and the original tunnel form which reach back to the beginnings of the metro system are good examples to that. They still fulfil their initial task (in terms of space), are easily recognisable, and helped (and still help) to form a strong identity for the RATP over the last century.



As entrances play an outstanding role for an underground metro system they should be presented as billboards; visible and well integrated in the cityscape. Taking the advantage and using these 'showcases' fosters the development of identity (like the NY taxis are considered as a part of the city and became iconic).



The idea of forming the entrances as figureheads was originally used by the RATP but seems to have been neglected over time. Renewing this strategy and adopting it for the 21st century by connecting them with transition spaces may be an interesting approach I would like to mention.



Above a positive example of a today's recent entry to St. Lazare metro station which is translated to nowadays needs. It is a recognisable form holding a staircase as well as escalators and an elevator.

A (probably less complex) canopy which shelters the access and acts as an architectural sign could be implemented to a large number of entrances. Probably a business model similar to the one for the RATP bus stations could be considered for funding.

Within the spatial conception we have the opportunity to introduce daylight and let users see the weather outside. Further we can create open sight lines, traceable pathways as well as spatial flexibility and atmosphere. – Space is limited and further extensions are expensive; the more is considered from the beginning, the less has to be repaired afterwards with interiors and signage.

### Functionality and Phenomenological Perception:

Nevertheless the possibilities of layer 1 issues, the focus of creating identity (for this time) lies on concepts to improve existing spaces and form identity through measures assigned to layer 2 & 3.

We need to create a readable 'interface', but due to the lack of space, the adaptation of existing spaces means mostly making compromises. Regarding the long life cycle of a station we can use interiors to express identity and at the same time update and enhance its a functionality through equipment and facilities. This visible layer allows us to adopt stations and adjust them to the life in the city, which changes every 10-15 years.

Personally I don't think too much of designing a sort of 'stage setting' to improve. It takes the clarity of metro lines (and the existing spaces) and risks to be outdated within a short period of

time. Art installations which work with the space are good and interesting tools to single out some of the stations. Architecturally speaking, functionality and phenomenological perception are strongly interdependent and could be highlighted as follows:

### Signage & Corporate Identity

Signage is an easy, but efficient way to underline the logic of a network, a line or a station, and to make them more comprehensible for passengers. By using a corporate colour code for furniture, the continuity and the coherence of a metro line can be enhanced (e.g. all seats on the red line are red).



In the existing situation one can see that this is not always used in a very coherent manner. Without changing a line some seats are red in one station, yellow in the following and green in the third. This confuses the perception of unity and distracts orientation. Signage has to be visible for all at all times, but at the same time to be presented in a discreet way. – Tall people looking for the name of the station from the train can't see the sign hanging high up on the wall; smaller people within a crowd during rush hours have difficulties finding the exit signs.

Using walls, floors and ceilings as information carrier fosters at all times to stay oriented and to feel the personality created through corporate identity.

### Entrance / Exit Experience:

To enhance the entrance experience, entrances should be visible in the streets and permeable for flux in order to reduce the psychological barrier. These facts attract people, keep them oriented and pull them into the system.

An enhancement can be made by building visible but transparent shelters with integrated lifts.

On these neuralgic points it is essential to give more necessary information. It would be great to be informed where you are, what you will find by using this entrance, and how far away you are from the envisaged platform. Specific user groups have to know if they can expect elevators, escalators or if they have to climb hundreds of steps down to the platform. Maps where to find the most convenient way to the specific platform as well as where to buy your ticket are one of the main desires of passengers.

The next barrier on the way to the platform are the gates which should not discourage people from entering (and exiting) the metro network. They should be designed wide enough to suit different users as elder people, mothers with children, handicapped and people with luggage.

Showing already at the entrance if there is a possibility to pass (conveniently) is also very convenient to passengers.

In my opinion Public Transport has the obligation to help and reduce private transport within the city boundaries and will therefore be used by more than just commuters. I see more and more the necessity to allow (technically) small transports like bikes, even if they are limited to specific times.

### Furniture

Corporate furniture and fixtures like seats; waste bins etc. are also essential parts which encourage identity due to their high recognition factor and their intensive use.

Furniture can further be used to organise the space, to create retreating rooms on platforms or to control the fluxes. The typical spatial layout could also become a piece of RATP's identity.

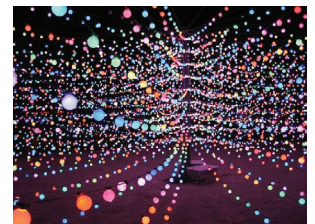
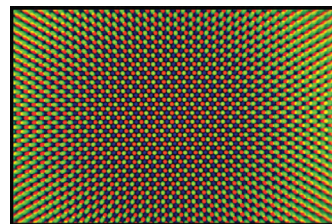
### Light & Colour

Light is a very strong instrument to create atmosphere. We can use it as a guide as well as to define spaces.

We can break the monotony, accentuating areas with different illuminations and different light temperatures. Further light can be used to adopt spaces over periods and seasons by dimming it. Light is a sign of activity and has an important influence on the human mind. In my opinion the basic temper in a metro station should rather be neutral, underlined only by some 'colour smudges'. Depending on the concept, the frugal use of colours enriches a place (without overloading it) and encourages the identification and orientation.

LED's could be integrated in walls, floors and ceilings to underline the space and add a 4th dimension to it by movements. LED's are controllable source of light which could be used as light installations, to emit information, to guide through their movements or just to change the lighting mood.

*(see also article by Vincent Eaton in Further Developments)*



### Materials, Surfaces & Textures

The use of easily maintainable materials and surfaces fosters a clean station and the perception of security.

In the Parisian metro stations the famous white tiles with its chamfered corners are very good examples to that. They help to break the space down into a human scale and interact with its surroundings by reflecting light. An artificial sky is created and together with the tunnel form they create atmosphere.



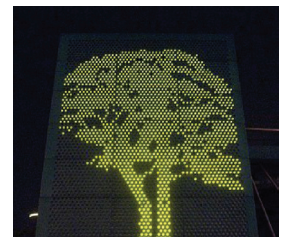
## Information & Communication

We are living in the information age and rely on being informed. In order to keep passengers updated with what happens in the metro network as well as what happens above, it would be good to introduce more methods to make information accessible for passengers.

Supplementary to the already discussed LED technology this can be also done by creating W-lan points or by installing TV screens on the platforms which present a selection of weather news, news, traffic information or short cartoons.

The network (and the city) gets a powerful instrument to communicate to Public Transport users, to supply cultural education and keep passengers informed. This sort of information fosters the connection of underground spaces and the city layer, especially if festivals or exhibitions are advertised or if the content relates to something that happens on surface.

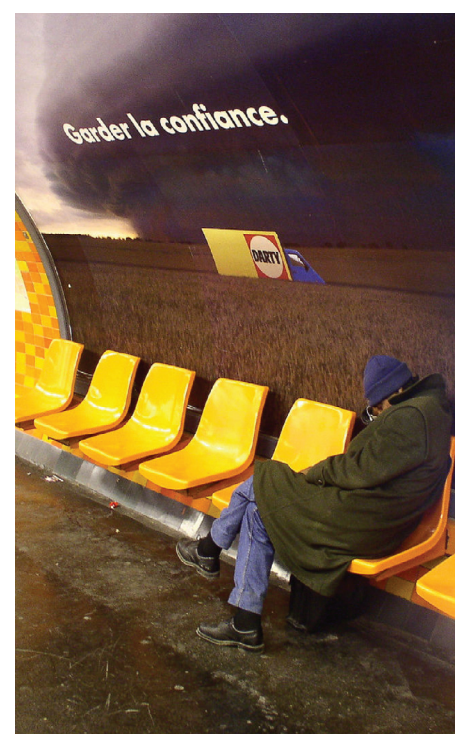
A station communicates also through its advertising messages (unfortunately the quality is often quite poor). I like the idea of framing advertise posters and make them part of the station for certain intervals like this is done in the Paris metro. This frequently recreates the visible impact of a station and can also be used more artistically like this is done in the 'Assemblée Nationale' station.



## 4.4. Concept of Transition-Space

The introduction of transition spaces helps to interconnect the urban layer with the underground metro system. They can be understood as an intermediate concourse level between the street entrances and the platforms.

New needs evoke new activities which are not only transport related; to meet these demands is an exciting challenge. Transition spaces should act as an extension to the public realm, intensifying communication in between the two patterns and creating a heteropia for a large user group. Naturally there is no desire to pull the interest away from the surface layer but to create an additional layer for urban densification.





## Spatial Conception:

The space should be conceived as a controllable public space, manageable in size, with the possibility to open and close certain areas without interfering with the PT (day / night situations). The design should foster the control of fluxes through its layout and bring a higher perception of well being and safety due to more social control by activities.

Transition spaces don't have to be very big. Their size should depend on passenger volumes and the size of the interconnection nodes they are situated in.

Furthermore, transition spaces should have little depth, be close to the surface and should offer (easily controllable) accesses to public buildings like a library as well as shopping centres, parking garages etc.

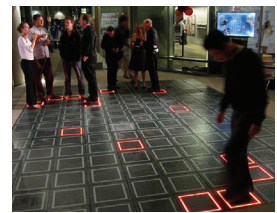
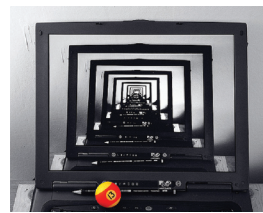
Enhancing interconnectivity through the introduction of natural light and sight lines brings the city and the metro system closer together and helps to consolidate them.

The predominance of an open atmosphere with animation through art performances or musicians and retail like cafés or restaurants can create a vibrant and convenient space which is welcoming to various people.

Transition spaces give attractions to passengers, break the monotony and create a strong orientation point which can also be used as meeting point.

The lack of space raises the question how to introduce new activities without the extension of the physical room. The logic consequence would be to extend the spatial perception through virtuality, by creating 'windows' into another dimension. The introduction of this media will help animating the transition spaces (as the other parts of the network) with the possibility of user interactions and by transmitting information at the same time.

Nevertheless the great prospects, also this method has its borders as the human being still is a physical creature depending on physical space.



The use of transition spaces depends on the type of Public Transport system (whether it is open or closed).

In closed systems like in Paris, Transit Spaces placed in interconnection stations could pose a problem because they could introduce new barriers. Probably further development of ticketing strategies and -systems can be interesting for the future.

Because of its constitution, the concentration on this specific 'level 1' task would be probably less cost intensive but highly efficient.

*(see also article by Joao Cruz)*

## 4.5 Outlook

Rethinking nowadays PT stations and looking at their future prospects for my diploma thesis, I engaged in the design of an attractive future PT node in Vienna which I called "hypertrans". The term "hypertrans" (= more than transport) means a multi-functional traffic node which exceeds the common functions of a PT station by allowing virtual journeys and therefore satisfies the interactive demands of our modern community. Besides easily accessible transport connections, comfortable shopping and restaurants, the passenger shall also have the opportunity to relax, i.e. by travelling virtually or exchanging information. The surfaces are information transmitters building constantly new "images" through the interaction of the user. Thereupon, the 'body' has to be constructed such as to build a coordinated flow of traffic, light and information.

The RATP await big challenges in the near future. It's more than evident that there is a necessity of expanding the system due to an increased demand. At this stage it is probably a good moment to reconcile existing policies and develop sustainable strategies. As underground space is expensive and existing lines are difficult to extend, additional quality service should be offered.

In my opinion PT has to come out of the ground and foster a tram system which is well integrated in the city pattern and convenient to cross and interconnect for pedestrians. Emphasised quality services offer interconnection and are convenient for short and middle distance rides. There are methods to foster tram systems to take over the role of cars step by step and emphasise a more ecological approach. The coexistence with independent transport is still feasible.

Furthermore, approaches to develop attractive models to cope with demands PT & rent a bike, rent a car, park and ride are interesting proposals.

# Conclusion

A pleasant stay is conditioned by a space that protects against negative influences, catches the user's attention, analyses conventional things and offers the passengers new perspectives and physical perceptions.

We have seen that the main guidelines for a prosperous station are a strong spatial concept with flexible and functional spaces, intuitive pathways, easily accessible and well connected to the city. These points emit a good basis for future alterations.

Recapitulating we can say, that giving an Identity to the Public Transport system can be achieved through architecture, with the right distribution of light, well designed corporate fittings and well considered signage. Furthermore the implication of additional functions as transition spaces helps to increase the acceptance of passengers, prepare it for future demands and keep the system state of the art.

These guidelines are understood as a basic concept that has to be developed in detail regarding the specific spaces.

To realise these keen projects and ideas it is for sure that political support (and understanding) is inevitable.

About 100 years ago the RATP stood before similar challenges and managed to solve them. I am confident that they will also master the upcoming challenges and guide their PT system through the 21st century.

## ANALYSIS AND GUIDELINES ON 3 LEVELS

| Layer 1  | Layer 2   | Layer 3  |
|--|---|--|
| <b>Structure of the space</b>  | <b>Human interaction + equipment<br/>Facilitators</b>   | <b>Phenomenological perception</b>   |
| <b>Spatial structure</b>   | <b>Use &amp; usability</b>  | <b>Sensual perception</b>  |
| <b>Spatial reading</b>   | <b>Usability reading</b>  | <b>Phenomenological reading</b>  |
|  |   |  |
| The spatial urban INTEGRATION  | Signage + information systems   | Visual perception <ul style="list-style-type: none"> <li>- light</li> <li>- colours</li> </ul>   |
| The logic of the underground space<br><br>Space syntax                         | Control, fee & ticketing system   | Auditory perception <ul style="list-style-type: none"> <li>- level of sound</li> <li>- relation between sound +space or material</li> <li>- music</li> </ul> |
| Views, Social control  | Surveillance (camera's)   | Olfactory perception <ul style="list-style-type: none"> <li>- ventilation</li> <li>- smells</li> </ul>   |
| Interrelation<br>inside – outside<br>underground – aboveground<br><br>Accesses | Furniture (seating, waste bins, litter, ..)   | Tactile perception <ul style="list-style-type: none"> <li>- texture of the finishing material</li> </ul>   |
| Natural light  | (Artificial) functional lighting<br>Emergency lighting  | Ambiance lighting  |
|  | Complementary Functions <ul style="list-style-type: none"> <li>- Shops</li> <li>- Snacks</li> <li>- Atelier, ...</li> </ul> | Materialisation  |
|  | Maintenance   | Climate  |
|  | Communication <ul style="list-style-type: none"> <li>- Publicity</li> <li>-</li> </ul>                                      | Sustainability   |
|  | Art / video's   |  |



# 5. How can design positively influence the perception of security in public transport?

Rob van Hoofstat

## 5.1. Introduction

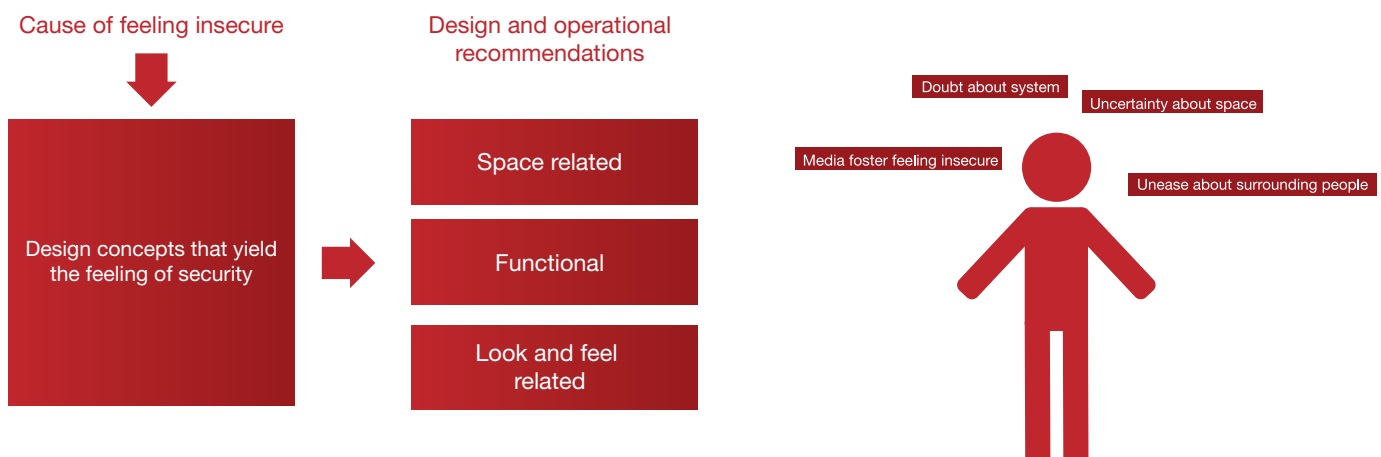
This chapter explains how we can reduce the feeling of insecurity. This chapter is therefore organized from a passenger perspective. It starts from the different causes generating insecurity. For each cause it highlights the concept(s) that allow to reduce fear. The concepts give birth to design recommendations as well as accompanying operational/communication recommendations, as both domains are highly intertwined.

In later chapters these recommendations are regrouped into build environment topics: space (network and station topology), functional interface and finally look & feel aspects.

It is technically and economically not possible to recast the existing lines & stations. Therefore most space related recommendations apply only to new lines and stations. Budget constraints will even require further trade offs.

### The causes of perceived insecurity in public transport

1. *Unease about the surrounding people (other passengers, passers-by, Public Transport staff);*
2. *Uncertainty about the space;*
3. *Doubt about the functioning & safety of the transport system;*
4. *These feelings are fostered by the media whenever they relate incidents in the public transport stations or even close by.*



## 5.2. Cause 1: Unease about surrounding people

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### Use, ruse and abuse

#### USE

Users of the PT system are expected to display "public" behaviour, in contrast with "private" behaviour. Public behaviour respects the many – mostly unwritten – rules that govern human behaviour and interaction in public places. Such a reassuring behaviour should be encouraged by well thought design combined with operational measures.

#### RUSE

By ruse we could understand people lying on the seats or on the floor or sitting with their feet on the seats, running fast, yelling, smoking where not permitted, are drunk, displaying unadapted behaviour. Ruse confuses or irritates the bona-fide users.

The borderline between use and ruse is vague: what about the public use of cell-phones, or teenagers sitting on the ground, or couples that embrace each other passionately in public? Changes in social behaviour exemplify changes in society. Public behaviour that once was rejected or pinpointed is nowadays widely accepted or even has become culture.

As the borderline is vague, and culture driven, marginal forms of ruse can not be forbidden. It seems better to accommodate with it to some extent by creating back-regions in waiting area's, where a more private behaviour is accepted.

Insert a set of thumbnails with images of such in between situations.

#### ABUSE

By abusing of the transport system we mean: damaging furniture, applying graffiti, jumping entrance barriers....This is particularly the case if the personal space or physical integrity of the bona-fide traveller is invaded by intimidation, inappropriate verbal or physical contact, theft or aggression or, to the extreme, by terrorism. Of course, abuse should be prevented and also subject to fine.

### 5.2.1. Front region and back region

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#### FRONT REGION

The function of the front region is to provide for safe and swift movement of the travellers from the street to the trains and vice versa. It includes entrances, exits, stairs, escalators, elevators, ticketing areas, gate areas, corridors, and the front of the platforms.

#### BACK REGION

The function of the back region is to provide for waiting outside the fluxes of the front regions. These back regions, out of the main fluxes, put travellers at ease and allow for some back-region behaviour like phoning, eating, relaxing etc. without disturbing the travellers in the front-region flux area. Such regions are to be provided on the platforms, and where applicable in waiting or rest areas of mezzanines.









## 5.2.2. Convex spaces, axial views and outlooks

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### CONVEX SPACE

A convex space is a space offering large overviews.

### AXIAL VIEWS

An axial view is a long open or transparent space that allows travellers to see their next destination.

### OUTLOOKS

An outlook allows the traveller to situate himself in his environment. This can be a landmark building in the city or overview on a mezzanine or on the platforms



## 5.2.3. Translating the concept of heterotopia

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The first mission of Public Transport is to offer mobility to: young & old, male & female independent of the social or cultural background. Public Transport is an essential asset of the urban environment not only to bring mobility to all, but also to foster economic and social development, to reduce CO2 emissions and generate a cleaner environment, to open up the urban context to dynamic and innovating development as well as communality and social cohesion.

The BILAN of this research program described a "heterotopia", amongst others as a public space filled with identity, relations, history, as well as possibly public and private initiative. The field research we carried out reveals that a public transport space in which a sound combination of public and private activities is developed reveals less criminal offences than a public transport space in which besides the PT the majority of the activities developed are strictly commercial.

*(see also article by Joao Cruz)*

Making the PT-system more attractive will increase usage and yield the PT system more travellers, also outside rush hour. Their profile will more reflect the mixed profile of the inhabitants, commuters and visitors.





## 5.2.4. Balancing access control and attractiveness

Most public transport systems reserve the access to the inner corridors and platforms to their regular passengers. Two methods of access control are in use:

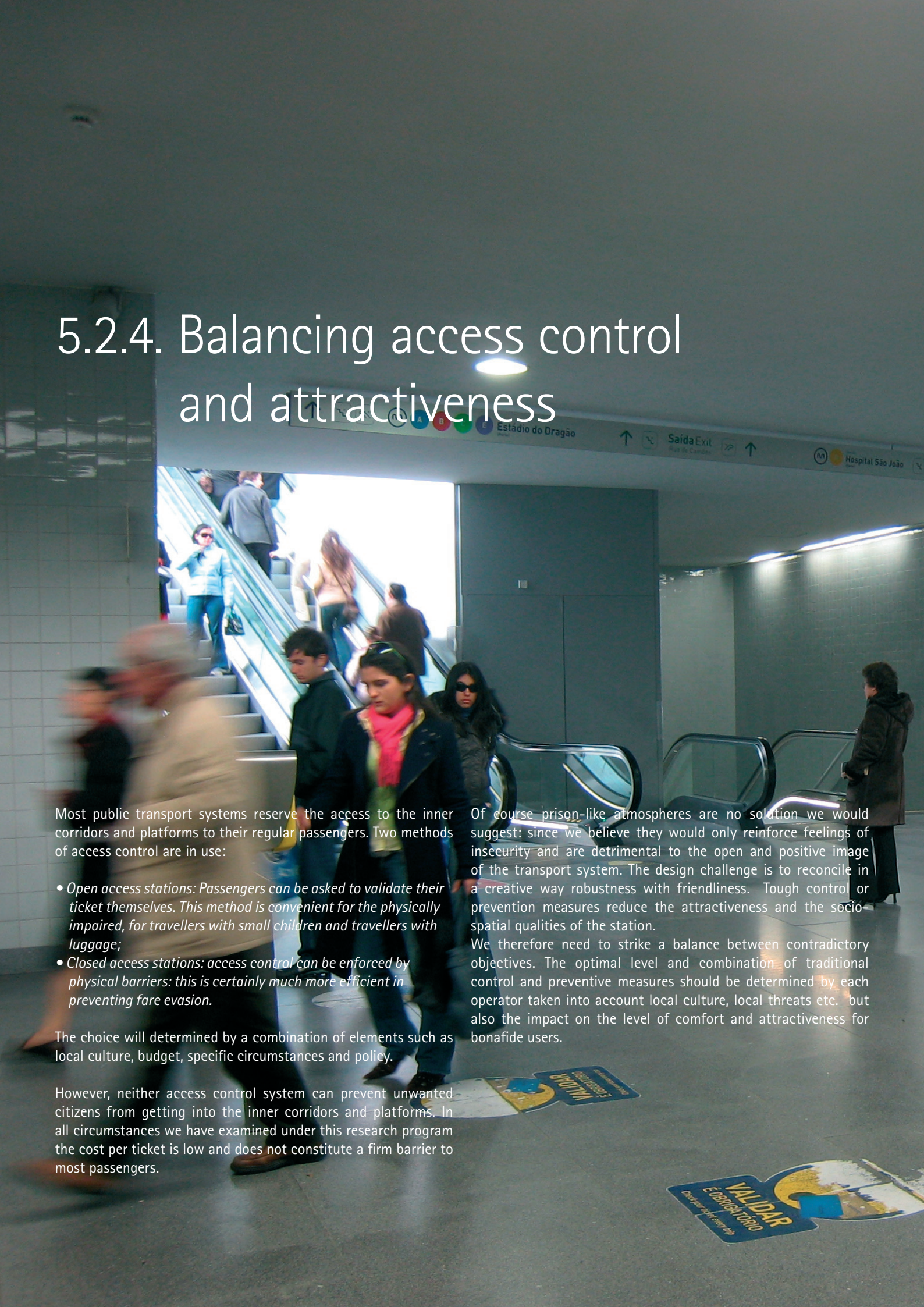
- *Open access stations: Passengers can be asked to validate their ticket themselves. This method is convenient for the physically impaired, for travellers with small children and travellers with luggage;*
- *Closed access stations: access control can be enforced by physical barriers: this is certainly much more efficient in preventing fare evasion.*

The choice will be determined by a combination of elements such as local culture, budget, specific circumstances and policy.

However, neither access control system can prevent unwanted citizens from getting into the inner corridors and platforms. In all circumstances we have examined under this research program the cost per ticket is low and does not constitute a firm barrier to most passengers.

Of course prison-like atmospheres are no solution we would suggest: since we believe they would only reinforce feelings of insecurity and are detrimental to the open and positive image of the transport system. The design challenge is to reconcile in a creative way robustness with friendliness. Tough control or prevention measures reduce the attractiveness and the socio-spatial qualities of the station.

We therefore need to strike a balance between contradictory objectives. The optimal level and combination of traditional control and preventive measures should be determined by each operator taken into account local culture, local threats etc. but also the impact on the level of comfort and attractiveness for bonafide users.









## 5.2.5. Shortening the waiting time perception

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Waiting takes a lot of time, in our minds. Information of public interest as well as advertising can shorten the perception of the waiting time, pass useful information to the traveller and transform boring transport in some kind of a journey.

A simple, economical and proven means to achieve this is to install on the platforms advertising frames. Advertising brings images and messages to the platforms appealing to waiting passengers. Advertising companies will come with new content usually every two weeks, which offers entertainment. Flat screens are a new carrier for general Public Transport-system information and promotion, news, city information and advertising. Many constraints, described in the recommendations govern however their use.

Projection is a more experimental way of distributing images. Problematic is that the line of sight between the traveller on the platform and the opposite projection wall will often be blurred by the trains.

The projected images risk also to be of a too low luminance and contrast for the well lit platforms.

## 5.2.6. Maintenance is paramount

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Without good maintenance it is a waste of money to invest in design to reduce the feeling of insecurity. Stations that are filthy, walls that are covered with graffiti, furniture and other installations that are defaulting, water on the ground or leaking through the roof, lights that are out of service,... will lead to the impression of an environment that is left to itself, without any supervision or management.

Prior to investing we need to make sure that the new investments will be affordable from a maintenance viewpoint.

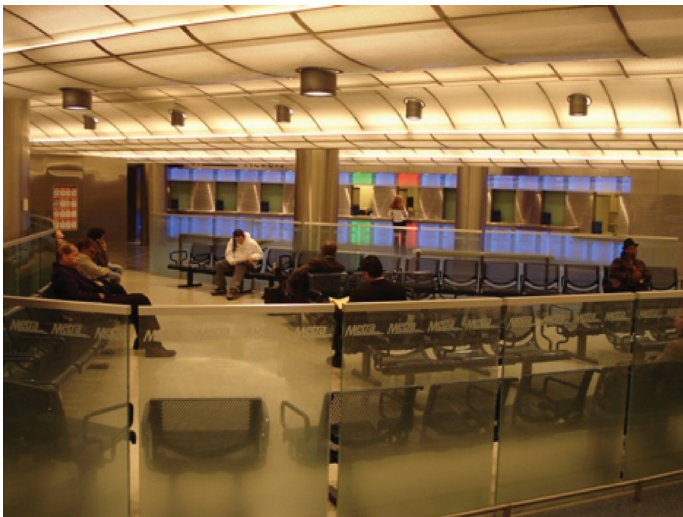
## 5.2.7. Recommendations to create a heterotopia that generates a reassuring behaviour

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Well thought design can to a large extent prevent and positively influence these causes of anxiety by encouraging and facilitating a reassuring behaviour and attracting new kinds of travellers.

### SPACE RELATED RECOMMENDATIONS

- *Design space in such a way that a maximum of people can see each other. This can be done by regrouping certain functions, by a convex lay-out of the space, by using glass and creating long axial views and outlooks within the station. An open, not complex, internal topology provides fewer opportunities for ruse/abuse, as people can not hide, and travellers are not isolated. Avoid dark corners, meandering corridors & narrow or isolated platforms;*
- *Many stations have a low occupancy in off-peak hours; therefore it is important to regroup passenger fluxes as to achieve a minimal critical occupation;*
- *The front region should be designed to provide easy and comfortable access from the street to the trains and vice versa and should not encourage hanging around except for the short waiting periods on the platforms;*
- *Provide for back-regions: these are places bordering the front region where travellers can wait and relax while leaning or sitting still able to observe what is happening in the platform space. Such back regions can be created by benches, handrails, displays, allowing passengers to withdraw somewhat from the front region. They should provide back-cover for waiting travellers, and orient their view towards the front region so that they can observe what is happening in the platform area;*



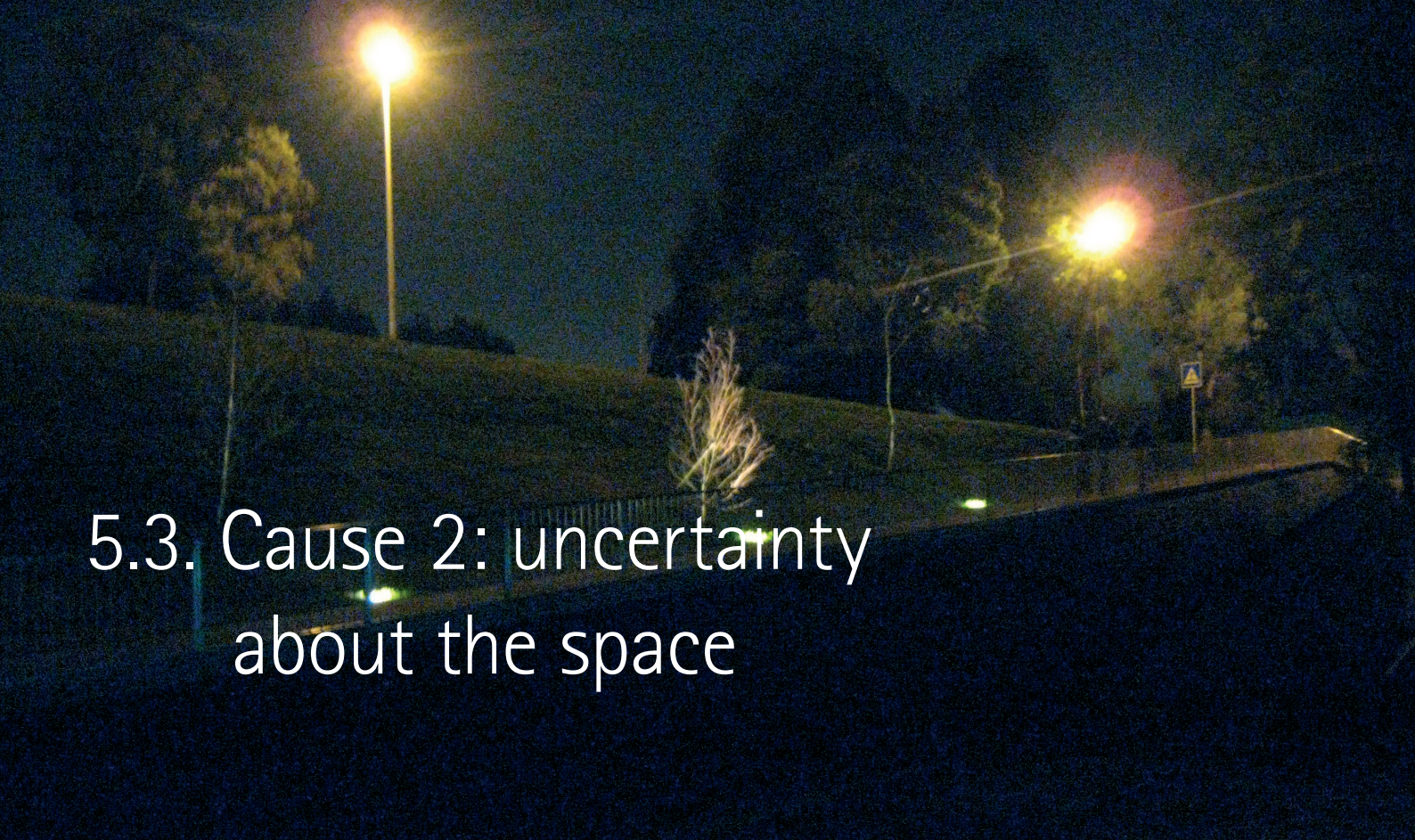
## FUNCTIONAL RECOMMENDATIONS

- *The public transport facility area must be clearly defined. It is advised to install gates that can be closed during the night and to mark the entrance during opening hours by a change in colour or structure of the floor;*
- *Combine direct and indirect lighting. In the front regions the passenger flux should be accommodated by clear light guiding the passengers flux. The level of light in the back region can be lower but must have a sufficient level for feeling secure. A good solution for platform lighting is to combine direct lighting of the front region with indirect lighting. Light coloured ceiling and/or the walls can thus be used to reflect the indirect light into the back regions. In staircases light can be build in in round Inox-handrails, so that the stairs and steps are clearly visible. (cfr chapter Barbara Hediger);*
- *Use white light for the illumination of all signage elements The colours we see are the intersection of the colour of the light and the colour of the surface.*
- *If the light does not encompass the full light spectrum certain signage items will appear dark, or change colour.*
- *Canalize the flux of the travellers through signage, floor material and/or colour, light intensity and appliances as to avoid collision, to separate zones of fluxes from waiting zones;*
- *News-stands, snack-bars, pharmacies, dry cleaners, post offices, public (guarded) toilets and nursing rooms in the main interchange stations can make the network more attractive and their operators provide also for some minimal human presence. Preferred localization is in a back region on a mezzanine level with high traffic, but sometimes smaller service or retailing facilities can be localized also on a wider back-region platform area;*
- *Provide for nearby car and bike parking facilities in commuter suburban stations;*
- *Additional features are required to welcome pregnant women, parents with young children, elderly and PRMs:*
  - *alternatives to stairs: preferably ramps or transparent elevators as part of the main access facilities*
  - *indication of preferential seating at platform level and in the trains*
  - *stuffed walkways for the blind, following normal routing as well as vocal announcement of trains and direction at platform level and stations at train level*
- *Communicate clearly through signage and messages suggested and intolerated behaviour. There must be clear indication about what is not allowed within the facilities as well as from what point a valid ticket is required;*
- *Provide an inbound communication system that allows travellers to signal unexpected or unwanted behaviour by installing SOS-totems or simply display an easy to dial telephone number. Install a control centre equipped for immediate remote monitoring and organising quick interventions. Make sure passengers can use their mobiles in the station.*
- *A CCTV system can also discourage use/abuse as offenders know that they can be identified immediately or later on. In the future these systems will allow for automatic tracking of abnormal situations. For new installations, their localization, definition, and remote command possibilities should be carefully considered*
- *Robust equipment/furniture and easy to maintain walls will also reduce the effects of ruse/abuse and enable the quick removing of graffiti;*
- *Last but not least the visible presence of stewards, control and security staff will also discourage ruse and abuse, except when the situation gets out of hand.*



## LOOK AND FEEL RECOMMENDATIONS

- Use white or light pastel colours for the walls as to
  - (a) enlarge the perception of the space;
  - (b) create a peaceful quiet feeling;
  - (c) avoid to disturb signalization and advertising;
- The appliances, equipment and furniture should have a clean look and feel, their design and materials should facilitate maintenance and warrant sustainability;
- Maintenance and repairs are paramount and carry the preference when deciding on new investments
- Don't use the colour of chairs and equipment as a signage element (e.g. line colour). This will lead to a cacophony of colours that will create unrest, and finally blur signalization;
- Advertising can make the waiting time feel shorter. It is recommended to create large advertising frames on the station walls. The frames must be clearly separated from the space reserved for the station name.. The advertising frames should be at regular intervals, interlaced with the station name, as to create a certain rhythm.
- Flats screens with programmed spots and actual information can be used to shorten the waiting time and enhance the travelling experience:
  - The screens should be aimed at the back-region and not encourage travellers to obstruct the fluxes in the front-region;
  - As waiting times are much shorter than in waiting areas of airports the spots or news flashes should be short ;
  - Text related to news or events can be added by subtitling;
  - Advertising should be screened beforehand
  - Non commercial content should relate to the Public Transport-system, the city, the weather, or other topics of public interest to the traveller
  - A high critical mass will be required to justify the high fixed cost of managing and creation of adapted clips. Using the same clips or news flashes on flat screens in the trains will help to achieve critical mass.
- Provide soft background music at off-peak hours as to create a feeling of occupancy.



## 5.3. Cause 2: uncertainty about the space

Travellers are stressed if they can not find their way. This problem exists as well at macro city/network level and at micro station level.

### 5.3.1. Congruence of the Public Transport network with the city lay-out

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At street level a larger city is organized around main long axes and squares, where the long axis come together. This plan is resident in the mind of the inhabitants and transmitted to visitors by way of city maps.

When the lay-out of the PT system is congruent to the lay-out of the city, the traveller will easily understand and memorize the Public Transport systems topology.

When planning a line it is preferable that the route follows the main arteries, as they are visibly present in the mind of the users and indicated on all city maps.

The transfer stations should correspond to existing main squares. Those squares are almost always hosting major landmarks or landmark buildings. (e.g. opera, city hall, congress, former market-places... ). Their names can be used as easy to memorize station name.

#### Promote stand alone entrance constructions

In case of ground level or elevated Public Transport systems the visibility of the access points is easy to achieve. Underground transportation is however less visible. Often entrances are not much more than small and discrete stairs leading down from the pavement, or worse, hidden in an anonymous alcove of a nearby building. The difference from a parking access or an underground pedestrian crossing is sometimes not evident.

It is important, from a perceived security viewpoint, that the travellers can easily find their way from the street into the PT system. Concentration of all entrance functions required in that place (stairs, elevators, escalator, Public Transport information point, ....) is to be preferred.



This requirement offers also a great promotion opportunity. Underground PT-systems have a big commercial disadvantage: they are not, like taxis and busses, visible in town. Their stations are to be compared to shops in underground commercial galleries. Persons that are not familiar with the neighbourhood will not be attracted to them, unless they have no alternative means of transport.

This concept offers many advantages:

- *makes the underground PT system clearly visible in the city;*
- *increases the attractiveness of the neighbourhood;*
- *facilitates access for the different kinds of users;*
- *avoids multiple narrow passages with low usage that are frightening;*
- *facilitates control;*
- *offer an outlook on and from the below mezzanine;*
- *bring daylight towards the vertical transport and the underground level;*
- *brings, for a new station, a cost advantage compared to many separate entrances.*

Complementary direct access to shopping malls and concourses in public parts of buildings can offer an advantage to their occupants and in the same time offer a secondary (safety) entrance/exit. But this should not be a substitute for the visible street level entrance construction.

This recommendation is very effective for new stations or stations that are rebuild/transformed for other reasons. It is clear that regrouped existing spread entrances/exits is out of budget for existing stable stations.



## 5.3.2. A visible logo above all station entrances

The concept of the entrance building is not enough to identify the PT system as these constructions do not all have the same form for historical or urban planning reasons. For most of the existing stations such a separate construction is even lacking.

Therefore a standard means of identification of all the entrances to PT stations is required. This is provided by the use of the logo of the PT-network.

### FUNCTIONAL RECOMMENDATIONS

- *The logo of the PT system should be present above all station entrances, old and new, as it is paramount for the identification and the promotion of the PT-system at street level and does not require major transformations or investments;*
- *The logo should be visible from all sides. For stand alone entrances the logo needs to be executed double sided, or as a cube. If the entrance is in a building several logos are required: one placed on the wall of the building above the entrance and a second double sided one perpendicular on the wall.*

*the traffic and out of reach for vandalism. If a small entrance construction is present, the best place is on top of this construction.*

- *The logo should be illuminated from within*
- *The size of the logo should allow its identification from about 150 meters, as this is important for both orientation and promotion,*
- *At the beginning of an installation program of logos in the street the actual logo design need to be checked for visibility. As we known omnipresent logos like Shell's have had several face lifts without changing the basic concept. The visibility and look and feel of the logo can often be enhanced by small changes in colour, background, contrast, etc.*
- *At the beginning of such a program the urban planning authority of the city needs to be implied as to define admissible size and height.*
- *The name of the station is also required for orientation purposes, above all entrances, but it is sufficient if this name is readable from the vicinity of the station.*

*A cube is also possible. The logos should be positioned about 5 meters above street level as to be within eyesight above*



### 5.3.3. Good readability of the internal space of the stations

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Under readability we understand that the travellers can easily orientate themselves in the station and understand the position of the station in its neighbourhood. This is important to take stress away from the travellers.

Readability is a given for street level or elevated stations but not for underground stations.

Insert example of view from metro train (RVH).

Readability can be measured by the number of times the traveller has to change direction starting from the street and going to the platform. Directional changes that occur in the same space are to be neglected as this does not disorientate the traveller.

The more the station is deep and the more lines that are served by the station the more readability will be difficult to achieve. Multilevel underground interchange stations are hard nuts to crack from this perspective.

#### SPACE RELATED RECOMMENDATIONS

As it is almost impossible to recast existing stations the recommendations below apply only to new underground stations or stations that are rebuild for some other reason.

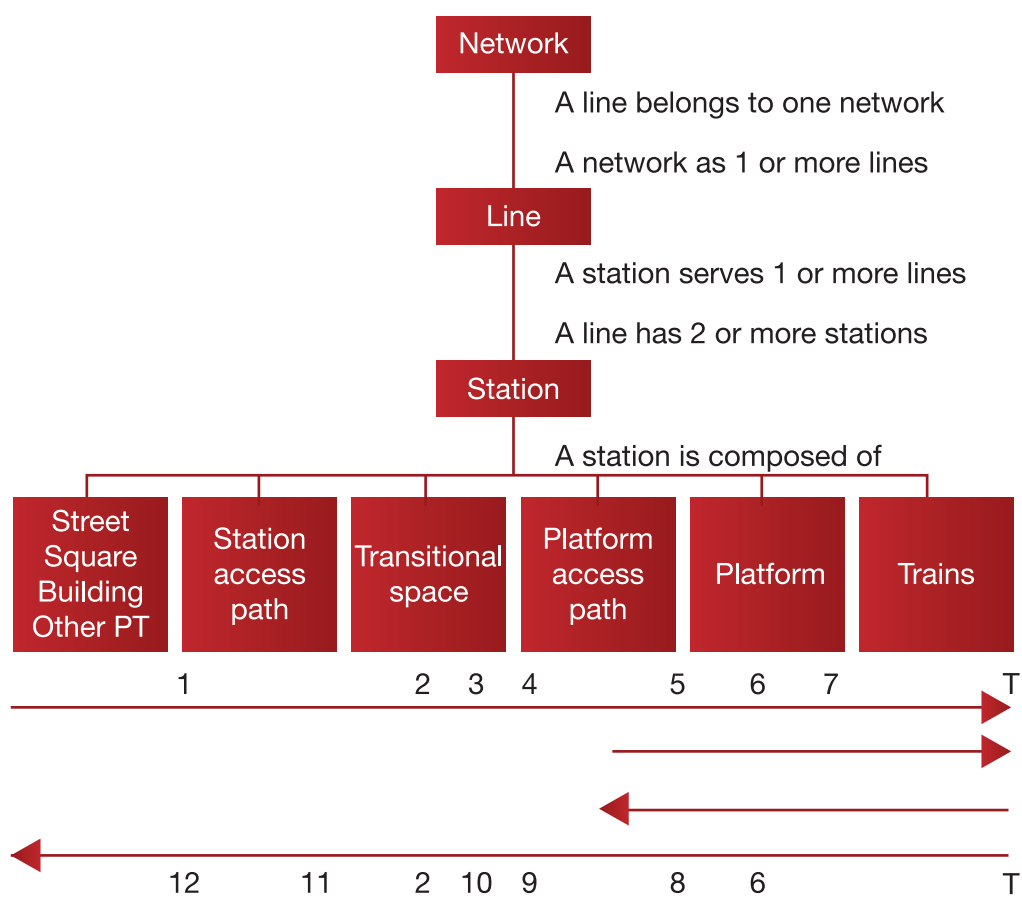
- *have as few different spaces as possible in the stations:*
  - *create one open entrance/exit column from the transparent street level building to the lower levels that regroups all vertical means of transport (except emergency stairs)*
  - *use mezzanines that hover above the platforms in one common space encompassing the different levels*
- *if closed corridors or staircases are required make sure that the next space where the traveller needs to go is visible from the start of the corridor or staircase*
- *use elevators, escalators and staircases with transparent walls*
- *if possible create outlooks on some landmark features of the neighbourhood*
- *if the space is available it is preferred to cast the station as one big hall with transparent vertical transport and hovering mezzanines.*

# 5.3.4. A comprehensive and coherent information system

Congruence with and visual reference the city lay-out and good readability of the stations helps travellers to orient themselves. However in most existing cases there is only limited congruence and poor readability of the stations. Occasional travellers, foreign visitors or PRMs will anyhow need additional information – voice, written or given by other humans"presence – to find their way.

## FUNCTIONAL RECOMMENDATIONS

A comprehensive information & routing system is therefore required to assist all the passengers in finding their way around:



The numbers indicate the different points where routing information is required

## FUNCTIONAL RECOMMENDATIONS

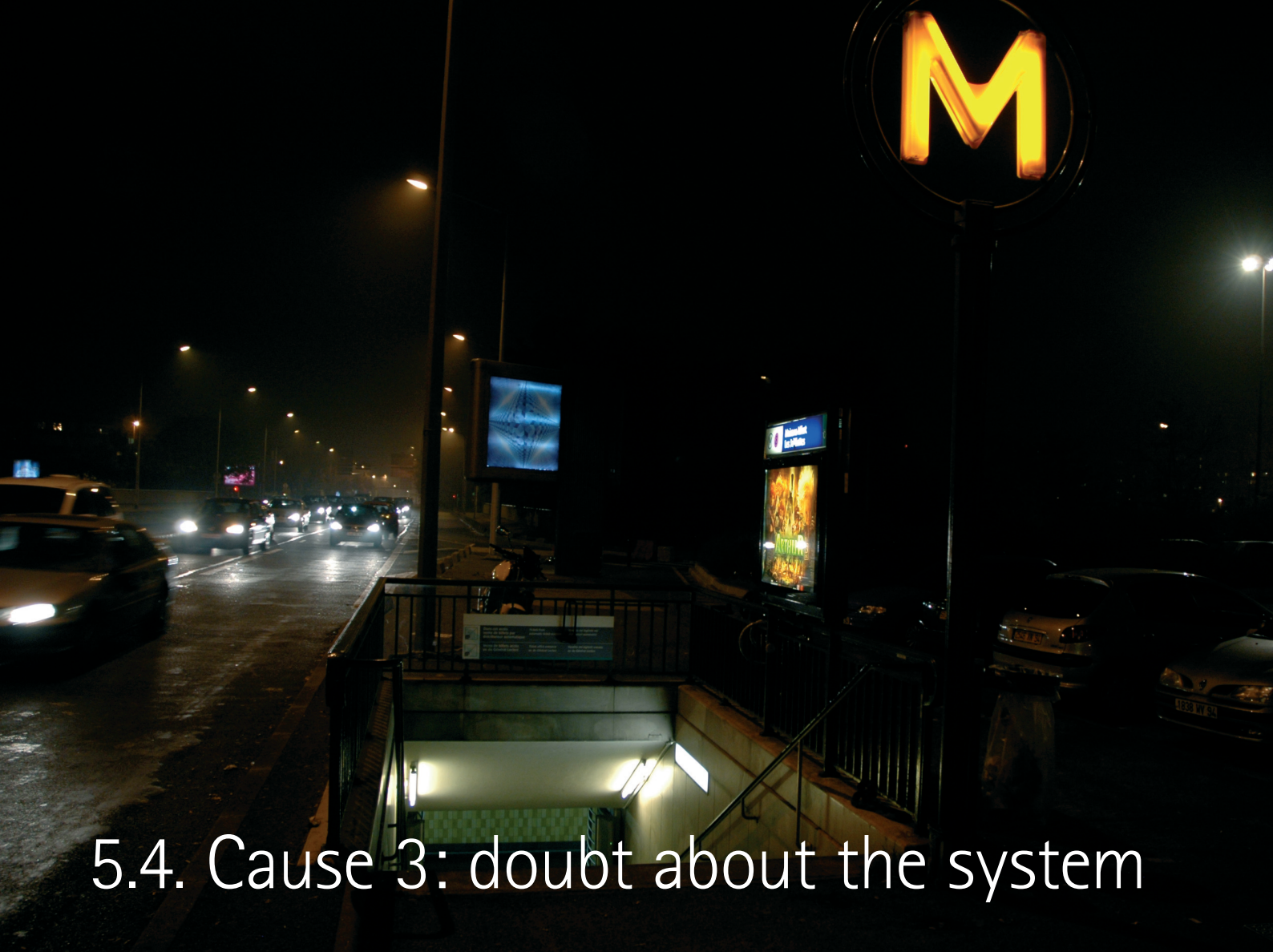
- Each components of a network need to be identified by a unique identifier:
  - Network: is identified by its unique logo
  - Line: it is recommended to identify each line by a roman number, as this is workable for all (foreigners, blind, colour-blind), practicable in networks with many lines, (western) language independent, usable on mono-colour displays and easy to list. The line identification can be supported by a differentiating colour, and when applicable even by a name (loop, circle line)
  - Station: it is necessary to identify each station by a unique name. The name of a transfer station or an end station should refer to the main topographic landmark of the neighbourhood. This can be the name of a square, a monument, a building, a park, a bridge, a railway station, an airport or even a well known cemetery ...). Preferably the name of these stations should be language independent. For the names of other stations the name of a street that is perpendicular on the line can be used if no well known landmark is present. In bilingual cities one can not avoid to have 2 language versions of the station names.
  - Direction of a line: the name of the end station is to be used to indicate the direction

Each type of identifier should always use the same font, and background shape & colour.

Size, lighting, and contrast with the background should provide sufficient readability from the real reading distances.

- The following information is required on the path of the traveller:
  - 1 Station entrance:
    - PT-operator logo(s) visible from all sides at 150 meter
    - station name
    - network map at street level
    - operating hours
    - service messages
  - 2 Transition space:
    - station name
    - network map
    - neighbourhood map
    - fare info
    - service messages
  - 3-4 Access path to platforms:
    - repeat line number & end station at each entrance & bifurcation
  - 5 Entrance of the platform:
    - line number & end station
    - service messages
  - 6 Walls of the platform hall and center panels of double sided platforms :
    - the station name should be repeated at regular intervals visible from with the trains
    - network map on the platform wall or a central panel in case of double sided platforms
    - neighbourhood map on the platform wall, or on a central panel in case of double sided platform
  - 7 Above the railside of the platforms repeat at regular intervals and visible for the waiting travellers:
    - the line number & end station
    - service messages
  - Train:
    - line map
    - direction or end station name
    - next station name
    - service messages
  - 8 – 9 Platforms exits
    - Exit + outside destination name(s) of square, street or building)
    - transit possibilities within the same network: line identifiers & end stations
    - transit possibilities to other PT network: logo of the other network
    - service info
  - 10 – 11 – 12
    - Exit + outside destination name(s) of square, street or building)
    - transit possibilities to other PT network: logo of the other network
    - service info
  - Service info relates to:
    - Waiting time to next train for a direction
    - Operating conditions like delays, canceled trains, closed stations....
    - City events in the neighbourhood of the station
  - IT driven displays are a practical way to communicate service messages is to use. They allow also that one platform can be used for trains going to different end stations
  - For the visual-impaired:
    - braille indications in elevators and at the beginning of stairs and elevators
    - stubbed walking paths
    - vocal announcements of direction of trains and service messages at the platforms
    - vocal announcement of next station in the trains
  - City maps on paper and on the internet should show the station entrances by means of a small logo. If possible also the lines should be indicated with their number and if available also their colour.





## 5.4. Cause 3: doubt about the system

### 5.4.1. Inspire confidence in the reliability and safety of the transport system

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Stations that are closed, trains that are delayed, elevators that are at a standstill, lack of cleaning, graffiti on the walls, empty ticket boots... all these give the traveller the impression of a poorly managed and/or running down Public Transport system. This adds up to their stress and fear.

Therefore it is important that all these aspects are well managed. This means that the public expect the stations to be clean and free of graffiti, and that equipment that is in disorder to be immediately reported and quickly repaired.

A certain number of disorders can however not be avoided. Good communication with the customers is crucial as to show that everything is well under control. Customers should be made aware of opening and closing times of stations, exceptionally closed stations with the reason of closure, delayed trains, passing trains non accessible to passengers, elevators and lifts under repair.... Customers can in critical stations also be warned against pick-pockets, and communication is of course a priority in emergency situations.

Operating the public transport system is operating a service facility. Like in all service environments communication with the clients is essential. Communication starts with the marketing of the system (good external signage making the public transport system more visible in the city). Proactive and reactive communication within the facilities keeps the clients confident that they are taken well care off and that the facilities are securely managed.

## FUNCTIONAL RECOMMENDATIONS

- *The minimal requirement is to have a remotely operated public address system at platform level.*
- *Inexpensive running text message strips are an economical means for displaying short service information and are very suitable at the station entrances as they can operate in full daylight.*
- *Inside the station flat screens offer more extensive possibilities. The flat screens used for service messages should focus on the fluxes in the front regions and are different from the flat screens that could be used for shortening the waiting time in the back regions.*





## 5.5. Cause 4: the media boost the perception of insecurity

### 5.5.1. Foster direct customer communication and manage media-relations

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Only a small minority of the passengers becomes victim of aggression in the public transport system. Often incidents in the neighbourhood of a PT station and independent of the PT system are referred to and located in the press as having taken place 50m from station X, Y or Z. When a lethal incident is covered in the media, all the travellers and potential travellers of the public transport system are confronted from existing and potential travellers of the public transport system are confronted from all sides with this incident. Most of the media cover more than one city. The incident is now relayed extensively to millions. This is detrimental to the image of the public transport.

It is important that such incident is not interpreted as the consequence of mismanaging or insecurity. The recommendations proposed in this report will have a beneficial effect on the number of incidents but can never prevent a single major incident. It follows, in such an event, crisis communication needs to be handled.

Catastrophes like collisions, fire, explosions killing thousands are of a different order. They are prime time news all over the globe. Again the management will have to control the crisis and restore normal operations.



## FUNCTIONAL RECOMMENDATIONS

- *In case of major incident or a catastrophe, crisis communication needs to be implemented*
- *The operator should prepare for the different major incident scenarios in advance, and have a press officer in charge of this communication;*
- *In case of catastrophes it is recommended to assign upfront two teams, each chaired by a top manager: one team handles the crisis itself and the communication around it, the other team, more technical, is responsible to restore normal operations;*
- *The emergency scenarios should be exercised yearly by the crisis management staff outside normal service hours. Messages should be prepared in advance, and means of communication (public address, message boards, moving text displays, flat screens etc.) tested;*
- *As we have seen communication is a key factor to inspire confidence. Communication should not be limited to reactive communication in case of a crisis. All opportunities should be used to communicate positive messages via the media. As the media know that many people are interested in the evolution of public transport, it is possible to get also positive news into the media;*
- *A public transport company is a service company. A service company needs to communicate actively with its clients whenever they are using the service. This can be done by folders, message boards, running text, flat screens etc. Proactive communication through its own channels towards its own staff as well as towards the passengers should tackle positively the issues related to the perception of security.*

More and better communication does not require huge investments, but can yield a significant positive impact.





## 6. Architectural and Urbanistic analysis of transit spaces

Livia de Bethune & Eran Mordohovich

### Introduction

As planners and designers of metro station, or any other transportation nodes, we have the responsibility of identifying the elements which impact the different senses which are related to the (non) secure feeling of the users.

The physical realm of a station consists of many levels – from its location in the urban context to the structural details of a handrail or the colour of a tile. Many of those have a direct impact on the way people, who travel through the transport system, experience it.

A spatial design is creating spaces and places. People perceive those as secure or alienating. They can be pleasant and clear but some can create disorientation, wake up primal fears and provide opportunities for negative/ criminal/ a-social situations.

*The aspiration for efficient flow of commuters, economical competency and the design trends of the period are main factors evident in the metro stations examined in this exercise. It is less obvious if the need to provide secure – in contrary to safety issues – environment for the individual commuter was embedded deep in the original design. It is obvious though, that later on, actions were taken to answer the lack of secure feeling and the incompatibility of the spaces to serve off mainstream users groups such as disabled people. Those actions were taken to restore the public's confidence in the system and convince that those stations are secure to use all around the clock. Along side with the true effort to make things work better and safer, in many cases a chaotic appearance was created, reflecting the patched up manner things were evaluating.*

We can divide the spatial aspects, into categories (which refer to urban and architectural contexts, discussed in this chapter):

- *The spatial characteristics resulting from dimensions, proportions (human vs. structure), spatial organisation of different functions, presence and location of certain architectural elements in the space, etc.*
- *The tangible utilities – The facilities, which are related to the functionality of the system and influence the quality and perception of the spaces. Among those are control and ticketing system, signalisation etc.*
- *The phenomenological factors, which create the "atmosphere" within the architectural envelope and give it its sensual and tectonic characteristics: light (its colours and intensities), materials (their surface, finish appearance, associative images, durability, acoustic qualities etc), smells and acoustics.*



## 6.1. Categorising the spaces in the interchange zones of public transport.

A metro station is a transitional space, experienced in a dynamic manner by people using it.

We define certain zones, according to their location, function and their spatial logic. Together they form the dynamic sequence of spaces, characterizing the way users experience the Totality of the transportation complex (Introduce a scheme: O ---- O )

- *The access zone, which connects the street (the urban realm), and the underground complex. It forms in certain sense the reception hall of the station, and which usually determine the user's first impression of the complex. This zone normally consists of:*

- *The entrance of station on the street (urban) level.*
- *The vertical movement means – mostly stairs, escalators and lifts leading towards and outwards the underground levels.*
- *The ticketing hall – this area we consider as*

*part of this space and yet we see in the last years an evolution towards a mechanisation of the system and a reduction of the importance of this space. Saying that, in many stations it is still the space where new users are questioning: 'Where to go now?'*

- *The transitional zones in which travellers move towards the trains through:*

- *Vertical movement zones as stairs, escalators or lifts*
- *Horizontal transitional zones as corridors.*

- *The waiting zones – train platforms, where people are forced to be more passive for a while. Only the senses and mind stay alert and the traveller gets another type of experience and seeks for distraction and comfort. In this zone, the dynamic experience is of the passive kind – static commuters watch fellow travellers and trains passing by.*

Those zones will be conceived as secure/insecure by people, not only depending on the above-mentioned spatial characteristics but also on other elements such as the volume of commuters at specific moments of the service hours, social behaviours of fellow travellers, levels of maintenance, human/digital control and surveillance measures etc.



Spatial design on itself cannot totally diminish fears, insecure or criminal activities. However, It can, if done with the sensitivity to the individual commuter, reduce part of the unpleasant feelings frequently associated with metro or underground structures. Good design can reduce also potential opportunities of criminal acts.

The architectural and urban research described in this chapter features the following analysis points:

- *Spatial reading of the transit complex (using the space syntax method, where applicable – see chapter methodology)*
- *Sensorial or Phenomenological readings of the transit place.*

Our study aims, at this stage, at the analysis of specific existing stations. Saying that, the recommended guidelines should be seen as applicable in the broad perspective of design of metro stations and systems.

A design, aimed in reducing fear and raising the sense of identification, should be incorporated in any important reconstruction or renovation schemes of metro spaces. Integration of fear-preventive design in the early stages of designs of unrealised yet stations (or lines) will benefit, first of all, the future commuters (more attractive system will result in more commuters eventually). It is far better to have fear-preventive design awareness embedded in the early design process, than having to patch up and improve later (financially as well as image wise).

## 6.2. Spatial reading of the actual

### 6.2.1. Principles of the methodology of Space syntax (or – the logic of the space)

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#### The axial line system

Space Syntax is a method to analyse the logic and the functioning of given space. Bill Hillier and Julienne Hanson developed this methodology<sup>1/2</sup> that is based on views, and spatial experience, which orientate the movements in the city.

*The city is shaped by the socio-economic forces through the relations between movement and the structure of the urban grid. The choice to use the space syntax method, which tries to understand and explain the qualities of urban structure, was done since we see the (underground) interchange zones of urban public transport as public spaces and continuation of the urban network.*

In the following paragraphs we will explain the basics of the method components on an urban network and its application for our specific research on interchange zones of public transport.

The logic of movement in space is to follow long views, which can be mapped on a city plan as long axial lines. The more turns you have to do to reach a new view, the deeper the space is. the deeper it is, the less integrated it is towards the urban network, and the less comprehensible it is. A lesser-integrated space normally means it has a more private character.

*In the cases of metro stations, the less angles (e.g more direct view) one has between the entrance and the platforms, the shallower the platform is. In terms of the space syntax, this means that the platform is better integrated in the urban network and it will be conceived as more public.*

Spaces that are deep (and harder for orientation), are less integrated in the urban network. Those spaces are not adapted for a large public use and especially for occasional users (like tourists).

*Space syntax analysis can also be implemented on the urban scale level in order to analyse how the stations with their entrances are integrated in the urban tissue of the city.*

In this research the space syntax method mainly was used to evaluate the interior parts of the stations (including the entrances as the contact zones between street and underground spaces).

**There are mutual relations between the physical location of a place, its socio-economic status, the architectural composition of the station and the sense of security of the users of public transportation.**

We tried, in this study, to demonstrate (in the case of the De Brouckère station) how both levels were analysed using the space syntax method. This exercise displays how can the macro (urban) level and the micro (the station itself) be related in terms of their rule in urban life.

<sup>1</sup> Bill HILLIER, Space is the machine, a configurationally theory of architecture, Cambridge university press, 1996

<sup>2</sup> Bill HILLIER, Julienne HANSON, The social logic of space, Cambridge university press, 1984



## Convex Space system

The form of the space defines the use of it.

People move in lines and want to know where they go – those are the long axial lines. Besides the active movement through the urbanscape, there are places, which invite to pause, observe and meet others. We'll get a better understanding of these spaces by mapping the convex spaces of the network. A convex space is a space in which all the people can see each other. Public space (streets and squares) can be divided in a **multitude** of small and larger convex spaces.

The more axial lines cross through a convex space, the more interesting and stimulating it will be experienced.

This can be explained by the strategic views along different axes (in different streets). For example, main urban squares are large and interesting convex spaces (or they are composed of a few convex spaces) with different streets merging into it.

*Mapping the metro station spaces, will give insight whether it has potential convex spaces. Large convex spaces, where one have a possibility for overall views on all persons present or passing by, can indeed give a feeling of security.*

## Inter-relations between the convex spaces and the axial lines.

The total spatial value of the system (whether a city or a station, in our case) depends not only on the quality of a single space but even more on the interrelations between convex spaces. In many historical towns, which may look disordered, the main spatial events (mostly squares) are connected one to another by maximum 2 axial lines. This minimal number of connections contributes to good readability and good orientation in the public domain. In reference to other parts of this study, we see that disorientation contributes to the feeling of anxiety.

## Isovists – the strategic visual fields

One of the factors which adds to the quality of convex space, are the strategic visual fields offered from a place towards the surroundings.

Places, where people like to stop and to sit in the city, are places which don't have necessarily esthetic or "atmospheric" qualities, but are places where one can gain strategic views, and where there are possibilities to watch other people activities. The most popular spots in cities are the places where one can see and be seen – for example Piazza di Spagna in Rome.



View 'from' the Spanish stairs on the passage flow below and long street

*In relation to this issue, we ask the following: the waiting spaces in our stations, the train platforms, do they offer any strategic views, which can facilitate some attractively to those obligatory stop places?*

The recommendation guidelines, emerging out of the spatial analysis, refer to possible solutions at three levels. The intensity of the planned measures will depend of course on financial possibilities as well as on the acuteness of each and every situation:

- *The global concept – guidelines, which should be embedded in the conceptual design of metro stations/lines, and at the early stages of planning. Those recommendations aim to bring to a rethinking over the structure and proportions of metro transit nodes.*
- *Major interventions – the aim is to stimulate, by specific recommendations, the rethinking over existing structures. Adopting those measures might mean major structural and refurbishment actions. Those actions, if implemented, are likely to create a coherent structure and design – a positive aim on itself.*
- *Local interventions – recommendations, which refer to specific elements – zones or components – and the ways to improve one or several of them. The aim of reaching coherent, fear-reduced environments, depends in this case upon creating a set of sufficient measures, which together will have a global impact in the space.*

## 6.2.2. Recommendations corresponding to different specific methodological components:

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### Walkways

Some walkways in the transit spaces, on different levels, are quite long. Beside the experience of length, the walkway is often enhanced by:

- *Stairs,*
- *Turns, which provoke disorientation and hesitations,*
- *Poor spatial quality of underground space*

The long sinuous walkways become then an obstacle to efficient friendly use of the public transport.

For the sense of security purposes, it is recommended to:

- *Shorten the walkways inside the station, especially in underground situations, to bring the people quickly in the multifunctional urban tissue or to the platform zones*
- *Reduce the number of possible walkways to increase the density of the fluxes of commuters and the possibilities of control.*

### Axial system

Reduction of axial lines – in practice that means the reduction of corners and turns which force the dynamic user to shift his/her body or centre of sight direction. It also means a design, which permits more direct visual contact between different levels of the station, starting from the street level and ending in the lowest floor. Recognizing the fact that underground transport structures can exceed considerable depth, it is recommended to gap those distances by minimal changes of stairs/escalators, and with maximal transparency between levels.

### Convex spaces

In a narrow and deep structure as the Diamant station, the creation of significant central space is unlikely to be realized. It is the fragmented nature of the total space, especially on the main ticketing level -1, which can be changed. This can be reached, for example, by eliminating some inner small spaces or partitions. With this action, a more coherent convex space can be achieved.

### Isovists – views

In order to improve the visibility and widen the visual fields, it is recommended to remove all unnecessary or exchangeable elements (like signage stand), which blocks visual control on some strategic nodes of the station, but also on platforms, where furniture, advertisement boards or ticket machines hinder views and eventually provide "blind" points.

### General spatial Guidelines (recommendations)

The guidelines come to draw possible actions, which should turn spaces and the current organisational nature of existing metro stations to less alienating environments. Some of those guidelines can be seen as planning recommendations for future structures and some as guideline for major interventions schemes, aiming to generate more friendly user transport systems.

Increasing the flux, by the reduction of the number of entrances and over sized transfer space, can achieve some objectives, which have a direct link to the secure feeling:

Reduction of the situations, in which commuters find themselves wondering alone in corridors and oversized spaces.  
Reduction of the complexity of spaces, by reducing the number of convex spaces.  
Offer lively views at and from convex spaces.  
Reduction of the spatial depth of the station by shortening and/or eliminating the courses in and out of the station  
The gathering of more commuters around limited zone within a station. This approach may create the critical base mass of commuters for certain commercial activity, which on itself has a role of social control in stations  
Concentrating the entrances and creating the most direct possible connection between street level and trains' platforms.  
Shifting the transfer walkways from underground level to street levels: this move will generate more commuters' movement on street level and not in underground spaces. In other words: in many cases it would be better to walk on street level (where social control is more likely and feeling of anxiety is common) and cross one or two roads, than to wonder in empty underground transfer spaces.



### Integrating security with safety measures.

The duty to construct and operate a safe transport system and the wish to create a human, secure space for the commuters do not always compliment one each other. The multiple stairs, escalators, doors and other emergency escape means, as well as width of spaces, are advantageous for safety needs but on the same time all those "contribute" to some of the problems we had identified as causes for increased confusion and eventually fear.

The major recommendation is to provide less small-scale escape means scattered all over and between the different levels, and try to group them to a significant vertical shafts or openings. This kind of approach will also provide better orientation (less multiples choices) and likely to bring in more light from level to level.

Some safety escape routes are developed in a theoretical way. Good orientation readability is essential for efficient evacuation in moments of panic and therefore a right balance has to be found in the design process.

All those actions should of course be compatible with all required safety needs and dimensions.

### Designing stations as places

Viewing the metro system as an extension of the urban infrastructure and public domains, require treating it as a public place – not only as a technical corridor, which is only about processing maximum passengers in minimum time.

Direct visual connection between people and places in the station through open floors, spaces where people can see one each other and feel in control over the space they positioned in – all those can contribute to a more familiar comforting environment.

## 6.2.3. Phenomenological reading of the actual situation of the transit spaces

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# Introduction

## Sensorial perception

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### Visual perception (sight)

#### 1. Natural light

Besides of the spatial characteristics, which are formed and expressed through the structural principles of the station, they are many more factors, which determine the type of environment and the ambience created in a specific station. Those factors have to do with the way we, as human beings and commuters, experience certain elements with our body's sensorial system. We will refer here to the main elements in this field, with which the physical designers have a significant role in creating, controlling and finally correcting in later stages. It will be finally a combination of several sensorial elements (and likely of spatial ones), which will create the positive or negative feelings among users towards the transit complex.

When being in a given space we are aware of the total impression we receive, and give no thought to the various senses that have contributed to that impression. For instance, when we say about a space that it is cold, we seldom mean that the temperature in it is low. The reaction probably arises from a natural antipathy to forms and materials found in the room – in other words, something we feel.

Daylight is generally perceived as more attractive and comfortable than artificial light. There are several reasons for that:

*Light emitted by the sun covers a wide spectrum of frequencies (colours). The blend of these colours makes up the white daylight. Artificial light sources cannot exactly reproduce the colour spectrum of the sun. The eye senses this, and reacts by tiring more easily.*

Daylight is dynamic. It varies through the seasons and times of day, the position of the sun and cloud cover. Artificial light is in most cases a static one.

The required amount of artificial light in interior spaces is set at a level required for minimum comfort. Daylight in interior spaces often reaches considerably greater light levels, which is perceived to be more pleasant.

Daylight is emitted by all sides of the celestial hemisphere and by the sun. Its distribution results in the illumination of the environment. This kind of illumination is comfortable for the eye. Nothing is as unappealing as a gloomy room.

Most people feel comfortable at luminance levels above 2000 lx. This is hardly surprising since this is the quantity of light one will find outdoors during the day, even in bad conditions. But the eye only requires a fraction of this light to work indoor. Studies have shown that artificial lights are switched on when the illumination drops below 75 lx. This is when colour vision starts to be affected.

There are enough reasons to try to integrate natural light into the transit spaces for public transport, even if those are underground spaces. For Underground transit spaces skylights are a very valuable elements. the more horizontal a daylight opening is, the more effectively it bring light into the space. The zenith light is 3 times brighter than the light of the horizon. Everybody has in mind the quality of the light entering through the oculi of the dome of the pantheon of Rome. A similar approach give possibilities for subway stations, like some designers applied in Porto, or Copenhagen. (III)

## 2. The quality of light

The way the light falls on the subject has an effect on the shadow it creates and on the plastic effect or the relief. If the space is too lighted and the light is too direct, than forms will be eliminated. If it is too dark no form will be seen. Therefore it's interesting to choose light, which gives many variations, and which brings out the true plasticity.

But one shouldn't use too concentrated light, because it create an effect of enclosure. In the transit places we mostly go for a feeling of openness, in continuity with exterior, and still local special effects can be interesting.

## 3. Reflection

The colour and texture (absorbing or glossy) of floor, walls and ceiling have a great effect on the light reflection and thus on the brightness of the space, (for example: dark brown has a reflectance factor of 10à25% while white has a reflectance factor of 70 to 85%.)

As an addition, daylight can be used as a real building material. We see this in qualitative architectural realisations. In many major buildings, daylight is also employed to create ambience and movement, to articulate the space in a new way.

The 19century railway stations were build with a large attention to light with their big glass and iron structures .

## 4. The night view

The light in the transit places without or with poor natural light can be compared to night situation, when the light level is insufficient

The night vision is a scotopic vision, it is peripheral with a blind central zone (the fovea) and it is monochromatic. The vision is less fine and necessities time to be used to the lower levels of light. this fact has to be taken in consideration when planning the levels of lighting in correspondence to the sequence of people's movement from dark to light and vise versa.

## 5. Light accents and effects

Light, natural or artificial, can be used as element or create some hierarchy in the space, to indicate entrances or stairs, etc... More lightened surfaces will look more near than less lightened ones. This luminance has to be taken in account. Light can guide and be used as orientation tool.

In this way it becomes a tool for the readability and it gives life to the space.

The combination of light and colour can create supplementary variations. (ill. Skylights at La Tourette of Le Corbusier)



## Colours – to be completed by Colourist Ingrid Lange

### Auditory perception (hearing)

As discussed before in this research, there has to be found a balance in the way acoustics are managed, in order to reduce anxiety from sounds in metro spaces. On the physical aspect of noise/voice control, the behaviour of materials is important as well as the proportions of any particular space.

Since the ear is more sensitive in quieter conditions, it is important to avoid too much noise absorption (to avoid from sudden voices to appear stronger than they are and create anxiety – that is the reasoning behind music background). On the other hand too hard materials will create a noise pollution.

In some transit spaces we hear the tunnel effect of the space especially if it's all made out hard materials. The ear receives the impact of both the length and eventually the cylindrical form of the tunnel. All of these hard, sound-reflecting surfaces give the space their hard, long-reverberating tones (echoes). It creates a special feeling.

The relation between sound, space and material

- *Absorption / Reflection / echoes / reverberation of sounds are all depending on the "hardness" of the material, its own geometry and the geometry of the ceilings, floors and walls.*
- *Orientation*  
*Sounds can also give people indication where certain functional parts of the station are. In some way "hearing perspective" as in visual, will help people orientate in a station when other guiding means are not sufficient. To achieve this, station design should allow this acoustic "transparency" without exceeding unpleasant noise levels or creation of overall dissonance.*

### Olfactory perception (smelling)

As discussed in the appendix of the first part of this research (Bilan), olfactory episodes can influence the mood, and create a sense of danger (even though it can be subconsciously).

#### Ventilation

Good ventilation in a underground spaces is crucial. Poorly ventilated spaces without steady change of air – ventilation – will eventually produce bad smells, and not wipe away smells produced by bad maintenance or mechanical sources.

#### Maintenance

Occasionally, bad smell manifest bad maintenance. Evident bad maintenance reflects neglect and the feeling of abandon. It can be licking pipes, standing water, unclean toilets, and uncollected garbage. All those will produce eventually bad smell, which will enforce the uneasy feeling of passengers.

### Tactile perception (touch)

The discussion over materials and the way people experience them should be divided in this chapter which deals with spatial design, to two aspects: the emotions/feelings/ambient materials create in people and secondly the way people physically experience different materials.

#### The image of material.

Specific materials (structural and or finish) reflect certain images associated with them. For example, bricks and stones will give the impression of street façade / solid structures / historic notions. Those associative impressions are also a result of the "zeitgeist" the time spirit, but also resulting from the tectonic composition of specific material. Since the basic structure of modern metro station is reinforced concrete, in many cases the material users experience in the spaces is only a finish thin layer and is there to reflect certain atmosphere.

### The colour

The colour of a material plays of course important role in the image materials reflect on the space. The intensity, "temperature", reflection of light and many more factors – all influence how the eye perceive the colour and finally what mood it generates in our brain. The composition of tectonics, colour and the spirit of time create an ambient, which can enhance other spatial characteristics of the station's spaces. Colours also enhance other senses than vision such hearing, smell or taste and therefore contribute considerably to the way we experience the space.

Colours – to be completed by Colourist Ingrid Lange

### Opacity vs. Transparency.

Materials can reflect extrovert or introvert character of a space. Transparent separation materials between spaces or floors will enhance a feeling of better control over the space, and permit deeper perspectives, even to areas one cannot reach directly. Opacity on the other hand defines more clearly the limits of the space. The smaller the space is, the stronger the effect of the opacity of walls and ceilings is. Whether smaller, introvert space generate more insecure feeling is less evident as a fact alone. Combining it with other characteristics of illumination, tectonics

### Temperature/texture.

When it comes to the physical feeling of the materials, it is much depended on the climatic regime in the different levels as well as on the tectonic character of the material. The way one sense the material through his/her hands will be part of ones determination whether it is an attractive enough space to stay for a while without being too apprehensive. If a handrail is a metallic one, it is probably going to be always coldish (never there will be a direct sun to warm it up a bit).

### Durability.

Durability of materials on itself will not generate or reduce fear directly. Saying that, the general impression of a transit space will reveal the level of maintenance and control those spaces enjoy (the broken window theory). Durable materials, which are easy to maintain (clean, repair, replace) and can withstand massive usage as well as occasional vandalism, can support well kept station.

# Conclusion

There can be specific recommendations how to change or improve one or another component comprising the total ambiance.

We find that in one station, some changes on this level will already make a difference and create hospitable, more secure environment. In others, only a holistic new vision of the whole components will be sufficient. The above-discussed elements usually compliments one each other and together they create the total ambiance.

In our phenomenological perception, senses are interwoven into one each other and are influenced by one each other (touch – vision, vision– hearing, smell – vision etc...). It is why a holistic design approach is a necessity in order to achieve satisfactory results. Recommending an optimal colour for the walls without considering the illumination concept (and vice versa) will be useless.

More than that: it might be that even a comprehensive approach to changes needed on the Phenomenological level, will not be the whole solution for problematic spaces. Those changes might be only part of a total spatial reconsideration of existing structure. The themes of materials, acoustics etc. should be fully integrated in the early design since they are so important for the secure feeling of each individual.

On urban and architectural issues, our proposal to categorise improvement schemes into three levels of interventions (The global concept, Major interventions and Local interventions) is based on the notion that the mixture of spatial and Phenomenological actions will be changing depending on existing situation, budget considerations and urgency. In any case, this mixture should be kept to insure that it tackle the issue of perception of security is not superficial but based on the deep understanding of the complexities of the user and of the physical environment which around him/hers/us.



# Annex

## REFLECTANCE FACTORS (in %)

### Colour

|                 |       |
|-----------------|-------|
| White:          | 70-85 |
| Light grey      | 45-65 |
| Medium grey     | 25-40 |
| Dark grey       | 10-20 |
| Black           | -5    |
| Yellow          | 65-75 |
| Yellowish brown | 30-50 |
| Dark brown      | 10-25 |
| Light green     | 30-55 |
| Dark green      | 10-25 |
| Pink            | 45-60 |
| Light red       | 25-35 |
| Dark red        | 10-20 |
| Light blue      | 30-55 |
| Dark blue       | 10-25 |

|   |       |
|---|-------|
| Material                                  |       |
| Lacquer, brilliant white                  | 87-88 |
| Aluminium, high gloss anodised            | 75-87 |
| Aluminium, mat anodised                   | 75-84 |
| Sound absorbing ceiling, white perforated | 60-80 |
| Marble, white                             | 60-70 |
| Mortar, white                             | 35-50 |
| Concrete, light                           | 30-40 |
| Concrete, dark                            | 15-25 |
| Sandstone light                           | 30-40 |
| Sandstone, dark                           | 15-25 |
| Granite                                   | 15-25 |
| Brick, light                              | 20-30 |
| Brick, dark                               | 10-15 |
| Wood light                                | 30-50 |
| Wood, dark                                | 10-25 |

|                |        |
|----------------|--------|
| Ground surface |        |
| Meadow, lawn   | +/- 5  |
| Snow, fresh    | +/- 70 |
| Snow, old      | +/- 50 |
| Fields         | +/- 25 |
| Concrete       | +/- 50 |
| Gravel         | +/- 20 |
| Grit           | +/- 10 |









## 7. Perceived and real security figures, investments and priorities

Joao Cruz

### 7.1. Perceived and real security.

Public transportation networks are part of the "urban insecurity imagery" in the minds of citizens. This imagery correlates with the general fear of being victimized in an unpleasant and undesirable event that can range from a antisocial behavior to a serious crime – depending on each country's rules governing morally acceptable behavior. Fortunately public transportation is the stage for only a small proportion of all the serious episodes that people fear. Crime statistics, no matter the country of origin, show that public transportation is not the environment that holds the biggest share of criminal events in our societies. Nevertheless public transportation is commonly pointed to by citizens, again regardless of their nationality, as an insecure environment, one of the first if they are asked to make a list of insecure locations.

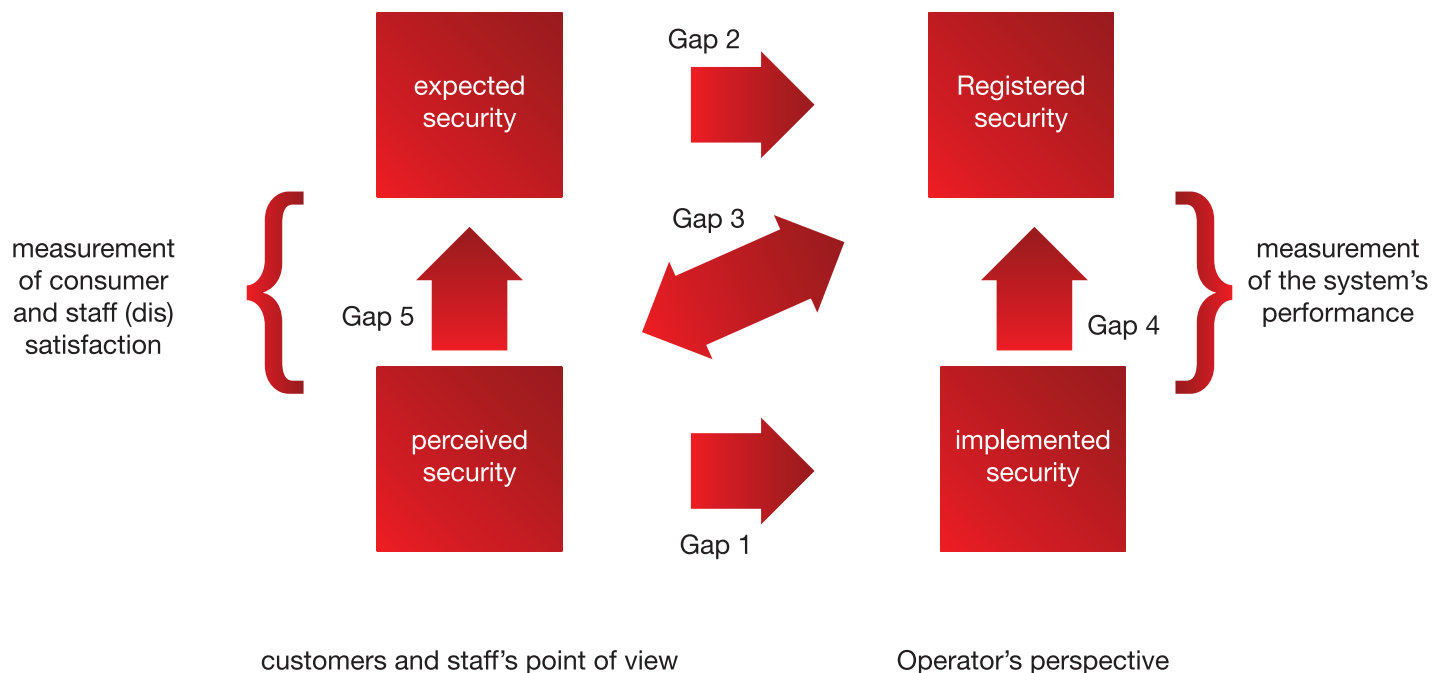
Despite being typically a low-crime environment, public transportation is burdened with the reputation of being a nest of daily incivilities, antisocial behaviors and petty delinquency. These behaviors (that from now on will be called incivilities in short) and the physical evidence left behind are in fact the main feeders of the insecurity imagery associated with public transportation. Incivilities and crime have a common root in social degradation that alarms public transportation passengers and worries public transportation operators.

The real security of Metro networks should not be the main focus of concern for Metro operators. Their real concern should be directed towards what passengers and Metro's staff think: the perceived security. This "manipulative" view does not underestimate the importance of actual implementation of security measures, but displaces the main focus of attention from real security to the overall model that rules the "security equation" on public transportation. According to this rationale (first shaped by the EU-funded Prismatic Project), passengers and staff feel insecurity when a significant gap develops between their levels of expected (desired) security and what they perceive (see, feel) to be the security on the PT network (gap 5 on the figure below).

The feeling of passengers and staff (that mutually influences each other) is built on the direct observation of the routine of the network but also, and not irrelevantly, on stories told by friends or in the media and affected by their personal condition. This is an intimate construction that can only be influenced through indirect tactics.

<sup>1</sup> The elderly, teenagers/children, persons with handicaps, minorities, women, the economically disadvantaged, uneducated or those in poor health seems more subject to a sense of vulnerability, which decreases their feeling of security, according to Julia Stafford and Geraldine Pettersson, People's perceptions of personal security and their concerns about crime on public transport; literature review, Department for Transport, Prepared by Crime Concern, UK, 2002.





Perceived and real security in public transportation – Model adapted from the Prismatic Project.

Source: Prismatic [www.prismatic.com](http://www.prismatic.com), STATE OF THE ART- Passengers' actual and perceived security in public transport; theoretical and empirical elements-DELIVERABLE D2, European Commission, 2002.

In order to decrease the size of the gap between perceived and expected security, operators can only locate and shape the registered security (i.e. measured as number of reported crimes/pax/Km) and the implemented security (i.e. number of security personnel, investment in CCTV). The model illustrated on the figure above works like this;

- Operators reducing Gap 4 will force the reduction of Gap 5.
- Operators causing a reduction in Gap 1 or Gap 2 will decrease the width of Gap 3.

In brief: to bring expected and perceived security closer together (what might attract/repel passengers) operators can only actively manage their tools with their eyes permanently on the passenger and staff (dis) satisfaction, not on the real security performance of the system.

If left alone, this model seems naturally to tend to drive apart the four types of security and to increase the illustrated gaps. To do nothing about this particular concern seems unwise.

<sup>2</sup> John Van Kesteren, Pat Mayhew and Paul Nieuwbeerta, International Crime Victims Survey 2000, UNICRI and Dutch Ministry of Justice, The Hague, 2001.

<sup>3</sup> For example: in Belgium during the 1987-1991 period, the following were reported to the police: 20% of the sexual offences committed, 45% of the assaults and thefts and 91% of car thefts.

<sup>4</sup> John Van Kesteren, Pat Mayhew and Paul Nieuwbeerta, International Crime Victims Survey 2000, UNICRI and Dutch Ministry of Justice, The Hague, 2001.

## 7.2. The role of design to real implemented security.

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Improving perceived security is predominantly an effort of communication – communication through the design of the physical things and through the design of the service. Nevertheless this effort must be conducted along with an equivalent effort to improve the real security of the Metro network, in which design can serve as a tool to:

- *Facilitate vigilance within the network – enhance the efficiency of control,*
- *Facilitate apprehension – create opportunities that increase the chance of penalizing transgressors and dissuading potential transgressors,*
- *Make the network unattractive and risky to potential criminals,*
- *Facilitate keeping the network pristine – which includes a swift detect-and-repair response to damage caused by unwanted behaviors that were not prevented.*

## 7.3. Dark Figures

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"Dark figures", in criminology, represent the relation between the effective number of committed crimes and the number of crimes reported to the police authorities. These figures are estimated using UN standard victimization surveys and nation wide police reports. Everywhere, in every country, the number of reported crimes falls short of the number of real events. Various reasons are believed to lay behind this misreporting, depending on the analyzed country, but a common pattern can be found internationally: crimes against persons (e.g. sexual offences, threat and assaults) are less often reported than crimes against property (e.g. burglary, car theft, theft of credit cards). People do report the most potentially traumatizing crimes less frequently (those involving direct physical/psychological aggression) but more often report those crimes in which an insurance claim (e.g. car theft) can be made or which might lead to an illegal use of one's identity (e.g. passport or credit card theft). This paradox might be affected by the perceived seriousness of the offences: a brief glance at the ICVS data shows that crimes against persons are not always ranked as the most serious.

As a general rule it can be said that victims report crimes to authorities when a compensation is expected, when people believe that apprehension and punishment of criminals is likely or effective, and when the act of reporting does not extend the sense of trauma/vulnerability suffered.

Although there are no specific data pools about incivilities (many of them do not fall within the scope of formal criminal laws), a similar pattern behavior might form here: incivilities are, thus, underreported due to the unlikelihood of quick and just punishment of the person responsible.

A common practice in police departments engaged with their local community (i.e. practicing a philosophy of neighborhood policing) is to give top priority to crimes and incivilities aimed at citizens and their homes, no matter the relative seriousness of the offenses within the entire crime landscape. Immediate and special attention is paid to these events due to their capacity to generate fear.

Another relevant input from police science (gathered from police surveys) is that victims seem to value a caring reception/contact/support by the authorities as much as the effective apprehension and punishment of the criminals. Care and support to the victim seems to have an extraordinarily powerful healing effect and, thus, should be considered by Metro operators as an effective tactic to contain the consequences of real crime/incivility episodes for people's perception of (in)security.

## 7.4. Crime and incivility on Metro networks reported to authorities.

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Most crimes and incivilities reported to authorities (police or the Metro operator) on Metro networks quite likely concentrate on big node stations of the network, where the number of potential victims and potential perpetrators are high. Low traffic stations, with a smaller number of passengers, will thus occupy a relatively modest position in the formal records of criminal activity. Surprisingly, when asked where they feel more insecure, passengers will probably point to deserted stations – low traffic stations are more likely to be deserted.

As an example of these dissonant realities (although not directly related to Metro networks), we can observe the maps supplied as annexes to this document (Map 1 and Map 2). They refer to a study carried out by Alina Esteves in Lisbon, Portugal in 1994–1996, where the researcher asked a large survey sample of citizens to identify the most insecure locations of the city of Lisbon. The answers were quite consistent. After this phase the researcher compared the citizen-generated map (Map 1) with the police records (illustrated on Map 2). The two maps do not match; they reflect two different realities: people's perceptions and police records.

## 7.5. Operators and the investment in security by design

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The return on an investment in security can only be roughly estimated. Criminals, delinquents and perpetrators of incivilities adapt to the evolving Metro environment, and this might affect the estimated return – the expected level of security registered – placing considerable emphasis on the role of the management team in charge of financial decisions. On the other hand an investment designed to produce a specific result might fail in its objective, not having the expected effect among passengers. This might be due to the evolution of passengers' expectations of security or to a sudden enlargement of the "security equation" illustrated before (see Prismatic model). As well, a negative side effect of the investment might diminish the overall result of the latter on the perceived security (i.e. a patrol carried out by a pair of workers is more effective but sends a disturbing signal to passengers: "this is such a insecure place that two workers are needed...").

## 7.6. Security-by-design; a "two-fold" approach.

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The design of the physical components of a Metro network that are in immediate contact with passengers and staff (the physical interfaces, i.e. stations, vehicles, staff uniforms, tickets) is an important variable for the security perception and the effective security performance of the network. They might turn the maintenance, surveillance, control or rule enforcement into easy and efficient tasks, or make them hard to perform, uneconomic and unsustainable. I would call this the "design of the physical things".

The same way, the design of the service (the set of procedures, actions and rules that shape the contact of the Metro company with its passengers, through machines and through staff) can be a help or a burden to the implemented and perceived security. I would call this the "design of the immaterial things".

The physical part of the network performs as a tool of the immaterial part (service). This seems rather simplistic "workshop-talk" but, in essence, the two elements really do form such a complementary relationship. No one type of design can provide a complete answer to the security needs of a Metro network. Only an approach that considers both types of conception can offer a realistic (and robust) solution of "security-by-design" to Metro operators.



## 7.7. When can "Design-for-security" be useful to Metro operators?

A "Design-for-security" orientation can be embedded in the design of the physical interfaces of Metro networks. This orientation, if adopted and wisely realized, will be an important part of the security<sup>5</sup> equation of the Metro service. Metro operators have three general opportunities to benefit from a "Design-for-security" strategy applied to the physical interfaces:

- *New stations or new vehicles: when new equipments and facilities are designed from scratch, the strategy will be most efficient. A bigger number of variables can be adjusted and a seamless product achieved. The extra costs of following this type of strategy (as opposed to a strategy that ignores design-for-security) will be close to zero. The construction of new stations or the purchase of new fleets are rare events in the life of a Metro operator – with construction even more rare than the acquisition of new fleets. It is the conception phase of the Metro that is the most appropriate for incorporating the "design-for-security" strategy, for it enables a "healthy birth" of the new network incorporating preventive measures from the outset.*

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- *Refurbishment of old stations, old fleets or old equipment: when the premises, equipment or part of the fleet of a Metro reach the end of their life cycle, refurbishment or retrofit is performed. These are good opportunities to incorporate a "Design-for-security" orientation in the design of the new parts or the transformations to be implemented – these provide a chance to upgrade the network's security performance. The final result is not as efficient as in the previous example, since at this stage not all the variables are adjustable. The results of these interventions are corrective/improving in nature. The cost of the "Design-for-security" approach can be spread over the cost of the general "design-for-extension-of-life-cycle". The second life cycle of the station or fleet, which begins after the refurbishment/retrofit, can be smoother than the first part as a consequence of the added improvements by the "for-security" strategy.*

- *Reaction to a particular breach in security: if a particular security problem arises within the Metro network, the operator might try some non-physical remedies to eliminate/minimize the consequences and costs. Should no durable solution be reached, an intervention of designers might be required to develop physical changes/corrections to the site/fleet/equipment in order to end or render acceptable the costs of the now prominent security problem. These occasions are rare – mainly due to the immense capacity most operators seem to have developed to put up with and ignore nuisances within their networks – and are usually consequences of initial design strategies that do not include "design-for-security" concerns. Passengers' repetitive complaints or eruptions of serious crime/delinquency/vandalism help create the sense that a corrective/palliative intervention is necessary. Costs are usually high.*

The design of the service is not constrained by these three typical opportunities. Changes in the procedures, actions and rules that govern the contact with passengers can be implemented at any point along the Metro life cycle, and thus it is easier for a "design-for-security" orientation to be incorporated into them than into the physical things. It's no exaggeration to say that a "design-for-security" orientation incorporated into the design of the service will be more effective if the physical part of the Metro network has received equivalent attention.

As any other business component; the "design-for-security" is a form of investment. Metro promoters and operators can build and operate a network without investing in "design-for-security" but certainly, nowadays, the performance of such a network will be of very low quality in the passenger's eyes. It will also be an expensive network to run, since revenue will be low and degradation extensive.

"Design-for-security" can be a voluntary or involuntary choice for present and future Metro networks. In existing networks (the great majority with security concerns) this investment should be directed towards particular sections of the current network – assuming a full refurbishment of the network is not realistic – where the most positive effects on the passengers' perception can be expected. The question is, then: where to place the "design-for-security" investment? The brief answer is: it depends on the particular problems each network is expected to face, and it depends on each network's own anatomy and biodynamics.

And also an important part of the quality of the Metro service. Security and safety must be grouped under the scope of general quality of the service sold to PT passengers.

### In summary:

- *Citizens point to public transportation (and Metros) as one of the insecure territories of urban environment, but,*
- *The popular image of insecurity on public transportation is based more on the numerous incivilities than on the rare serious crimes committed on the Metro networks,*
- *Police reports don't reflect people's feelings of insecurity, and,*
- *People don't report all irregular events (crimes and incivilities) to authorities, quite likely seriously underreporting the events that most feed their own perception of insecurity on the Metro networks.*
- *Metro operators are faced with the need carefully to direct their design-for-security investment to where it is most needed.*

Metro operators must base their design-for-security interventions on passenger and staff perception of (in) security, not on conventional police reports. This leads operators to the need to:

- a) *ask passengers uncomfortable questions about their personal feelings of security (can be alarming if not carefully handled), or*
- b) *genuinely put themselves in the "passenger's shoes" – a task that is harder than it seems, and also an infrequent one.*

## 7.8. What lies behind the "Design-for-security" concept?

"Design-for-security", "Design against crime" or "Crime prevention through environmental design" are design strategies that are aimed at the concrete application of some of the theoretical propositions of modern criminology with regard to crime prevention. Incivilities – since they can serve as the breeding ground for crimes – can also be manipulated by the application of such strategies.

Very succinctly, I would describe the 16 crime prevention techniques summarized by the "situational criminology school" as the paramount structure of all "Design-for-security" interventions. Other crime prevention approaches are also relevant to the design field but, for practical reasons, only the situational one is presented in this document.

| Sixteen crime opportunity reducing techniques (adapted from Robert C. Clarke: Clarke, Ronald, Situational crime prevention: successful case studies, New York, Criminal Justice Press, 1996. |   |   |                                     |
|--|---|---|-------------------------------------|
| Area of actuation: Increasing perceived effort   | Area of actuation: Increasing perceived risks | Area of actuation: Reducing anticipated rewards | Area of actuation: Removing excuses |
| 1. Target hardening  | 5. Entry/exit screening                       | 9. Target removal                               | 13. Rule setting                    |
| 2. Access control  | 6. Formal surveillance                        | 10. Identifying property                        | 14. Stimulating conscience          |
| 3. Deflecting offenders  | 7. Surveillance by employees                  | 11. Reducing temptation                         | 15. Controlling disinhibitors       |
| 4. Controlling facilitators  | 8. Natural surveillance                       | 12. Denying benefits                            | 16. Facilitating compliance         |

To design with security in mind, on a Metro network is thus:

- a) *To increase the effort perceived by the potential transgressor as necessary to perpetrate the crime/incivility.*
- b) *To increase the risks perceived by the potential transgressor as being associated with the eventual transgression.*
- c) *To reduce the rewards anticipated by the potential transgressor resulting from the crime/incivility.*
- d) *To remove mental excuses used by potential transgressors to impair/minimize their own moral constraints against committing a crime/incivility.*

The tactics to pursue these four strategies are:

1. *Target hardening: provide the potential target of a delict or misconduct with characteristics that make it harder to commit the delict or misconduct – e.g. making a ticket machine theft-proof or using screw heads of an uncommon shape that require a special tool to unfasten, installing lighting high up and difficult to reach.*
2. *Access control: the access to the potential target is not fully free, requires a previous scrutiny or an ID control – i.e. paying a ticket to access to a designated area, showing ID, segregated areas limited by counters/barriers.*
3. *Deflecting offender: implement ways to avoid the concentration/presence of the population of potential offenders in a certain area – i.g. reduce the number of available seats to avoid long stays, keep limited opening hours, install telephone booths that work without coins only.*
4. *Controlling facilitators: procedures or physical characteristics that facilitate the tasks of controlling – i.e. ticket with ID photo makes it easier to spot fraud, the concentration/shape of the passengers' entry facilitates ticket control. Single direction corridors might help to detect unusual movements.*
5. *Entry and exit screenings: dual control increases the chance of access denial or apprehension in the event of some irregularity being detected.*
6. *Formal surveillance: implement a specific mechanism (manned and with the assistance of machines) specifically in charge of surveillance – e.g. security guards, patrols, CCTV.*
7. *Surveillance by employees: explicitly instruct employees, no matter their tasks, on the role they should play in the surveillance of the network; this also involves shaping their work-stations/posts in such a way as to facilitate the performance of these additional tasks – e.g. install mirrors, raised seats to improve view, provide two-way radios to report.*
8. *Natural surveillance: promote surveillance of the network by passengers, pedestrians, nearby residents, motorists – i.e. providing "ostensive transparency" to the network, easy and safe reporting of events.*
9. *Target removal: remove potential targets difficult to protect from insecure sites – e.g. create alternative pathways to avoid having passengers pass through deserted and unsurveilled tunnels, remove vending machines, shorten purchase operations with ticket machines.*
10. *Identifying property: mark the Metro property with easy to spot signs/registration numbers and, if possible, with the company logo. Intended to make it easier to identify theft/misuse of the equipment (re-selling stolen products becomes harder) and defuses the "belongs to no one" image.*
11. *Reducing temptation: self-explanatory.*
12. *Denying benefits: render useless, valueless or severely impaired any stolen components of the network. Reduce the amount of cash in ticket-machine safes. Refuse an audience to exhibitionist behaviors (e.g. graffiti). The benefits of a particular criminal action might be non-financial, self-esteem-builders, a sense of control, personal pride, team-builder events.*
13. *Rule setting: establish and spread rules of conduct to make it easier to govern the network and to influence passengers' actions towards positive behavior – e.g. by rules on smoking, ticket purchase, acceptable behaviour, noise and litter, authority mission.*
14. *Stimulating conscience: promote the broadcast of appeals to the potential transgressor's conscience, to reinforce it as a barrier to opportunistic behavior – e.g. signs like "CCTV controlled area" or "Stalking is crime", education/socialization campaigns for children. The key aim is to capitalize on peer pressure and informal social sanctions.*
15. *Controlling disinhibitors: limit those elements that might lower personal inhibitions – e.g. false perception of the real value of the target, absence of a perceived guardian/person in charge, loss of identity/personality of the potential victim (the notion that "there is no victim", "the victim is nobody"), availability of alcohol or drugs, rough behavior generated by gang/mob dynamics.*
16. *Facilitating compliance: make full compliance with the established rules easy – e.g. easy to understand ticketing schemes, easy to understand indication of what actions are allowed/ not allowed, ashtrays at the approach to no-smoking areas or trashbins close to no-trash areas, visible signage informing people of the rules.*



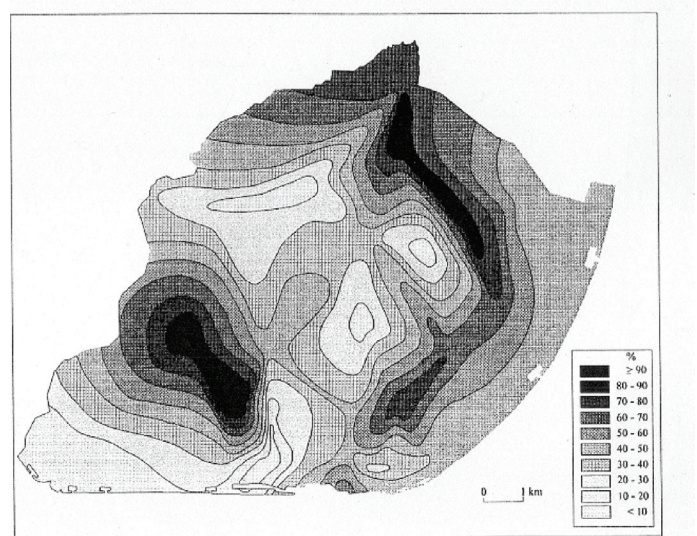
## 7.9. Is "design-for-security" a strategy that leads necessarily to a hardened environment in Metro networks?

No.

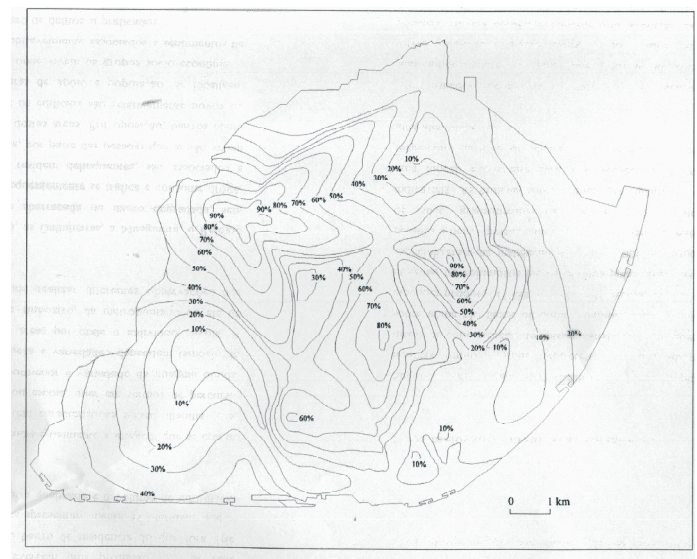
Only if a careless design plan is implemented can a visibly hardened environment be created. A "design-for-security" plan adapted to the Metro environment (knowledgeable about this environment's congenital dynamics) must always reconcile the crime prevention proposal from criminology with the following three main goals:

1. *The generation of a business environment attractive to its consumers (passengers). Consumers must associate their consumption with a pleasurable environment, otherwise they will move their buying pattern somewhere else. A pleasurable environment means:*
  - I) effectiveness of the transport plus
  - II) serenity of the experience, plus
  - III) people's satisfaction with their life style.
2. *Operational performance that allows the Metro operator to keep production facilities and production tools visible to the consumers (almost all the network) in a pristine condition, using efficient maintenance resources – this means keeping the network permanently clean, controlled and fully functional in a cheap way.*
3. *The need to engage passengers in the surveillance of the network and in the creation of a welcoming environment – turn passengers into a positive and active part of the security equation. This can only be achieved by providing a network that is cherished by the passengers.*

Map 1. Insecurity map according to the population (Source: Esteves, Alina, A criminalidade na cidade de Lisboa: uma geografia da insegurança, Edic.Colibri, Lisboa, Portugal, 1998). On this map, darker areas are those perceived as more insecure.



Map 2. Map of reported violent crimes drawn from police records – pattern values (Source: Esteves, Alina, A criminalidade na cidade de Lisboa: uma geografia da insegurança, Edic.Colibri, Lisboa, Portugal, 1998). On this map, higher figures represent more crimes reported.



## 7.10. Automatic Ticket Vending Machines (ATVM).

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- *Install the ATVM in an area of the station where people are frequently present. If queues are probable place the ATVM in a position that will avoid conflict between the queue and passenger flow.*
- *If possible install ATVM in sight of employees in nearby ticket offices or control rooms.*
- *In stations deserted for long periods (low traffic stations, potentially non-staffed stations) consider installing the ATVM outside the station premises, on the street/sidewalk in highly visible locations (see the examples of Oslo and Amsterdam, at least) so motorists, pedestrians and neighbors see it and can give an alarm in the event of something illegal/irregular happening. Always equip these areas with good artificial lighting and CCTV. If possible use a different floor surface or element that can act as a "territorial mark" of the Metro company – something that differentiates the area around the ATVM from the rest of the street. Create a surrounding for this "street ATVM" that does not allow bike/car riders to snatch-and-run with passenger's wallets – locate the machines away from the sidewalk edge or install physical obstacles to impede fast-moving vehicles from approaching the purchaser on the ATVM.*
- *If possible install help-points (see the next section on this) close to the ATVM.*
- *Ask suppliers of ATVMs to provide or develop interfaces that are easy to use under a wide range of environments (strong sunlight, dimmed light, rain, etc) and a broad population (young, old, people with gloves, impaired vision, etc.) in order to make the purchase operation quick – it will probably be necessary to provide different forms of payment (i.e. card, cash, bills, coins).*
- *If a PIN code or password is necessary for one of the purchasing methods, install side screen/panels to prevent furtive observation of the keyboard by someone near the ATVM. Alternatively, demand that the supplier install the PIN/password keyboard in a central location close to the average user's waist.*
- *Mirrors to allow the passenger operating a ATVM machine to see someone behind his/her back might be useful.*
- *Mark and advertise "Wait behind the yellow/red line" (or "Wait your turn here") signs to keep waiting customers far apart from the one operating an ATVM. In some cultural/social environments it might be hard to get compliance with these marks on the floor; poles installed over the painted mark on the floor with a small placard (waist or chest level) on top with the same instructions ("Wait...") might help to shape new habits – these poles can also orient the formation of the queue. Repetitive reminders broadcast by local loudspeakers might also help to enforce the rule.*
- *Don't allow beggars close to ATVM (if allowed at all).*
- *If change is available from the ATVM ask ATVM suppliers to adopt an "anti-obstruction design" on the change-duct. A common ruse by criminals is to obstruct the duct to keep all the (passenger's) change provided by the machine and collect it afterwards when no one sees them.*
- *ATVM shall be built in walls whenever possible (example: Metro do Porto). The same applies to all ATM and Automatic Vending Machines (AVM) within the Metro Network.*
- *If the ATVM are not embedded in the walls of the station, install sloping roofs to avoid objects/litter being left on top of the machines.*
- *ATVM, ATM, AVM and phone booths shall be positioned in such a way as to turn their users/customers into involuntary observers/guardians of nearby corridors, platforms, halls, escalators, lifts or staircases. This can be a very convenient by-product of the location of that equipment, but it should not be the main reason when choosing a location for them. It is worth remembering that ATVM and public telephones nowadays don't need to be obstructive machines taller than the average passenger: to keep this machine's height lower than the customer's eyes greatly enhances the opportunity to use them as sight conductors.*

## 7.11. Metro employees – posture, visibility and tools.

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- *Add to every worker's tasks the mission of surveillance of his/her surroundings. Instruct the workers on how to report any suspicious or irregular activity and ask for urgent assistance if necessary. Also instruct workers on how to behave: a) to protect themselves from a possible aggression, b) assist victims, c) de-escalate a dispute.*
- *Increase the visibility of workers to passengers: provide them with prominent workplaces, high-visibility vests (don't use common models similar to those available in automobile emergency kits, a professional look can only be achieved with tailor made models exclusive to professionals). High visibility does not mean that only reflective vests (EN-471 standard compliant) should be used. In fact most "off-the-shelf" EN-471 reflective vests are designed for rough outdoor use and are common with emergency personnel, which might be perceived as dissonant with the relaxed atmosphere desired for the Metro. If reflective vests are considered the best choice for a particular Metro network, it is a good idea to design a uniform that is exclusive to the Metro staff.*
- *Shape the workers' routine in order to increase visibility: e.g. train drivers should be required to stay out of the vehicle at terminal stations when waiting for the green light, ticket office workers should wear high visibility vests for any task outside the booth.*
- *Workers should have a helping, friendly attitude – even those with ticket control tasks. Avoid concentrating control and repressive tasks exclusively in any one group of employees (e.g. ticket control teams that only ask for tickets and issue bills). Try to transfer the tasks associated with possible physical repression/apprehension to local police or special intervention teams, let your station and train staff keep a friendly image among customers. Instruct workers to avoid military-style body postures. Inform passengers that they can ask for any kind of assistance (orientation, explanations, information, safety, security) from any worker in uniform.*
- *If several companies are operating within the network with uniformed personnel, try to adopt a common vest model: they will give the impression of forming a bigger group in passenger's eyes.*
- *Provide workers with good looking, practical and comfortable civilian-looking uniforms. A pristine image (adapted to the local cultural standards) will endow them with extra authority.*
- *Provide all workers outside booths with a two-way radio (not mobile phones similar to those passenger might have in their pockets) to ask for immediate assistance/instructions if necessary. Radios that are permanently on will allow passengers to hear live sounds that reassure them that the employees carrying them are really connected to their colleagues (e.g. the radio sets at the driver's cabin of Metro do Porto trains are detachable from their dock and used as handsets when the driver have to leave the train to assist in any emergency).*
- *Study the dynamics of your network and make sure that workers are visible in the times and locations when passengers feel more vulnerable; more visible staff are probably welcome in off-peak times and not so necessary during rush hours. Consider hiring part-time young people (some from "problematic areas") as information & assistance officers to perform highly visible patrols and defuse the stress generated by groups of youngsters among older passengers. Don't entrust them with repressive tasks.*



## 7.12. Vehicles, interiors and exteriors

- Use the Metro logo proudly on the fleet – it reinforces the sense of property that acts as an inhibitor to certain acts of vandalism.
- Carry out inspections of the passengers' cars in two different ways: at the workshop with the train stopped, and during a normal train trip. It helps to identify unusually shaky components, vibrations and sounds that might give a subtle but pervasive sense of a lack of maintenance/an ageing fleet – inspections at the workshop alone can not detect this.
- Keep fleet clean. Pay particular attention to litter or human excretions on the floors and seats of the cars. Schedule cleaning inspections at the end of each trip (by the driver or a special worker). Ensure no train stays in service if there is considerable litter on board or if the slightest human excretion is detected – the damage caused by such a situation for the company's reputation for security is much larger than the delays caused by cancelling a train. Empower the driver to decide if the vehicle is in proper condition or should be removed from service. If very dirty seats or floor are reported by passengers to the driver (in networks where this type of communication is possible), evacuation of the train should be considered.
- Consider creating rules to mitigate the amount of litter/dirt on board. "No food" and "No drinking" signs onboard trains might improve the general condition of train interiors and might be reflected in the cleaning costs. It is wise to remember that any new written rule must be accompanied by: a) a clearly understandable penalty, b) means to enforce the rule and issue penalties for abuse. This is especially important for non-criminal behaviors (i.e. incivilities), for which ordinary social pressure is less effective as a means of dissuasion.
- Shape vehicles (rail vehicles are becoming more and more "modified off-the-shelf" products; where Metro operators can help determine the shape is in the parts that can be selected to customize the "off-the-shelf" underlying product) to make them as transparent as possible: wide windows, seats with low/middle backrests, cantilever seats, inter-wagon passages or wide windows.
- Avoid dark tinted glasses on windows and any kind of film that reduces transparency or visibility through the windows – i.e. silver-plated thermal/sun shields might turn translucent/opaque after ageing and repeated washing; advertisement films seriously impair visibility. Passengers need to see the interior of the train before boarding. Passengers on board should see the platform.
- Avoid too narrow/cramped seat configurations making voluntary/involuntary physical contact between passengers frequent.
- The seat configuration (distribution within the wagon) affects passenger interaction. Although it is known that seats facing the back of the next row impair eye-contact, while vis-à-vis seats (which include seats with their backs to the wall) increase potential interaction, there is no general assumption as to which is the most convenient configuration from the security point of view. Both options show advantages and drawbacks relating to their role in security (regarding mutual vigilance, irritability, stalking, vandalism of the backs or seats, confinement of a passenger close to window, feet –on seats, etc). It would seem wise to assess which option best serves the general interests of a particular network, depending on what are in fact the most disturbing nuisances. Old trains (getting to the end of their life cycle) or new prototype trains can be equipped with different seat configurations and put to normal duty, to test the most suitable alternative from the security point of view.
- Install anti-lying down details (i.e. armrests) on seats if these do not impair accessibility.
- Install easy (cheap and fast) to remove wall panels, seats, lighting and ceilings in order to allow fast replacement of damaged or dirty components. The cleaning and replacement of damaged interior parts in trains still greatly extends normal turn-around times; for this reason, some cleaning/repair operations are postponed to later occasions when the vehicle is due to be halted for deep mechanical checks. This specific dynamic is responsible for many trains being on active duty with damaged or missing parts, graffiti, or marks of inadequate washing. Operators shall urge manufacturers to develop vehicles that are more "friendly" towards daily maintenance and cleaning.
- Advertisement outside and inside the fleet is a wise way to decrease the surface available to vandalism. Advertising posters are an efficient protection shield, but some possible inconveniences must be considered:
  - a) Windows and glass partition elements should never be partly or totally covered by opaque or semi-transparent film.
  - b) Abundant advertisement (means that every single poster must compete visually in the already effervescent surroundings) impairs a relaxed environment and might irritate passengers. Whenever possible advertisement should be linked to the surface activities (school, universities, offices...)
  - c) Abundant advertisement dilutes the presence of the Metro company identity (i.e. logo), which constitutes a drawback in terms of the security and commercial policy of the operator company.
  - d) Advertisement inside trains should never weaken the original lines-of-sight to passengers or CCTV/CCVR. Lighting should also not be affected.
  - e) Advertisements in trains and stations must always be scrutinized first by the Metro company. Campaigns with allusions to violence, crime, fear, guns, aggressiveness, sexual assault, incivilities or antisocial behavior should be banned. The same applies to campaigns that ridicule the Metro or public transportation. This prior approval requires a formal agreement with the company that holds the concession for the advertisement areas, and frequent monitoring by the Metro company.

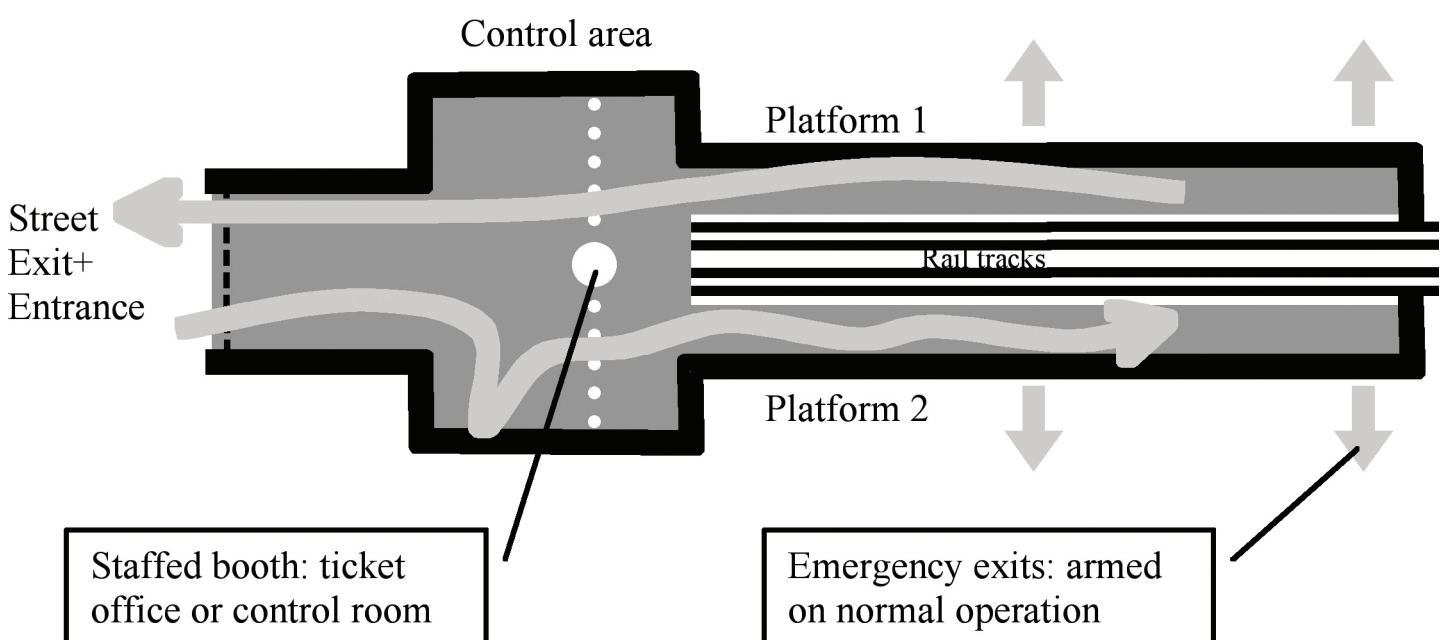
## 7.13. Comments on access control; entrances and exits to an ideal station.

The perception of likely control or apprehension in the event that an unacceptable behavior is performed is a powerful dissuasion. To ensure that the Metro company is able to fully control its network and the people that use the network, it is necessary to limit the number of different access routes to and from the trains. The concentration of passengers' paths makes the creation of control points more efficient; a smaller staff can monitor a wider population and all passengers are subject to control.

From the security point of view it is wise to concentrate the flow of people to a small number of passages. Ideally this should be a single passage, where ticket gates could be installed and a ticket office/control room could provide assistance to passengers. The same single passage would be useful to facilitate blocking transgressors by police or security officers in the event of an emergency.

The design of a station and its entrances/exit paths is guided by the geomorphology, urban configuration and expected flow of passengers. This might lead to a station configuration that requires a dispersed array of passages with a small cross-section or to a concentrated array of wide passages (if not a single one with full capacity). The second alternative is easier to secure. Unfortunately, many of the old Metro networks are based on a dispersed configuration that is harder (if not impossible realistically) to control. For this reason, some operators prefer to close some of the entrance/exit paths during low-traffic periods and to concentrate the flow of passengers in a single access controlled by staff.

The ideal station from the design-for-security point of view would be like the figure below.

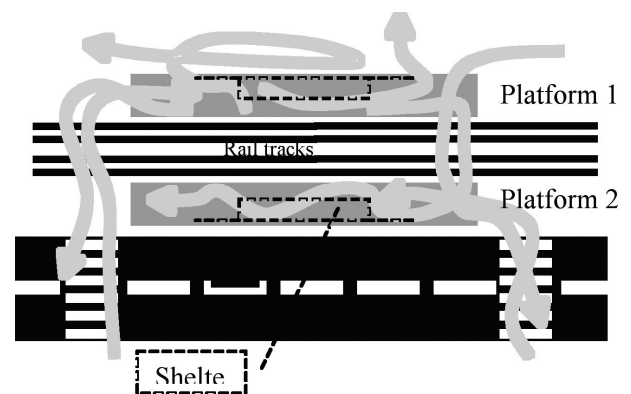


The need for dispersed evacuation routes in the event of an accident (fire, derailment, crash) inside the station can only be made compatible with the need to concentrate access for efficient control of passengers if dedicated emergency exits are created. The doors of these dedicated emergency exits (both at platform and at street level) are kept armed and controlled during normal operation but open automatically if an alarm goes off. This configuration requires constant vigilance and testing of the emergency routes to avoid obstructions on the exit route (e.g. neglected parked car in front of the door at street level)

At the same time the few (or one) existing entrances to and exits from the station must be capable of handling the maximum flow of passengers without any congestion.

The above-mentioned configuration (station with flows of passengers concentrated in single control area) is applicable to manned stations in which the Metro company is willing to actively control the flow and the premises. The entrance-exit access must be permanently controlled up to the street-level door either by staff or CCTV. Any eventual disturbance forming at this access must be promptly removed (e.g. antisocial behavior, litter, a suspicious individual in the vicinity of the door, etc.) if this is the only functional channel under normal operation.

Stations that are designed with un-manned operation in mind shall adopt an opposite arrangement: entrances and exits shall be profuse to avoid rogue individuals/gangs controlling the accesses – the surface stations of Metro do Porto located in the central axis of main streets and avenues are good examples of this conception (see diagram below)..



## 7.14. Comments on the three types of vigilance to foster on Metro networks.

Three types of vigilance are possible on Metro networks:

*Type 1: Informal vigilance, performed by passengers during their ordinary use of the network.*

*Type 2: Semi-formal vigilance, performed by workers with non-security tasks during their ordinary duties – workers not paid to secure the network.*

*Type 3: Formal vigilance, performed by security officers and/or police (in situ or remotely with CCTV) – workers paid to secure the network.*

Type 1 and Type 2 are the most pervasive forms of vigilance possible. They are also the most suitable for a stress-free environment, and the least expensive forms of vigilance. To make these types of vigilance efficient it is necessary to:

- a) *Design a welcoming and comfortable environment which feels safe and deserving of passengers' care,*
- b) *Design an environment that is not too demanding to survey and is robust for intensive use,*

*c) Provide passengers and workers with a formal rule of conduct against which they can check if a particular behavior is acceptable.*

*d) Provide passengers and workers with the resources to ask for prompt assistance to deal with unwanted events.*

*e) Formally add to the non-security worker's tasks the responsibility for paying attention actively to their surroundings and to report suspicious or irregular events.*

Type 3 is needed when type 1 and 2 are not enough. The extension and complexity of most Metro networks demands that Type 3 vigilance be used in some areas of its premises. To contain the costs of this type of vigilance, design shall be used to:

- a) *Ensure an easy to survey network,*
- b) *Ensure that formal surveillance can be perceived as effective – for the sake of prevention.*



## 7.15. Comments on Help points and telephones.

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- *Help points (inter-communication devices that allow passengers to ask for immediate assistance from the Metro company) shall be present in all unmanned stations at platform level in conspicuous locations – one per platform. On platforms with a single access route it might be convenient to install two help points to avoid the potential blockage of the help-point by gangs or in the event of an accident.*
- *Help points in manned stations are convenient if the platforms are not within the line of sight of the staff.*
- *Help points must be in direct sight of CCTV CCVR cameras and users shall be informed that there is a penalty for unwarranted use. Cameras connected to the help point shall be located in such a way as to identify the user and the immediate surroundings.*
- *Help points shall be indicated on station signage.*
- *A good solution for implementing help points is to install public telephones along the network and add an extra functionality to these telephones: by dialing a special short free number (e.g. 1-2-0), a connection is established to the nearest control room or manned ticket office with capacity to use the CCTV CCVR cameras close to the help point. It might be useful to limit the number of public telephones with the help point functionality; signage in the stations shall clearly point out which are help points and which are not. It might be interesting to use the very same help point terminals to provide two different functions with two different phone numbers; e.g. “120” for requesting assistance in safety and security emergencies and “555” for information on trains and lines. Conventional public telephone terminals are suitable apparatus, because they allow privacy in the communication with the control room or the information service. Terminals without handsets (speaker+micro in a body detachable from the main body of the telephone terminal) are less prone to ensure privacy and less prone to be used by distressed passengers.*
- *Passengers should be involved in the maintenance of these help points. A large sign can read: “This is a help point for use in emergencies. If you find the telephone speaker-set off it's the hook please put it back to ensure proper working conditions. If you find this terminal damaged please check its number and report it to our services on 123456 or to the first staff member you meet” . A distressing sound alarm is already added to some public telephones to alert passers-by that the speaker-set has fallen-down; this can be included on help point terminals.*
- *Although the need for help points in Metro networks fully covered by mobile telephone antennas can be subject to discussion, Metro companies should keep in mind that to provide a proprietary way to receive passenger's requests it might be a good security and commercial policy – some passengers might not have a working mobile phone with them or the mobile-phone network might be off during an emergency.*
- *Trains shall have a help point connected to the driver's cabin. In the event of the driver not replying to the passenger's request, this shall be forwarded to a control room – useful in the event of an accident that impairs the driver.*
- *A help point shall be installed in the areas where passengers concentrate in low traffic hours.*
- *On Metro networks where help points don't exist and only public telephones and/or personal mobile telephones can be used to seek assistance in the event of an emergency, passengers are to be urged (i.e. with advertisements, panels, pamphlets, public address systems) to dial an easy-to-recall number. This number shall be specific to the Metro network – even if it's in fact operated by local police or the regional emergency service – to provide passengers with the sense that the Metro operator is in charge of all aspects of its premises. Stickers with the national police number (such as those found in the Brussels Metro stations) inform passengers that the Metro company “washes its hands of” problems. It also indicates that the Metro company is impotent or unwilling to intervene when passengers need them to. It informs passengers that they are in the same predicament as in the street, in fully public spaces – and this severely erodes the identity of the Metro. A somewhat better solution is to name these emergency help telephone numbers “Police-Metro Network service” or “Emergency Service”.*

Ideally the help telephone numbers should be advertised as “Metro help-service” or “Metro Fast Assistance”

## 7.16. Comments on stations entrances and exits.

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Entrances and exits to stations – be they of underground, surface or raised types – must avoid the “dark cave” look. To prevent this effect, special attention shall be paid to:

- *Lighting,*
- *Lines of sight to and from the interior of the entrance-exit,*
- *Providing a sense of spaciousness,*
- *Good-looking and upscale materials at the entrance-exit,*
- *Use of bright colors on the surfaces,*
- *Easy to locate entrance-exit; if the location of the entrance is not easy to see from the nearest street intersection, install prominent signage. If passengers must walk a considerable distance from the sidewalk until the Metro entrance becomes visible/recognizable, consider/defend this walking path as “Metro property”; ensure it is well lit, clear signs are installed to direct passengers, and intense cleaning is performed. Consider extending the metro vigilance/patrols to this path.*
- *Shape the entrance to allow vigilance by neighbours, motorists and pedestrians.*
- *Shape the entrance so as to provide passengers coming from the interior of the station with an unobstructed view of the first few meters after the door. A wider angle of vision can be provided by side windows or openings.*
- *Providing access to emergency road vehicles close to the Metro entrance – ambulances or police cars might need to approach to deliver assistance. Ensure this access is not used by neighbors to park their cars, unload goods from lorries or as an access to criminal/terrorist/sabotage activities that require a car.*
- *Providing continuous vigilance and swift security intervention if necessary; entrances and exits must always be clear of any disturbance. Install CCTV if frequent patrols are not feasible.*
- *Shape the exit in order to make it easy to create two successive police or security officer barriers/filters in the event of an emergency.*
- *Shape the entrance-exit in order to really close it during non-service hours without creating dead-ends.*
- *If the entrance-exit is expected to be closed on off-peak hours and passengers diverted to alternative paths, install signage that explains how to reach the alternative ways. Install doors or shutters (meshed/crated ones will be necessary if the entrance is part of the ventilation system) to impede passengers walking unnecessarily towards closed entrances-exits – this irritates them and informs observers that the passenger is not familiar with the surroundings. Physically block the passage to cul-de-sacs: they are refuges for homeless people, vagrants and delinquents, and require vigilance that could be diverted to where it is more useful.*
- *Providing corridors that are as short as possible.*
- *The official code of conduct shall be visible at the entrance in a short and easy to understand version (perhaps stating the most relevant prohibitions and advice). Enter the Metro premises must be considered to imply acceptance and agreement with the code.*

Entrances and exits shall be as few as possible: see above Comments on access control; entrances and exits to an ideal station.

## 7.17. Comments on the area between the entrance-exit of the station and the ticketing area.

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Middle-sized and large stations might have a particular area in which to buy tickets that is apart from the station entrance and is also separated from the boarding platforms. In this particular area:

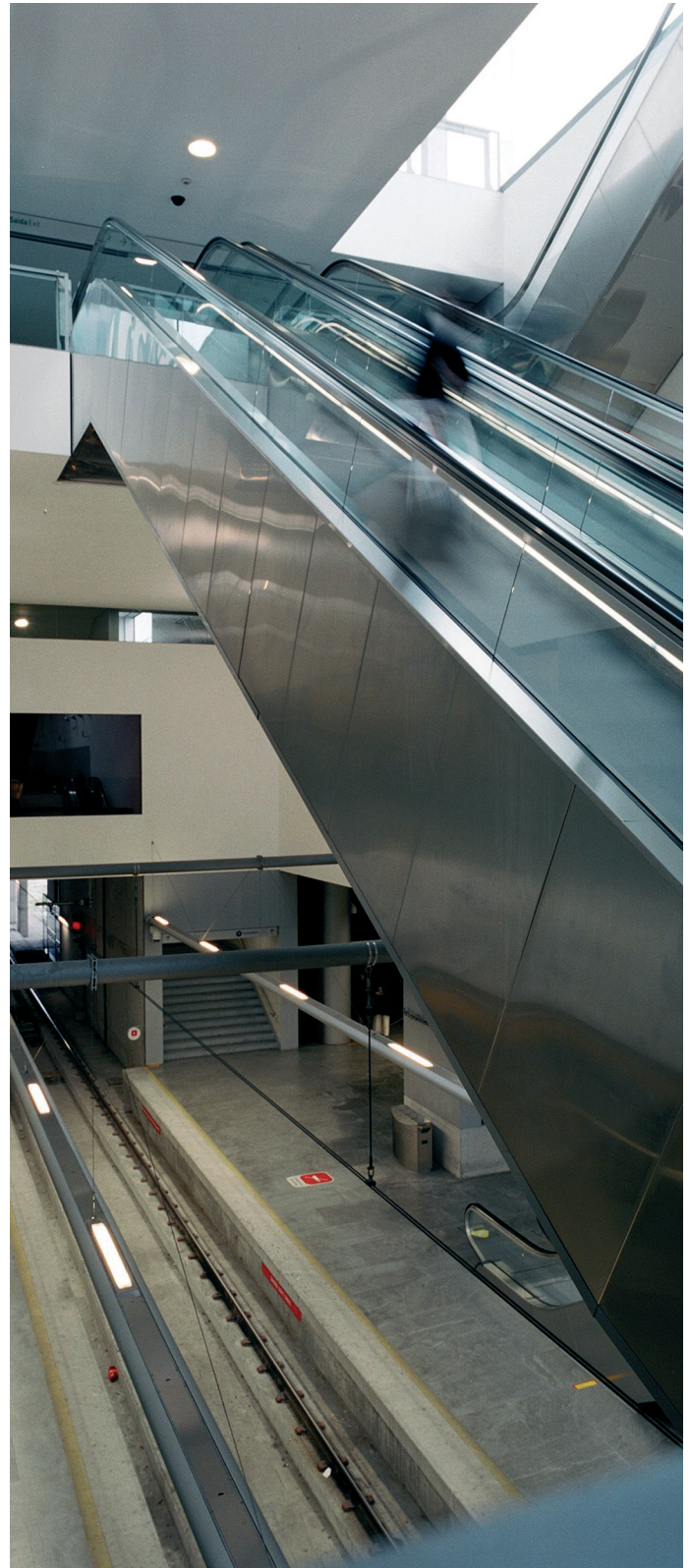
- *Special attention shall be made to the criminal-genesis and insecurity-genesis capability of this area. From the external door of the station to the border with the paid area, people can move freely without much constraint. Expulsion from the station is generally impossible if a ticket has yet been not bought or checked. The environment must be very easy to control by staff or CCTV.*
- *Corridors (if any) shall be short, airy, wide, high, well lit, with surfaces reflecting artificial/natural lighting in a positive manner (dark rubber or visible cement are not recommended floor finishing).*
- *Floating overpasses and handrails are good ways to avoid people passing close to the walls of wide passages – decreases the amount of graffiti and tags.*
- *Floating overpasses are a good way to provide extra sight points to passengers and staff.*
- *To avoid congestion and to mitigate passenger irritation (which arises when one feels that one is not in full control of his/her own immediate destiny), people must be able to orient themselves in a glance. Passengers cannot “spend time” interpreting complex, unclear, blurred or contradictory pieces of signage and maps. Signage must be robust, considering the wide population that uses the Metro and shall be fully revised if proven faulty. Once signage is a functional part of the security equation in Metros, its design should be aimed at performance and redundancy. Blending in the host architecture shall be carefully second-graded if it will impair performance.*
- *Mark clearly the limits of the paid area.*
- *Ticket control at entrance and exit (of the paid area) is better than simply at entrance. A network might include stations with double control and single control simultaneously.*
- *Ticket control with automated ticket gates it's a good way to improve security perception, but the barrier of gates/turnstiles should be visible from different points in the stations and should be under staff surveillance. Ticket gates are also a good opportunity to segregate passenger flows (in and out) to increase flow performance.*
- *Flashing lights or alarms must be associated with invalid tickets on automated gates; it is easier to spot by staff and informs regular passengers that the systems works.*
- *The installation of CCVR cameras at eye level (with an adapted lighting environment) on automated ticket gates could register the face of almost everybody entering the network (higher cameras are easy to elude with hats or hairstyle). The existence of this database synchronized with the gate's clock would constitute a powerful deterrent to perceived impunity.*



## 7.18. Escalators and elevators.

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- *Successive escalators and stairs should avoid a zig-zag configuration and should be sideways "transparent" (not closed between high obstructing walls) to allow broad lines of sight.*
- *Elevators shall have transparent shafts, cabins and doors. If not fully transparent, at least side and/or door-windows shall be provided.*
- *Non continuous sound (i.e. music or announcements that react to the elevator ride) are good to break a sense of isolation inside the elevator's cabin and restrain unwanted behaviors.*
- *Elevators' cabins shall be in light-colored materials (avoid stainless steel) with glassy surfaces to facilitate cleaning. Extra ventilation ducts and fans and tall cabins would make this equipment less oppressive and prone to vandalism than current models.*
- *The use of mirrors (unbreakable stainless steel models) and advertisement posters/information or frequently changed decorative surfaces might also deflect vandalism, although it needs to be made compatible with fire and explosion regulations.*
- *Lighting inside the elevator's cabin should be high up, difficult to reach and powerful.*
- *CCTV-CCVR and liquid detection alarms (although the latter are still unknown to the elevator business) might deter urination and defecation inside the cabins if the images are shown live to passengers or viewed in a control room.*
- *The access door to elevators shall be located in highly visible areas.*
- *Spaces under escalators shall exist (be accessible by people) only if useful to create a useful line of sight. Otherwise they should be eliminated with surrounding walls*



## 7.19. Platforms.

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- *Island platforms are better than side platforms.*

## 7.20. Ticket offices control rooms.

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- *Should be placed in sites where platforms and/or ticketing area (ATVM and ticket gates) and/or accesses are easy to see.*
- *When possible, a 360° angle of sight around the ticket office or control room should be created.*
- *To improve the staff's angle of sight fish eye or convex façade/window configurations should be considered for wall-built facilities.*

## 7.21. Ticket offices, control rooms and other kiosk-shaped facilities.

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- *Should be placed in sites where platforms and/or ticketing area (ATVM and ticket gates) and/or accesses are easy to see.*
- *When possible, a 360° angle of sight around the ticket office or control room should be created.*
- *To improve the staff's angle of sight fish eye or convex façade/window configurations should be considered for wall-built facilities.*

## 7.22. Public address system.

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Announcements shall be made on the PA systems specially tailored to create the perception among passengers that the network is manned and surveyed. Messages should be broadcasted live (an employee reading pre-printed cards is not expensive) to increase the sense of a human presence and, whenever possible, the content shall be adapted with small local/time specific details to subtly reinforce the idea of a real person being present. This is what airlines do when captains are asked to address passengers, to introduce their own names, to inform passengers of local time, local temperature, local weather conditions: it reassures passengers that a person, not a machine, is in command. The content of messages shall not allude to security matters alone. In fact this should be the least common subject. Commercial contents, greetings, instructions, reminders of how to use the network or tickets, delays, or trains approaching should constitute the bulk of the information.



## 7.23. Smart cards and the evolution of gates.

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"Smart cards" (the common commercial name of contactless cards) are tickets capable of holding a variable money-value to be spent (also) on the purchase of public transportation trips. These cards are electronic-purses that can be refilled with money-value. The value is debited by the supplier of the service (the transport company) by means of antennas installed close to the consumption site (the entrance or the entrance plus the exit of the means of transport). The debit is operated when the contactless card enters the antenna's range. When this happens, the price of the trip is charged to the contactless card and the remaining value is updated on the card memory.

To make sure that people unintentionally approaching one of these antennas are not charged for a trip they don't intend to make, or to prevent two cards in close vicinity (i.e. a couple walking, each person with a card) confusing antennas, the manufacturers of these systems tuned their products in accordance with one of several international standards available. These standards determine (among others) the range of the antennas. For the purchase of products like public transportation, the current antenna range is tuned for a small distance of 0 to 20 centimeters. Such a small distance requires users to bring their pockets, handbags or cards close to the antennas – a clear sign that the purchase is intentional and the debit accepted.

Due to this specific dynamic (which rests on the same principles as a purchase with cash or pre-paid tickets), it's not expected that ticket gates in Metro stations (if installed) would see their roles or configuration dramatically transformed: a door that opens only after a valid ticket is presented by the passenger and recognized by ticketing system.

A contactless ticketing system can be implemented with or without physical barriers that block the passage of passengers without a valid ticket. In its simplest form the contactless system only requires the installation of antennas in pylons or incorporated in arches through which passengers pass by, and ticket prices are debited from their cards. Under this configuration the entrance of passengers without a valid ticket can only be prevented if a deterrent human guard is nearby and reacts. If mechanically operated doors are added to the passages, then a contactless system with physical barriers is generated. Both configurations are similar to the conventional ones: "open" or "closed" conventional networks with paper or magnetic contact tickets. The "openness" or "closeness" of a network is a matter of the Metro Company's policy, not a consequence of any particular technology.



## 8. How to integrate the Metro system in the urban public space by enhancing the physical and reference links with the visible part of the city ?

### Initial remarks:

- 1) The proposals presented to answer the questions listed below is a mere set of suggestions. They might be applicable to some Metro network realities and unsustainable in other due to the specific constraints of each particular scenario. In general the effectiveness of these proposals is bigger if implemented in a coordinated manner. The use of a single design solution, has, if not coordinated with other initiatives, a lower impact.*
- 2) Some of the suggestions are facility-design-centred, others focus on the design of details or components of the physical environment common to the Metro networks, others to the content or style of communication between the Metro operator and its passengers, and, finally, others are aimed at the design of the procedures of the Metro company workers.*
- 3) The design suggestions below consider all the spectrum of Metro networks: fully underground systems, partly underground networks and fully at the surface (or raised to surface) networks. Comprehends also high density/frequency networks and quieter ones.*

## 8.1. Warning

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1. Place (whenever possible) the physical entrances to the Metro network in highly visible locations. Visible for pedestrians and motorists. Visible also for workers or residents in nearby buildings.
2. Equip station entrances with high-visibility signs (neon/illuminated advertisement panels/signs) located high (3m from the surface or more), with a good (extraverted) colour and shape contrasting with the background landscape. These signs shall be standardized and clear to understand/identify. A good example of this kind of solutions are the "international pharmacy sign", the green illuminated cross common in many cities of the world.
3. The surroundings of the station (one block radius or at least 200m radius) shall be equipped with a similar kind of signs to direct people to the station. If possible it shall state the name of the station and the distance to its entrance.
4. The immediate surroundings of the station shall be stripped of all visual obstacles that might hide the entrance or building/platform to pedestrians, motorists or neighbours (bushes, walls, "opaque vegetation", signs, electric switchboard cases, etc).
5. Lighting of the area around the entrances shall be perceptibly higher (higher amount of lux units) than the street light of the nearby streets. Read also chapter on lighting of public space.
6. Try to avoid entrances located in narrow depressions on the ground (valleys, craters) that might act like trenches, might hide the Metro facilities.

## 8.2. How to communicate with the public at the entrance?

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1. Greet the passengers – remind them you are aware of them. Use a written message like "Welcome to ...".
2. Make sure passengers know they are entering the Metro premises and leaving the streets/public domain. This shall be done close to a clear landmark that marks the border between street and station.
3. Inform passengers about their location within the network, the name of the station they are about to enter, the work timetable of this particular entrance, station and of the network. If possible install a map of the network and of the neighbourhood of the station close to the entrance; outside or inside the station, but close to the "door".
4. Inform passengers about the most important behaviours that are required to comply with within the Metro premises and that might confront to those allowed in streets: ie: don't smoke, don't run, be silent, use a valid ticket.
5. Inform passengers about an information desk/line to contact the Metro operator for complaints, reports about malfunctioning, emergencies or accidents.
6. Particular entrances in particular stations might be baptised with names, orientations or numbers to facilitate passengers self-location. If it happens add the name of the entrance to the rest of the information displayed at the entrance. Mark it on the neighbourhood maps.
7. All this information shall be organized in a hierarchic manner (from most important to the information rarely used) but in a very clear manner. Use boards/panel/signs with this information. Some of the information might be broadcast by a "Public-address" sound/PA/loudspeaker system (ie: greetings or reminder of suggested behaviour regarding eg mobile telephone conversations, leave way to the left on escalators, prevention of possible pickpockets on platforms, escalators etc)
8. Always use high-contrast and high-legibility graphics – remember this information must be easily available to all sorts of passengers under all sorts of lighting, under all atmospheric conditions. People don't want to spend too much time to decipher and/or enjoy exquisite graphics.

## 8.3. How to reference to the city topography in signage and maps ?

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- 1. The Metro network signage shall comprehend the indication of the facilities/services on the neighbourhood (post office, police station, public services, relevant shops, etc) and the name of the streets around.*
- 2. The Metro network maps shall include the same information in a less exhaustive manner (only the most important services/companies/transport interfaces/buildings) close to each station.*
- 3. Signage and maps style shall not be affected by any particular reference to one of the neighbours of the Metro. Strict visual identity standards shall be observed.*

## 8.4. Where/how to create a reference to visual landmarks at surface and/or levels ?

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- 1. Walls and floors of the stations might evoke a relevant neighbourhood of the station by means of specific colours, materials or shapes. Sound can also be used to make this reference (broadcast sound of waves on a beach, bird singing, music playing)*
- 2. Lines-of-sight might be created (through openings in the walls, transparent walls/gates, raised platforms/corridors, et) to direct people's eyes to special architectural, landscape or visual elements characteristic to the station neighbourhood (ie: a church tower, a singular building or square, a department store, a street market, a monument, a river bank). This manipulation of people's sight will be used to create a "local environment" but can also help frequent passengers to orient and locate themselves within the station intuitively.*



## 8.5. How to make the route of Public Transport/Metro visible in the city ?

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1. *Make the tracks (Metro lane or viaduct) as visible as possible. Show the Metro passing by. Remove all possible visual obstacles (some might be useful to protect motorists or neighbours from the Metros headlights or noise) in order to allow pedestrians and motorist to see the Metro.*
2. *Install appealing and highly visible signs (illuminated if possible) advertising the closest station and directing passengers to it. Inform people how far (meters or minutes walking) the station is.*
3. *Make stations entrances clearly visible.*
4. *Reveal good taste and quality in the selection of equipment materials. (do you agree?)*
5. *Use and install the Metro operators name or logo with pride at the entrances to the stations.*

## 8.6. How to reduce physical barriers between the city and the Metro ?

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1. *Avoid visual barriers caused by physical elements installed in the surroundings of the station, mainly around the entrances/ exists. Move the existing obstacles to innocuous locations.*
2. *Create special paths to passengers with reduced mobility as close as possible and as similar as possible to the "normal mobility" walkways. Install escalators with glass walls by the side of staircases instead of vertical elevators if possible. Make slopes/ramps accessible to everybody instead of step→+slope solutions. Remember the visually impaired: provide high-contrast and big size details.*
3. *Avoid directing station entrances to the road traffic if they are built close to the road. Allow some free sidewalk space in front of the entrance to allow for the manoeuvring of pedestrians.*
4. *Create physical barriers (place effective and solid obstacles) to deter unauthorized cars to get too close to the stations – they might be used to attack/assault the premises or a ATM machine. Even if not ill-intended, the 'trespassing' of cars on sidewalks (ie: unloading goods to a nearby shop) might create an important visual obstacle to passengers and potential passengers or a relevant obstruction to the entrances.*
5. *Create physical barriers to avoid motorbikes and/or bikes being driven / ridden within the station areas that are dedicated to passengers.*
6. *Raise, with smooth slopes, the sidewalk floor close to the Metro entrances in order to allow rainwater to flow away without being necessary to build entrance steps.*
7. *Give both the designers and the finance managers a big 20kg suitcase with castors and ask them to walk to and from the station pulling it. The physical obstacles (and inefficient walk ways) will be found and wherever existing, corrected soon. Give them the suitcase prior to starting the design phase and the obstacles will not be built.*

## 8.7. Is gated access a handicap from this perspective ?

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- 1. No. Gates are necessary to mark the limits of a territory (the production site of the Metro operator) where a particular set of business and behavioural rules are to be followed. The function of the gates is good to passengers (consumers) and to the Metro operator (supplier). The options of installing gated accesses depend more on the willingness and financial capacity of the operator (costs money to install, to operate and to maintain) than on any practical/functional constraint. Most Metro networks have been designed in such a way that "gates" exist already. It can be a set of "mental gates", a site where the "station begins", but it really exists in most cases.*
- 2. Modern solutions (automatic sliding doors, gates, turnstiles, hinged-doors/bars, gates operated by human controllers, etc) can easily be designed and operated to comply with the need of transparency, feeling of security, easy exit in case of emergency.*
- 3. Avoid visually opaque gates.*
- 4. Make them wide enough for people with luggage, in wheelchairs, with bikes to be able to pass. Alternative reserve several wider access and inform passengers what they are meant for. Such would stress the open attitude of the operators to other behaviour and or sustainable mobility activities.*
- 5. Provide helplines nearby all entrances/exit or a practical and fast way to passengers retained in one of the sides of an existing gate to contact a Metro worker apt to help the passenger, divert him/her to a human-operated gate, unlock the gate, or send a security officer to the site. This communication can be direct (worker on a ticket/control office nearby) or remote (two-way telephone, mike+loudspeaker nearby the gate or help point). If remote communication is planned, consider to have a CCTV camera close to the help-point.*

# 9. How to create a heterotopia attractive to all ?

## 9.1. How to accommodate for female passengers ?

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- 1. Create a secure environment, a comfortable and clean environment. In terms of cleanliness and maintenance observe same standards as department stores. Women are the less victimized population in violent incidents reported to the authorities. Males are more prone to be involved in violence (as perpetrators and as victims) and less careful – the feeling of fear seems to be less present with this population group. Apart of this, women are more prone to change their behaviour in response to the feeling of insecurity, and therefore the number of female victims among victims of violent crime in public transportation networks is lower – statistics prove this, literature also.*
- 2. Discriminatory policy might help: increase the number of female workers on Metro companies – it dilutes the aggressiveness among passenger in rail and bus environment – consider creating a discriminative ticketing policy to invite more women to use the Metro at all times.*
- 3. Make sure all passengers know that "sexual stalking" is not tolerated but immediately reported and punished.*
- 4. Create "Metro+pink taxi" solutions in low frequency stations: female passengers can ask the Metro company to provide an waiting taxi (registered with the Metro Company as a "safe provider") at her exit station at a determined time, to ride her home.*
- 5. Instruct Metro workers to be attentive to female passengers at uncomfortable environments: operating staff should make themselves more visible to the female and male passengers when there is an unbalanced gender mix forming on the platform or concourse.*
- 6. Ensure frequent patrols in less frequented corridors/transit zones.*



## 9.2. How to make Public Transport more attractive to lower, middle and upper class ?

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1. *Keep facilities clean. Avoid the social project or not for profit look of the stations and vehicles.*
2. *Promote a welcoming environment.*
3. *Avoid the "bunker" or "tank" look at the facilities and vehicles. Focus on quality loving audiences/target groups and make it vandal-proof in a discreet manner.*
4. *Promote marketing strategies that emphasize the convenience of the Metro with practical examples of efficiency, accessibility, time savings, environmental advantages, high safety standards in comparison to road traffic, reliability, timetables, etc. Promote marketing strategies aimed at the currently private-car-lovers due to pre-conceptions and unawareness.*
5. *Create synergies with hospitals, entertainment centres, event organisations, shopping malls offering special rates and/or special timetables to passengers.*
6. *Make easy the task of understanding how the network works and what it covers*

## 9.3. How to accommodate for residents ?

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1. *See above*

## 9.4. How to accommodate for commuters ?

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1. *See above*

## 9.5. How to accommodate for travellers with luggage ?

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1. *If the networks suffers stressful rush-hours (impossible to solve with higher vehicle frequency) inform these passengers of the most convenient time-windows to travel. Place this information at the entrances (and on the website, maps, pamphlets, etc).*
2. *Clearly direct these passengers to those paths including elevators/escalators/slopes.*

## 9.6. How to accommodate for young children / buggies ?

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1. Use the same solutions as for the passengers with luggage.
2. Focus specific marketing campaigns on children: use the excuse of school travel/visits and education to educate possible future passengers on how to use correctly the network and the costs/dangers of not complying with the rules. Use reward programs (discounts, free rides, particular apparel/gadgets or information, club-membership, etc) to promote the correct use of the network by youngsters.
3. Help schools to use the Metro in its visits/travels – arrange escort/stewards to the school groups, show them workshops, etc.

## 9.7. How to accommodate for pregnant women ?

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1. Provide a sound "any seat is a pregnant-priority one". Pregnant women should be given a seat anywhere anytime.
2. Let all pregnant women know they can ask for assistance from Metro workers if they feel necessary.
3. Create a small booklet "How to travel pregnant in our Metro" listing all the possible dangers and conveniences of the network to pregnant women. List all clinics, pharmacies and useful facilities to a pregnant woman served by a Metro station.
4. Provide pregnant women with discount/free tickets during her pregnancy. Some women can not drive a car and might be willing to travel by PT/Metro if and when they feel the environment is comfortable and safe.

## 9.8. How to accommodate for wheelchair passengers ?

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1. See above proposal to passenger with luggage.
2. Install free-stand hand-operated and simple ramps on the platforms or vehicles to facilitate boarding/de-boarding trains. Make the platform crew (if any) or driver responsible for, personally, boarding de-boarding the wheelchair passenger.
3. Mark on the floor special areas (ideally close to the top of the platform where the head of the train stops) "wheelchair waiting area". The driver will see the passenger on the platform within this area and will assist him/her after stopping the train, with the ramp. The ramp shall be "vandal proof", light and easily lockable to a dock on the platform or on the train cabin/salon.
4. Close to the station gate/entrance provide a easy-to-spot button to wheelchair users to ask for the presence of a Metro worker to escort him/her through the station.
5. Stations without the necessary equipment to ensure full mobility to these users shall be signalled on the map of the network.

## 9.10. How to accommodate for the blind ?

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1. See above.
2. Provide Braille maps, Braille labels on the handrails, walls, gates, at entrances
3. Provide salient-texture paths on the floor to direct passengers.
4. Use voice broadcast to inform train destination, name of the next station, expected time to arrival, etc.
5. Create a particular free-telephone line to provide real-time assistance to passengers when within the stations.

## 9.11. How to accommodate for the deaf ?

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1. Ensure all information available in broadcast (public-address loudspeakers, emergency alarms) are also available in graphic/visual/written form.

## 9.12. How to integrate kiosks/shops ?

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1. Place shops only in areas where their presence is of interest and/or convenient to the Metro company, eg where it creates an extra population of customers or informal guardians of the space, where the shops might participate in the cleaning/maintenance/control of the surrounding areas.
2. Avoid alcohol sale and other kinds of consumption that might be prone to rogue behaviour, litter or even to the formation of queues or crowds.
3. Avoid placing shops in narrow platforms or places where it could limit, endanger, disturb specific pedestrian traffic.
4. Specific shops might replace the ticket office in certain stations.
5. Adapt the shop-type and the opening hours to the commuters' routine as well as to occasional customers.
6. Develop special commercial policy to attract small brands and/or interesting shops to the Metro network and coordinate this with the commercial planning of the station surroundings. Avoid having strong competitive shops in the close vicinity.
7. Locate the shops in a way that allows its workers to control the shop but also the station premises.
8. Make sure (design) the commercial areas of the station can be closed without disturbing the normal and secure functioning of the station.
9. Major shops shall always be placed before the station gates. Some small shops/kiosks might be allowed after the gates.
10. Flower shops, cafés, and other pleasant smell-producing shops are interesting to animate the environment and to inform people on the nearby corridors that activity is being developed close to them, that there is something fresh/ recent/acting/living on the next corner. Avoid pet-shops and potentially depressing businesses or releasing strong unpleasant smells (strong odour foods...). Avoid loud music shops. In wide passages/concourses invite shoppers to install exterior stands (in front of the shop window/counter) in a manner that attracts customers, but does not obstruct sight.
11. Allow shops to be advertised on the surface/outside the station in an organized manner.
12. Promote partnerships between the shops and the Metro company like special prices/services to Metro-pass holders to foster the ties between the commuters and shoppers.



## 9.13. How to accommodate for art performances ?

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1. Allow only Metro-permitted (with permission and sponsorship of the Metro company) performances within the network. Ensure it does not congests/endangers the flow of passengers.
2. Use the loudspeakers of the stations to broadcast local/young/interesting artists' music.
3. Have live concerts on concourses and difficult-to-obstruct locations. Advise people to be aware of their pockets when listening.
4. Use the surfaces of the stations and vehicles to display visual-arts projects tailored to the stations (don't allow the stations to be used as a 2nd class/cheap art gallery). Good examples are the special-interior lighting (colourful) of a particular train set in Seoul (don't know the author/year) or the decorative ceilings (self-adhesive films) of the trains (eg Dutch Rail).
5. Use these events to raise the "perceived" cultural/social level of the average passenger: pull them on the social ladder.
6. Use the screens in the stations/trains to show experimental/artistic videos in between the advertisements and information videos.
7. Screen and never allow for an arts performance to impair the highest level of security feature (ie: visibility, cleanliness, disturb confidence of passengers or alter their perception of the space to a level that might confuse them). Don't allow artistic intervention that might be associated with graffiti/tags or destruction of the Metro resources or reputation.
8. Don't allow art performances evoking rail accidents, explicit human suffering, depressive moods, to ridicule/mock Metro workers, passengers or authorities.
9. Screen the arts project and ensure its performers/promoters are responsible for a contract with the Metro company.

## 9.14. Should the homeless be sheltered in the Metro ?

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1. No. As a general rule, Metro facilities are a productive resource of an enterprise (company, authority, state department, etc) devoted to the transport of people, not to shelter/provide home to the poorest layer in society. This is the State's responsibility by the hand of other institutions.
2. A good, efficient Metro system is never a good shelter: the use of transportation facilities to shelter homeless people will always be done at the expenses of the transportation function – affected cleanliness, uncomfortable encounters on the stations/corridors between early/late riders and the homeless.
3. The exception to this rule is one of common-sense: if the shareholders of the Metro company decide that the Metro premises can be used to shelter homeless people eg under harsh weather conditions, then, the Metro shall also be used for this side-function. Although this is possible to happen (in Lisbon it's allowed only on rare extreme-cold-weather situations, by night and with the coordination of the Municipal Social Services) we must keep in mind that this type of side-use collides with the provision of a modern transportation service with an agreeable environment, with frequent high-income passengers upgrading the "Metro-life-style".

## 9.15. How to create an open atmosphere through which different groups are not seen as threatening ?

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1. *Provide wide passages to allow passengers walking wide (passing by in a bee-line, avoiding, choosing alternative paths) from groups perceived as threatening (rogue groups, suspicious groups, drunk people, violent teenagers, hooligans).*
2. *Provide wide platforms to allow passengers to avoid close proximity to potentially threatening groups.*
3. *In narrow spaces (inside trains), in narrow corridors or in places where passengers cannot avoid proximity to 'threatening people' make sure the 'unwanted' individuals are aware that the Metro company is following their activities and willing to intervene soon. Broadcast special (not pre-recorded, not-aggravating/escalating) warnings aimed at them through the local loudspeakers, send highly-visible officers to the spot, follow/escort the group until they leave the premises.*

Jeremy Bentham, English philosopher and jurist (1748-1832) was born in Spitalfields, London, on 15 February 1748. He proved to be something of a child prodigy: while still a toddler he was discovered sitting at his father's desk reading a multi-volume history of England, and he began to study Latin at the age of three. At twelve, he was sent to Queen's College Oxford, his father, a prosperous attorney, having decided that Jeremy would follow him into the law, and feeling quite sure that his brilliant son would one day be Lord Chancellor of England. Bentham, however, soon became disillusioned with the law, especially after hearing the lectures of the leading authority of the day, Sir William Blackstone (1723-80). Instead of practising the law, he decided to write about it, and he spent his life criticising the existing law and suggesting ways for its improvement. His father's death in 1792 left him financially independent, and for nearly forty years he lived quietly in Westminster, producing between ten and twenty sheets of manuscript a day, even when he was in his eighties. Even for those who have never read a line of Bentham, he will always be associated with the doctrine of Utilitarianism and the principle of 'the greatest happiness of the greatest number'. This, however, was only his starting point for a radical critique of society, which aimed to test the usefulness of existing institutions, practices and beliefs against an objective evaluative standard. He was an outspoken advocate of law reform, a pugnacious critic of established political doctrines like natural law and contractarianism, and the first to produce a utilitarian justification for democracy. He also had much to say of note on subjects as diverse as prison reform, religion, poor relief, international law, and animal welfare. A visionary far ahead of his time, he advocated universal suffrage and the decriminalisation of homosexuality. By the 1820s Bentham had become a widely respected figure, both in Britain and in other parts of the world. His ideas were greatly to influence the reforms of public administration made during the nineteenth century, and his writings are

still at the centre of academic debate, especially as regards social policy, legal positivism, and welfare economics. Research into his work continues at UCL in the Bentham Project, set up in the early 1960s with the aim of producing the first scholarly edition of his works and correspondence, a projected total of some seventy volumes!

The text that illustrates the panopticon principle; "Panopticon; or the inspection-house", In a series of letters, written in the year 1787, from Crecheff in White Russia to a friend in England by Jeremy Bentham. <http://cartome.org/panopticon2.htm> ) "panopticon" doctrine: individuals shall be kept on a permanent predicament of feeling themselves observed by others they can not see or know. Use the CCTV systems to, efficiently, bring to practice this doctrine.

4. *Post signs with the accepted "code of conduct", enforce it and punish transgressors if not respected.*
5. *Act when unwelcome groups are being created: the Metro company shall show their passengers they can count on the active work of the company to protect a quiet environment to them. This will discourage groups to hang around in the network.*
6. *Keep passenger in movement always to facilitate the identification of people hanging around. People at a standstill in a certain place for a long time are easy to spot, if everyone is moving. Criminals/offenders might need to wait stopped to study the environment before acting. People within the network not making a logical travel shall be followed and politely asked (a form of letting them know that are under observation) about their intentions or needs. Its also an opportunity to show care/awareness to lost people or lone people waiting for a friend/relative.*

## 9.16. Should we provide for meeting points ?

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- 1. Yes, in particular and they should be easy to control. In front of ticket offices, platforms with good lines of sight. In general meeting points will be used only by confident passengers. Confident passengers are useful to the Metro.*
- 2. If a meeting point forms spontaneously in the entrance of a station and gathers threatening populations (drug dealers, prostitutes, noisy teenagers, stalkers) the metro company shall defuse this gathering point installing physical details that make the meeting unattractive: remove hiding bushes/ad panels if it's a dealing place, place strong lighting if it's dark, install sharp/uncomfortable handrails if they are used as seats by teenagers, bring frequent police sweeps if necessary.*

## 9.17. Should we provide for toilets ?

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- 1. Toilet are a gender friendly initiative but only under specific conditions:*
- 2. if paid-per-use and permanently manned and continuously cleaned- the acces control systems of automatic ones are easy to corrupt and destroyed. If these requirements are not possible to meet its better to avoid the installation of toilets and nursing spaces.*
- 3. The installation of violet-blue lights in some UK public toilets make it difficult to be used for drug injections (its hard to locate one's veins) seems to be effective to keep drug addicts away, but also seems to keep normal users away if the facilities are not manned with a control/cleaning team – since it provides a uncomfortable atmosphere.*





## 9.18. How to allow for social control ?

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1. *Make all premises of the Metro network “transparent”:* make it possible to be seen by passengers, pedestrians, neighbours or motorists if they do not hold any secret/confidential/classified content.
2. *When possible, make every single site visible from several other sites in order to increase the chances of being, at a certain time, observed by someone.*
3. *Influence passengers standard mainstream behaviour.* “Bystander’s apathy” can kill; inform passengers of this by awareness campaigns. Invite passengers to report strange, suspicious or unsuitable behaviour or parcels. Invite passengers to report crimes/felonies/incivilities by other passengers to the Public Transport organisation. Provide passengers with the means of reporting to the Metro company: easy to remember telephone numbers free phone calls from the telephone booths within the network, a Metro worker nearby. Instruct workers to welcome reports and to react in a way that is consistent with the company is communication campaign. Don’t grumble nor show irritation in the event of over-reporting or irrelevant reporting by passengers. Act, or inform passengers of what will be done with the information they supplied. Don’t make distinctions between “police-concerns” and “Public Transport-concerns” when receiving a report/notice from a passenger, receive all reports/notices through the same service/desk although some of them might be lately passed to the police authorities or the fire department.
4. *Drive the passenger’s “sight” through the premises of the network on their walk through the network.* Remove all visual obstacles (subtle and ostentious) to an observer at the top of a staircase or escalator, install ‘glass-caged’ elevators, allow raised “observation plateaux” on stations, allow “gang-way” or continuous trains (without doors between wagons), allow wide windows between wagons, make it easy to spot left luggage under seats or above vending machines.  
*HOW? (observation plateaux: must be provided by the architecture configuration. In the Hong Kong metro cars an elevated platform/step was created between the wagons to allow police officers to climb to it and see the crowd “from above”. In Tokyo Metro police officers are located in small steps/stools to oversee the concourses.* Easy to spot the left luggage: use “cantilever” design on seats (no feet/columns underneath), use non-obstructing support feet/columns to fix seats to the floor, Use light/reflective floor surface to ensure high contrast with bags and boxes hidden under the seats. Ensure a good level of lighting near possible niches to make easier to locate objects, install ramps/slopes on top of ATM/vending machines or other platforms to make impossible to leave a object above it (like in the wardrobes/lockers used for factory workers). To allow passengers sight to “travel” through the surroundings: don’t install visual obstacles if they are not strictly necessary, use attractive clean surfaces to avoid repulsive reactions like “walk fast looking just to the floor” or “don’t even look at it, its disgusting”.

(see also article by SUM architects)

## 9.19. How to assure sufficient passenger occupation within the station ?

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1. *Control the frequency of trains to avoid congestion or deserted platforms.*
2. *If necessary, in low frequency stations promote passenger gathering in a particular area of the platform (ie use special lighting to create an extra-bright/warm area) or in front of the ticket office if manned. In more extreme cases of deserted stations use only a part of the platform in low-passenger hours; inform the passengers of this.*
3. *How to make the passenger fluxes and platforms visible from different sides ?*
4. *Don't place visual obstacles between platforms.*
5. *Make the platforms visible from street (in surface stations) by the use of glass walls or no walls at all.*
6. *Flood with light the places where passengers are supposed to be alone for long periods.*
7. *Light the walkways to the station.*

## 9.20. How to assure more staff presence in and around the station ?

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1. *Displace the staff from "behind-the counter" to more visible locations. Some of the ticketing tasks can be transferred to ATM machines, this releases some extra workers to direct-contact functions*
2. *Joint active vigilance tasks to every worker's role. Educate all workers in vigilance, contact with passengers, conflict management and self-defense measures.*
3. *Place the seats at ticket offices or information kiosks raised in order to allow for a better vision by staff members.*
4. *Give all workers within the Metro service (no matter the company that pays his/her salary) the same uniform, as well as a high-visibility one. Provide them with a radio (not a mobile phone, that seems too equal to the devices anyone has in his/her pocket, provide a professional looking radio apparatus). Incite them to patrol in order to make them visible to as many people as possible. Assign them firstly to the places perceived as less secure. Design their patrol routes, don't leave to workers the choice of their routes.*
5. *Employ local "positive role models" from deprived neighbourhoods in prominent tasks to improve the relation with particularly harsh areas. Keep these workers permanently assisted.*
6. *Use CCTV to direct/send those few workers to the locations they are needed. Increase the visibility of your staff.*

## 9.21. How to offer sufficient personal space to passengers?

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Make stations, corridors and vehicles as wide as possible.  
In central platforms with one track in each side use discontinued (non-continuous, separated, allowing passage between both sides) glass screens to create walls-to-stand-on.  
How to avoid congestion of access routes ?

1. *Make them wide.*
2. *If not viable wide, spacious, facilities [If wide and spacious facilities are not possible to provide, like in old stations, focus on management of the flow of passengers through the use of elements like signage and single-lane corridors to increase the efficiency of the small space available. In short create rules to keep people more packed and give specific instructions to passengers] actively manage the flow of passengers. Mark arrows on the floor directing passengers, draw "waiting-lines" in front of the train doors, on the platforms, create rules and advertise them (in this corridor walk on the right side), use single-direction-lanes/corridors/escalators if necessary.*

## 9.22. How to avoid congestion of platforms ?

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1. *See above.*

## 9.23. How to provide "back-space" at courses and platforms ?

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1. *See above.*



## 9.24. How to encourage proper use by smart design ?

1. Keep facilities clean. Show passengers the Metro cleaning teams are working; thus suggesting the sense “we care and work for your wellbeing”.
2. Provide plenty of easy-to-spot trash bins on stations, platforms, corridors, halls, or implement a strict rule of “no-trash-at-all” inside the network. Don’t install trash-bins aboard trains. They are harder to clean, consume precious space and can affect seriously the comfort of the vehicle (smell, dirt, etc). Make friendly voice campaigns inviting passengers to behave: don’t be afraid of being too much patronizing.
3. Provide walls, floors, lighting, seats, elevators, ATM, and all physical/mechanical/functional components of stations and trains that are very resilient to brutal use, reliable and hard to break-down under normal circumstances – lots of phone booths and vending machines are broken by angry ‘mainstream’-customers exasperated by the malfunctioning of the machine.
4. Design facilities in order to avoid/subdue unwanted postures that might cause fast degradation of the premises: design impossible-to-sit-on handrails, however in specific places provide side ramps designed to lean against, but do not design them comfortable to lay against with a foot pressed against it, use special geometric designs that make impossible to sit on or place bags in unwanted places. (Joao, we would like to refer to the use ruse abuse theory here, design equipment in such a way that when used they only suggest good use instead of ruse) Design seats in which its impossible to lay down (ie install armrests or separated seats with different highs). Obliterate corners or niches that might be used as shelter to drunk, homeless or vagrant.
5. Design and install components of the network (mainly those in direct contact with passengers) with a “easy-to-replace philosophy” in mind. All parts shall be easy to replace once damaged or broken. Light equipment, handrails, signs, seats, trash bins, floor or wall tiles shall be installed in a way that allows for cheap and fast replacement. Implement a continuous surveillance procedure to detect damaged parts, to report them to the maintenance team, and to start immediate intervention. Damaged parts visible to passengers send a sign of careless posture from the company (cfr BILAN, broken windows). Perceived negligence and absence of care acts like a magnet to incivility and degradation people don’t feel appealed to care for something nobody cares for. Also signs that unruly behaviour is tolerated in that area, or at least no one does anything there. If immediate replacement/repair can not be completed quickly install protections/barriers/signs to visibly mark that repair works/replacement is being done. Don’t communicate dates (beginning of repair, estimated time of repair) if the repair is likely to be too long or exceed the deadlines – a long ago passed date posted in a information board informs readers that nobody checks that particular location since long ago.
6. Use security or hidden screws and fasteners to avoid passengers to open/dismantle parts of the stations/ vehicles easily.



## 9.25. How to increase the perception of security by smart design ?

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1. *Install CCTV/CCVR systems and act/react to its increased vigilance capability; direct patrols after detecting something on CCTV, direct voice broadcast after detection with CCTV.*
2. *Make all workers very, very visible. Provide them with the necessary backing and support to adopt a vigilant posture - radio communications, a 24h control room to contact/ask assistance from.*
3. *When an unattended CCTV monitor is visible to passengers (inside an empty ticket office or control kiosk) inform (with a large sticker) that the very same images are being treated somewhere else.*
4. *Direct workers' presence to the most remote and/or deserted of the network.*
5. *When using the PA/public address system/loudspeakers use live speaking workers instead of pre-recorded messages: it provides the comfortable feeling of someone's presence.*
6. *Design your ticket control system in order to check passengers twice: when entering and when leaving the system to increase the chance of apprehension.*
7. *Make public all the successful apprehensions and penalties (with a clear explanation of the crime/behaviour and associated penalty) made within the network on the past months. Use free newsletters or posters to do this. Follow the British Transport Police way to positively communicate this (please explain the latter? Joao). BTP (<http://www.btp.police.uk/index.htm>) usually posts on stations, publications and website information about recent good examples of police work. See the one below taken from the website:*

*August 2006*

*TWO men were sentenced to serve six years each for an unprovoked attack on a retired BBC editor at a train station in Bradford Upon Avon.*

*On 28 June 2005 at Bradford Upon Avon train station, Alexander Graham, 39 and Raymond Lawrence, 25, from Warminster in Wiltshire, threw their victim onto a railway track and attacked him.*

*Mr Beaty, now aged 71, managed to escape and run to the other side of the platform followed by Graham and Lawrence who continued to assault him.*

*Both men were found guilty of Grievous Bodily Harm with Intent at Swindon Crown Court and sentenced to six years of imprisonment. Detective Constable Steve Evers from Bristol said: 'This was an extremely unpleasant attack on an elderly gentleman. We are extremely pleased with the sentence. At court the judge commended Mr Ray Beaty for the way he stood up to his attackers.*

*The victim, who has been attending cricket matches for over 60 years said he was shocked and appalled by the incident.*

By "positive way of communicating the apprehensions made" I mean the construction of a message that focusses on the good part (ie: one less criminal on streets) of a sad theme (crime). The message is constructed in order to avoid the rise of an "insecurity and danger rumour". Sometimes BTP posts something like "We are looking for a suspect with this particular characteristics and behaviour. He's suspect of doing this and that in this particular area. If you see someone with this profile or saw it recently please call this phone number. We'll be glad to check it immediately". Sometimes CCTV frames/photos are used to illustrate the request of collaboration. This type of initiatives have two side-effects: criminals and candidates-to-criminals feel observed and might refrain their will and people interact closely with the police, people engage more in social control once they feel useful and "backed-up" by authorities.

## 9.26. How to enhance the look and feel of the place ?

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1. *Use specially Public Transport skilled designers; public transportation has its specific ways-of-working, what works well in a residential, commercial, industrial, street or office environment, quite likely, will not work on public transportation. The use of designers (with a very high degree of design freedom or without proper guidance from the Metro operator) with no previous knowledge about public transportation's social and economic dynamics and, sometimes, without user-experience as public transportation passenger/customer, is one of the most common reasons for the failure of PT designs (vehicles and stations considered). This failure is usually only detected several months after the beginning of the operation of the network/line/station/fleet when corrections are very expensive or impossible to implement.*
2. *Make places easy to maintain clean, and keep them clean.*
3. *Make places possible to be “appropriated” by passengers in order to have them use them properly. People only appropriate well maintained, comfortable and clean spaces.*
4. *Evaluate all year-around moisture, smell, sound, wind and sun-exposure, temperature of the station and manipulate this variables in order to offer a physically (somatic) comfortable space. Psychological comfort will be much easier to promote in a space like this.*
5. *Use vegetation in sites where it is possible to keep it “pristine”, well shaped, and does not obstruct vision or creates hiding places – vegetation has a “calming” effect (cfr Atocha station, Madrid) with most individuals but must not be a burden to the efficient station/surroundings of the station.*
6. *Do not post “notices”, “warnings”, “timetables”, or any other printed information in the ticket office window in such way that obstructs the vision of the worker (from inside the ticket office) or the vision of the passengers. Use special purpose boards to post that information. Papers placed on the ticket windows are usually opportunistically distributed (placed where a small area available and easy to reach - not on the most suitable place) and tend to be left there “forever”. The result is a “nobody cares” image in one of the most important contact-points between passengers and the company – and also a diminished angle-of-vision to survey the surroundings from within the cabin.*





## 9.27. How to increase the legibility ?

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1. *Design and build easy-to-understand buildings (stations, tunnels, corridors, staircases, etc): simple plans, wide sights to allow people see almost all the space always – no matter their location within or outside the station.*
2. *Design non-fully-homogeneous spaces: provide different decorations or shapes to different corridors, entrances or halls to differentiate them (cfr. convex spaces, SUM architects)*
3. *Design in a non-labyrinth manner.*
4. *In a very legible space use signage to reinforce legibility. In a labyrinth or confuse space use signage to inform and direct people.*
5. *Design and install “fool-proof” signage.*
6. *Use large, high-contrast, assertive and uniform signs.*
7. *Repeat message/information in a redundant manner (ie: remind passengers in a long corridor if they are bound to the platforms or to the exit with “To trains>” and “To the Exit>” signs. Be particularly precise in node-stations, where orientation might be more difficult.*

## 9.28. How to induce correct use by smart design ?

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1. *Limit the possible uses of each part/component of the network to a single use or small group of possible uses.*
2. *Use signs to explain efficiently how to use correctly more complex items like ATM, ticket gates.*

Use plenty of arrows to direct people. (Joao, are you sure? I believe the architect will contradict this vehemently...). Of course they will. Architects always say good architecture does not require signs. The same happens with consumer products; well designed products are “self-explanatory”.

This is true at a theoretical level but reality proves that this is not a general characteristic among current buildings, stations, public transportation facilities. This leads us to the unpleasant conclusion that (then) what we have nowadays is not “good architecture”. My opinion is that if lots of signs reassure passengers of where they are, where they are going, and how to use gates or ATM, even within a very nice built environment, then please do use signs and arrows.

Public Transport needs passengers to orient to increase their self-confidence, and to decrease their irritability.

## 9.29. How to increase the quality of the user-experience by smart-design ?

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1. *Make people feel comfortable (at ease) within the network, explain the network, how it works and how to ask for prompt assistance if needed.*
2. *Provide continuous clues about the presence of the company nearby the passenger and clues that it is taking care of passengers (making repair works, cleaning, updating the decoration/lighting, providing information, reacting to irregular consumption of the service sold, etc.*

# 10. How to prevent major incidents and reduce the ruse and abuse ? attractive to all ?

## 10.1. How to discourage ruse by smart design ?

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How to avoid abuse by smart design ?

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How to avoid free riders by smart design ?

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- 1. Install gates, install detection mechanisms to detect jumping or fraud at the gates. Provide intervention teams to apprehend individuals trespassing gates, implement an easy-to-use punishment method – if possible fully processed by the transport company – and increase the discomfort associated with being apprehended (ie, being banned from the network for several days, high fines/penalties, time-consuming regularization process, having his picture spread amongst security workers of the network, etc).*
- 2. Provide reliable and easy to use payment methods to purchase tickets in stations at all times.*
- 3. Implement frequent random controls.*
- 4. Explain clearly the ticketing system and the penalties for not complying.*

## 10.2. How to discourage pickpockets by communication and smart design ?

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1. *Design wide access gates. (in fact: built gates in order to require a minimum space between two consecutive passengers – some airports have this at the customs area – use light-sensitive sensors or two rows of doors if only possible)*
2. *Avoid congestion near the doors on the vehicles, gates or on escalators – implement a “one-step-far” minimum proximity among passengers when accessing to narrow passages like train doors.*
3. *Teach passengers how pick pock teams act. Explain with dramatized situations (ie: the instructive video shown aboard the GVB-Amsterdam Trams in 2007).*
4. *Teach people how to be vigilant about their belongings and how to re-act if being victimized.*
5. *Release and make public the identity of pickpocketers with police approval (Police usually knows them and can have a picture of them): a known pickpocketer can no longer join a pickpocket gang in the usual manner... in the same area...*
6. *Mark and enforce “wait your turn here” lines around ticket-offices, ATM, phone-booths.*



## 10.3. How to avoid graffiti by smart design ?

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1. Actively pursue and punish those involved in this type of offences. Work together with neighbourhood associations.
  2. Ensure everybody knows graffiti is a punishable offence, not a form of acceptable expression. Explain the punishments associated with apprehension.
  3. Install handrails or other obstacles in wide corridors/ passages/staircases to keep people far from the walls – make ‘graffitable’ surfaces hard to reach.
  4. Design and build in order to have high ceilings or at least more than 3m high in every location – ceilings can be painted also...
  5. At night keep vehicles in fenced and surveilled yards during night, install sand/stone floor beds around the yards to make furtive approach/escape noisy or more difficult. Keep the yard lit and patrolled. Use remote-controlled lighting to use when an intrusion is detected. Use remotely operated water-sprinklers along the tracks on the yard as an effective dissuasion “weapon” aimed at intruders – also facilitates the identification in the event of trespass – *someone fully wet at 03am near a Metro garage...*
  6. Use:
    - i) easy to clean surfaces,
    - ii) easy to repair surfaces,
    - iii) self-sacrifice surfaces or
    - iv) inefficient surfaces, in vehicles and facilities.
    - Easy to clean surfaces; vitreous surfaces (glass panels, glass covers, glazed varnishes, tiles with smooth glassed surface) are easier to clean (remove paint from). Ensure there is a efficient detection mechanism and a correspondent cleaning reaction. Graffiti is a form of marking a territory and a reputation/status sign, if Metro companies don’t allow it to survive (exhibition) more than few minutes/hours graffitiers don’t feel rewarded enough to continue.
    - Easy to repair surfaces. Surfaces can be easily re-covered with a thin film capable of hiding the graffiti and providing a newly pristine look. Re-paint and re-cover with self-adhesive films are two processes of achieving this goal. Vehicles, its components and stations can be designed with this process in mind. The process of re-applying paint or film in a small area of the vehicle/station, quickly and cheaply must be designed also from the very beginning. *NYC metro implemented a “single colour policy” on its train exteriors in the 1980’s to allow the cheap intervention of its fast-reaction-painting-teams that use rolls and fast-drying paint to immediately cover graffiti.*
- Self-sacrifice surfaces are usually part of “corrective strategies”. There are transparent varnishes on the market (*Most industrial paint or chemical manufacturers have this sort of anti graffiti coatings. ie AGS-Trion Tensid AB, Graff-it-off™ from Geo Enviro Group, )* that can be used on all kinds of surfaces (for glassed windows an equivalent type of products exists under the form of self-adhesive film (*Llumar, 3m, etc*), indoors or outdoors. This thin layer of protection sacrificed during a graffiti attack. The varnishes can be easily removed (with the respective paint on them) using an “antidote” solution, and then re-applied once more to keep protecting the original surface. Strong self adhesive films on windows follow the same use-philosophy. Operators try to avoid/postpone these applications once costs are still relevant (*what do you mean?*) (only networks with extensive/constant damage by graffiti do install these films and coatings -its necessary to cover large areas of their patrimony – both are expensive. This extra protection (coatings or films) still is an important economic expense, an add-in, not something that comes as “standard” from the train suppliers or the construction contractors. Advertisement posters and advertisement self-adhesive films (allowed) covering vehicles or station walls also act like self-sacrifice surfaces.
  - Inefficient surfaces: are a set of solutions that can be divided in two classes; ‘
    - a) transparent varnishes/liquids that once applied on the surfaces to protect (usually expensive ones like in trains) create a thin glassy surface where most paints can’t dry properly – and therefore can not adhere conveniently. This class of products allow for an easy removal of most paints but must be re-covered frequently to keep its efficiency as non-efficient surfaces for paint to dry on.
    - b) The other type of surfaces that are not efficient/ attractive to graffitiers are those that require too much paint, too much time or too much effort to create a barely visible/notorious graffiti: deeply corrugated or irregular surfaces are great paint “consumers” and unattractive, fences and metal bars several centimetres above a flat wall have the same effect, vegetation covering architectural elements or creating a shield do the same. Very abrasive surfaces (ie: blasted concrete/cement) prove also highly inefficient for painting graffiti/tags with pen-markers,.

To all surfaces (in trains, stations, fences, poles, bridges) that are less than 2,5m far from the ground (or stable platform capable of being climbed to) shall be paid special attention: these is the “range” of heights that its primarily aimed by graffiters. Plan the surface finishing or paint-scheme (lively) off these areas in trains and stations to make possible a good anti-graffiti dynamic.

Graffiti and other forms of destruction (engraving, cuts with knives or nails) will always exist on Public Transport; operators should design and build their premises and purchase their fleet with a “fast and cheap replacement/repair philosophy” in mind. The costs of this policy must be incorporated and streamlined in the routine of the business.

Try the use of advertisement posters or short-term decorative interventions (frequently replaced) in hidden places (ie inside elevators/lifts cabins) to deter graffiters interventions.

## 10.4. How to avoid litter by smart design ?

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1. *Provide plenty of trash bins adapted to the reality (don't simply choose a nice model from a catalogue...) of the place; big capacity if free newspapers or pamphlets are distributed on the network, small but easy to use nearby exit gates, cigarette ashtrays close to the entrance if smoke is not allowed, etc.*
2. *Provide visible (easy to spot trash bins).*
3. *Place the trash bins in places where they are useful (non-educated passengers will not carry their own trash for more than a couple of meters...) and easy to unload or clean.*
4. *Educate passengers in accordance to the trash-policy of the network.*
5. *Don't place trash bins where their presence can lead to disturbance in the flow of pedestrians.*
6. *Clearly mark the rail tracks as non-trash areas !*
7. *Make the unloading of the trash easy to complete: don't require special tools.*

## 10.5. How to avoid drug trading in and around the station ??

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1. *See above.*
2. *Provide frequent police sweeps,*
3. *Don't allow the formation of “stopover” points or areas where groups can feel comfortable. If a suspicious group started recently gathering at a certain point of the network or close to a certain station act immediately, ask the cooperation of the police or local associations. Don't wait until the group takes possession on the site. Let them know they are under observation, make it uncomfortable for them. At the beginning of a “meeting” its easier to disperse it. If the trade is extensive and well established around a station the intervention of the municipality is required: the Public Transport operator alone ,or with the police, can't change it...*
4. *Install CCTV/CCVR cameras conspicuously around stations.*

## 10.6. How to avoid suicide at the platforms ??

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Very few papers and experiences were written and conducted about this subject, in part due to the operators reluctance/unwillingness to talk about it. As far as I know these can be mitigation strategies;

- 1. Make an agreement with the media (news agencies, press, TV and radio) to ban the publication of news about suicides on tracks; imitation (copy-cat behaviour) is characteristic of suicides committed in close days. This might diminish the detonator-effect of news to suicides (on tracks).*
- 2. When possible create a good view to the platform for the driver on an incoming train; this allows him/her to reduce speed if someone with a suspicious behaviour is spotted on the border of the platform.*
- 3. Install alarm buttons that quickly send a sign to the incoming trains, officials, and perhaps switches off electric power in the third rail (if any)*
- 4. Immediately, reduce the approach speed on incoming trains.*
- 5. Place rail tracks on narrow raised platforms (a platform for each rail, with a deep trench between them and a trench at each side of the train). The trenches should be big enough to hold a layed/curled human body far from the rails, in the event of a jump.*
- 6. Instruct platform workers on how to detect potential "suicides" on the vicinity of the tracks. Instruct them how to divert these passengers to other locations or outside the station. Allow platform workers to require "slow approach mode" to incoming trains if suspicious behaviour is detected.*
- 7. Install barriers/fences about 1,20m or higher height on the edge of the platform. These fences shall have automatic sliding doors corresponding to the train doors.*
- 8. Avoid signs similar to the Japanese one "Don't jump to the tracks on rush hour please !", might not work in other cultures...*

## 10.7. How to minimize consequences of an bomb attack ?

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1. *Make the detection of left-bags easy.*
2. *Make easy to inspect/check the content of trashbins.*
3. *Allow for easy evacuation – make wide passage ways, provide efficient smoke evacuation from undergrounds, install alarm buttons to unlock emergency escape routes, and, above, all, instruct and train passengers with simulations in their usual stations.*
4. *Provide “blast/shockwave directing” trash bins (armoured bomb-proof structure encloses/contains the explosion and directs the blast towards the trash bin opening to a less-bad area, usually the ceiling/sky, to avoid pedestrians to be directly hit, this is a US model suggested by FTA).*
5. *Provide independent wagons on a train with a reinforced shield at the end of the wagon – to avoid that a single bomb could significantly damage two consecutive wagons in a tunnel. This collides with open-end or gang-way train configurations...*
6. *Instruct passengers how to evacuate a train.*
7. *Install reliable emergency lighting and visible signs.*

## 10.8. How to avoid panic/stampede ?

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1. *Instruct passengers, if possible with in-situ simulations,*
2. *Explain passengers the escape routes of their usual stations.*

## 10.9. How to prevent ruse/abuse/major incidents by surveillance ?

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1. *Involve workers (no matter their tasks) in the role of informal but active vigilantes. Teach them how to report their observations to a 24h/day control room.*
2. *React to incidents; this leads to the idea that the company is actively surveilling the network. It acts as a preventive measure to future incidents.*
3. *Place visible workers to direct/condition passenger's behaviour in events like football matches or other large meetings. Use personal or remote surveillance to place and coordinate these workers.*
4. *If possible use lighting or PA systems to let suspicious/rogue groups or single individuals to know they are being observed. Control these lighting and sound (apply locally, just on the spot the aimed group or individual is) in accordance to the input obtained by surveillance.*



## 10.10. How to facilitate interventions in case of major incidents ?

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- 1.Design the surroundings of the stations in order to accommodate rescue cars and first-aid deployance, ensure these areas will be free in the event of an emergency, exclusive areas are more reliable; create buffer-zones to evacuation of large groups.*
- 2.Install fire hydrants all over the network and very easy water-feeding-point.*
- 3.Install emergency devices (man-powered?) to be used in the event of an evacuation of injured people on stretchers along long staircases.*



# Development recommendation 1

1. Creating agreeable entrances/exits to underground stations using sound and images.
2. Creating a permanent or travelling exhibition from information & visuals available in the BILAN.

Vincent Eaton

# Creating agreeable entrances/exits to underground stations using sound and images.

## Concept

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By using sound, images, a combination of both, mobile phones for social history, in an economical method, entrances and exits of metro stations can be made more enticing and interactive, a mini-event rather than seen as an effort. The following imagines ways to make this brief journey friendlier, relaxing, more of an event than a restricting passageway to hurry uneasily through.

So we think up a user going underground to a metro and having to walk a long tunnel before arriving at the ticketing area.

## Sound

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Arranged (or embedded) through the tunnel, along top (and/or bottom and/or shoulder-height) are mini-speakers. A few aural possibilities include:

In the morning, the user hears the chirping sounds of birds, a rooster crowing, human yawning, brushing teeth, water running in a basin, etc.

In the afternoon, the user hears relaxing sounds including the sound of water of a fountain, a Zen chime, a distant chanted "Om", the ring of a passing bicycle.

In the evening the user hears the sound of crickets chirping, the sound of shutters coming down...

Equally, hard plastic, resistant buttons spaced evenly down the corridor, that, when pressed, as the user walks by, make a random, computer generated soundscape that accompanies the walker for ten seconds. The soundscape could be musical, weather oriented (wind, rain, etc.), animal (cats purring, dogs barking, cows mooing).... Different buttons cause different sounds/notes to be heard.

Without imitating radio advertising, forthcoming cultural events in a city can be highlighted: for concerts, singing and music; for theatre, dialogue.

## Images

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Arranged through the tunnel are projected images, perhaps via beamers attached to DVDs, or spots with unchanging images. If sound was added, so much the better. A few visual possibilities include:

- From top to bottom, a waterfall image (with its sound).
- Skateboarders moving along the floor.
- On the wall, a motorcycle moving silently along a road in the desert.
- A metro train zooming past.
- A hopscotch image on the floor, with each square a name of a metro station.
- Bees buzzing around a hive.
- A cattle stampede going up on the wall.
- Above, airplanes leaving cloud streaks in the air.

- On the ceiling, from one end to another, you have a changing sky, starting at one end with a sunrise, and going “through the day” from sunshine to clouds to storms and ending with a sunset.
- On the walls, a field of flowers a camera travels slowly through.
- Projected images of current art/architecture/film exhibitions, with show dates and locations.
- Promote by showing attractive visuals other stations in the city people might not usually visit, so people get to know other parts of the city metro system.

Sensors can be placed low in the tunnel, and, according to passing foot traffic, they can generate random light shows at foot level: there would be many poetic changes in light with heavy foot traffic, and modest light changes when foot traffic is quieter. How interactive this would be depends on installation.

## On the Platform – the Story of a Station

Educational/cultural/social possibilities exist while users are waiting on a platform for their train to arrive. On the opposite wall can be a list of free-of-charge phone numbers and metro and city key words that are only available underground. Using their mobile phone, they call a number from the wall. They enter a code for language to hear people’s stories about the place where they are waiting, either of the metro, or of places and history above and around that metro station.

This can become an underground documentary oral history project recording stories and memories told about specific geographic locations in and around metro stations.

Professionals could collect people’s personal histories and anecdotes about the places in the metros neighborhoods that are important to them. In each metro location signs with a telephone number can be installed that anyone can call with a mobile phone to listen to that story while standing on a platform, engaging in the physical experience of being in the area where the story takes place.

Stories to be collected and recorded could range from personal recollections to more “historic” stories, or sometimes both -- but always are told from a personal point of view, as if the storyteller is standing on the platform with you and was casually talking about their neighbourhood/metro station to a friend.

It’s history from the ground up, told by the voices that are often overlooked when the stories of cities are told. We know about the skyscrapers, sports stadiums and landmarks, but we can look for the intimate, neighbourhood-level voices that tell the day-to-day stories that make up a city and metro line. The most nondescript station can be transformed by the stories that live in it. Once heard, these stories can change the way people think about that place and the metro at large.

By engaging in this way, people develop a new intimacy with places, and “history” acquires a multitude of new voices. The physical experience of hearing “the wall talks” bring uncommon knowledge to common space, and brings people closer to the real histories that make up their world. All members of a community around a metro stop would be encouraged to participate and contribute, so that the voices reflect the voices of the multicultural diversity that make up a city’s neighbourhoods.

## Other

In place of battling from graffiti, a competition commissioned for graffiti artists to celebrate the neighbourhood/local metro. Projects are accepted, a winner selected. The possibility to observe this graffiti being painted on a selected location that makes it clear this is a city project. The process of creating the graffiti is videoed and shown in loop on a small LED screen in the metro nearby: how it was done, and a little interview with the Graffiti artist in his/her intention, etc.

Break dance performance: times and places in metros with adequate space: show times and spaces are pre-ordained, allowing traffic to flow around groups of performers. Turn tunnel into cultural galleries, showing BDs, expos & installations, multimedia events....



An abstract graphic in the background of the page. It features a series of thin, parallel lines that form a large, stylized 'V' shape. Within this 'V', there is a circular shape that resembles a pen nib, and from it, a series of lines extend downwards, suggesting a hand holding a pen. The lines are in various shades of blue and grey, creating a sense of depth and movement.

# Development recommendation 2

## Role of colour in transit zones of urban public transport

Ingrid Lange

# Role of colour in transit zones of urban public transport

## 1. General considerations

All of us have experienced the effect of environment on our morale and our well-being.

Our senses are our antennas, our contact with the outside world. They are called upon non-stop and our body reacts to these different vibrations in an intense manner.

In order to choose the appropriate colours, it is important to know the effect that each colour will produce, as much on the space, as on our being so as to make a sensitive choice for the effect we wish to generate.

It is imperative to visualize the colour study while taking into account two aspects: the physical effect that the colour produces on the surroundings, and the psychological effect that each colour will create on the users, so as to use the colour in a proper manner, achieve the well-being of the passenger; on the one hand the physical well-being, and on the other hand a sense of security.

Considering these two elements, let us create a harmonious and peaceful place, in accordance with all the factors that are closely linked to it, such as light, sound, smell and texture.

It is thus indispensable to know the physical and psychological effects produced from each reflection of the wavelength and each colour sensation in order to utilise it in an appropriate manner.

“Beyond the physical impact, the colours constitute a universal language resulting from the vibrations that they produce; they form an identical psychological language for each individual” Nicole Van den Broeck<sup>(1)</sup>.

(1) Nicole Van den Broeck  
Centre de recherche du langage de la Couleur (Center for Research of Language of Colours)  
Rue de la Falise, 39  
B-1470 Baisy-Thy

It is with the knowledge of this language taught by Nicole Van den Broeck and with experimentation at the time of various courses and projects carried out that we can state the impact that the colour generates in our deepest being.

## 2. Physical and psychological impact of colours

### 2.1. The phenomenon of colour perception

It is important to remind oneself what is colour.

Three components intervene in the phenomenon of colour perception:

#### The nature of the object

The light that illuminates this object which is essential for the eye to receive the message. Without light we do not see anything.

The eye that receives information and sends it to the brain.

When white light falls on a substance or on an object, a part of the light is absorbed and the other part is reflected, it is the reflected part that is visible to us.

We see the red wall because the molecular structure of the wall absorbs all the wavelengths of the spectrum except the red wavelength that it reflects non-stop to the eye, generating in us the chromatic sensation of the red.

Thus, the colour does not exist by itself; it is only the partial and specific reflection of the light.

The luminous rays are the energy belonging to the large family of electromagnetic waves that are different from each other on the basis of their wavelengths.

The visible part of light called the visible spectrum is a well-defined part of these wavelengths ranging between the ultraviolet and the infrared (on the scale between 380 and 720 nano-meters or billionths of meter).

The eye is capable to transform this well-defined portion of electro-magnetic wavelengths in luminous or chromatic sensations. On the basis of the wavelength perceived by the eye, different from each colour, the impact will certainly be different.

## 2.2. Physical and psychological impact of achromatic colours

### The achromatic colours, white and black. Let us have a look at what happens with the colour white?

A white object means that the molecular structure of the object absorbs a negligible part of the light and reflects a greater part to the eye.

#### Visual Impact:

White, hence, will give the visual impression of increased space, the white surface seems to move back, and the light is reflected in large quantity (70 to 85%).

White, added to other colours in large proportion on the level of mixtures, will have the same combined effect from the impact specific to each colour.

If now we place white besides of other colours, we observe that it will soften the strong intensity colours that are adjacent to it because its own radiation is such that it does not allow its surrounding colours to radiate beyond their limit.

An experiment of a yellow square on a white surface or a black surface; on a white surface the yellow square seems much smaller than on the black surface.

In addition to the physical impact, the psychological impact produced is an impression of cleanliness, perfection, purity, but also of emptiness, asepsis and isolation.



### What happens with black?

Black is not a colour, it is the absence of colour (for humans). The object absorbs the totality of wavelengths of the spectrum, nothing is reflected to the eye.

#### On the level of space

Black makes the surface dense. The walls come forward, the space narrowed visually.

Moreover, black absorbs all luminosity, its index of reflection is 5%. Added in large quantity in combination with other tones, it will also have the same effect on the space, that of visually bringing closer the coloured surface.

If we put black besides other colours, it makes them brighter, not having any radiation of its own.

It allows the colours that are adjacent to it to radiate their maximum level.

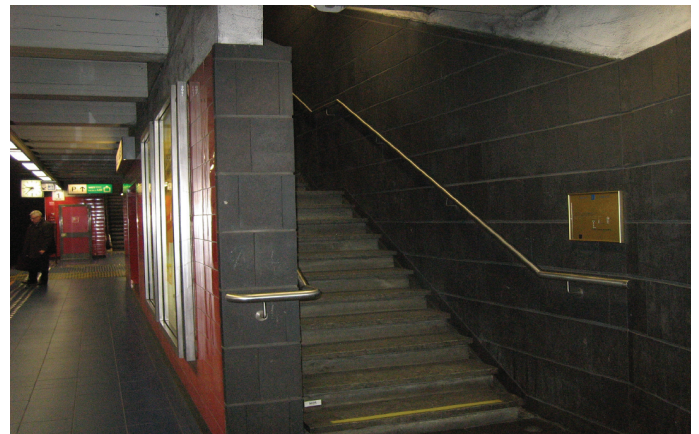
#### Feelings generated by the colour black:

Feeling of oppression, unease, induces revolt, lifelessness, depression.

#### Where and when should it be used?

A colour scheme having a large proportion of black brings about the same sensation.

Black should be used carefully, as well as any tone of which the black proportion exceeds 50%.



Would you like to take this staircase?



### 2.3. Physical and psychological impact of chromatic colours

#### What happens in the presence of red colour?

Let us begin with its impact on space.

Red belongs to the warm palette of colours. Likewise all the shades of this palette, it exceeds its surface and invades space. The wall comes visually closer, thus the space decreases.

We can hence use it, like all the shades of the warm palette, to improve the proportions of our space while taking into account the sensations it produces. For example one can bring a wall closer or decrease the space of the ceiling.

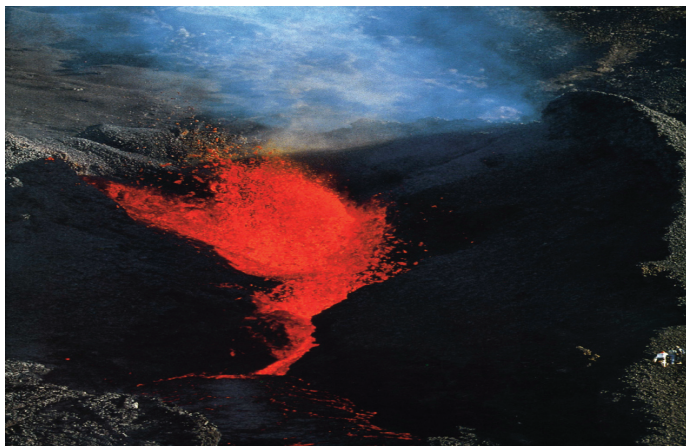
#### Feelings generated by the colour red:

Red pushes us towards extraversion, it invites us to act, move, as well as all the colours of the warm palette.

It instigates us for a very short time but note, not for long. Used in pure form, red symbolises alarm, it puts us in alert (red light – fire alarm).

It also gives an impression of luxury, richness, it is powerful, with the tendency to overpower us. It creates the desire of festivity and sexuality, it increases tension.

Careful, red is powerfully exciting. It can provoke anger, revolt, aggressiveness and moreover, with tendency to oppress us.



#### Where to use and in what quantity?

The best advice in matter of colour is the observation of nature. It is interesting to discover that nature shows us the manner in which we can at any moment refer to it as a guide. Let us observe how nature presents red to us?

Red is found in flowers. One never sees it in pure form in large quantities. Nature presents it to us, also in brief moments: volcano, fire, the short life of a red poppy.



Use it in the same form, with utmost care, in small quantity or in less intense shade, diluted with white.

Use it as a signal to gain attention.

Use it carefully to benefit from its instigating qualities.

Physically, red can be the indicator of a direction to follow, ideally on the floor. At eye level, it should be reserved for signage, and all the elements should be legible at first glance, because its vibrations make one alert.



Here, red is employed as a signal for the fire posts. The impact is decreased given the large quantity of red used on the walls.

Red will also be used temporarily to celebrate an event (Christmas festival) or any other event in the city, a unique and special moment.

Let us follow our chromatic circle.

While passing from red to yellow we came across:



## Orange

Combination of yellow and red.

### Impact on space

It belongs also to the warm palette, extraversion.  
It decreases, narrows space with its characteristic of overflowing the limit and its significant radiation.  
Moreover, due to its huge capacity to reflect light, it will make the space very bright.

### Feelings generated by the colour orange

The walls come closer while creating a feeling of warmth, cocooning.  
Orange is a colour that favours for movement and communication.  
It is a colour full of spirit and an urge to live.

### Where to use?

Thanks to its luminosity, it has its place in the transition zones between two spaces and on the waiting platforms for the warm comfort that it induces.  
Overflowing colour, it should be like yellow and red, softened with the addition of white.



Here the warm impact is revealed.  
This orange, omnipresent, still respecting the rules of harmony, it would be more aesthetic. (see next chapter).

## While going from red to blue, the shade burgundy.

It is formed with red and blue with an important proportion of black.

Mixture of warm and cold palette, introversion and extraversion.

### Impact on space

The colour burgundy, on one hand it belongs to the warm palette and on the other hand the presence of black in it, will reduce the space, narrow it, heat it.

### Talking about feelings

The addition of blue to red will push us to act, but act with poise, serenity, depth and with more maturity than under the effect of pure red.

In burgundy, we do not find the aggressiveness and violence of red.

### Where to use?

Burgundy can be used in waiting zones since it brings together the warm dynamic feeling but without the aggressiveness of red. However, it is to be integrated in soft harmony, in small quantities as it can become oppressing.

## How does the colour brown affect us?

Brown is the mixture of yellow, red and black.  
It belongs to the warm palette.

### Impact on the space

A brown wall will give the impression of coming forward towards us, decreasing space.  
Brown, with its proportion of black, will absorb light.  
It reflects very less light, it darkens the space.

### Feelings generated by the colour brown:

Feeling of strength.  
Like the tones of earth seen in nature, they are also perceived as welcoming, warm.

### Where to use?

It is proscribed in the transfer zones because brown in absence of natural light, does not reflect much light. It is thus sad, unpleasant and to be avoided.

## What happens under the effect of yellow?

### Impact on space

Yellow is a colour from warm palette, it invades space, narrows it, reduces it as it goes out and radiates beyond its limits.

Colour that illuminates space, yellow fills the surroundings with light.

Its degree of reflection is from 65 to 75%.

Yellow attracts the eye; it is clear and powerful.

### Feelings generated by the colour yellow:

Colour of awakening, it is part of the palette of extraversion, and stimulates physical and mental activity.

Yellow makes us happy, energetic and optimistic. It leads to communication but on the other hand the vibration from yellow strengthens the ego hence can invoke conflicts.

### When and how to use it?

Let us see its presence in nature and compare:

Where do we find yellow? In flowers, sand, sun ...

Yellow is present in nature either in little quantities particularly in flowers, or in large quantities if one chooses it in softer shades, as in the sand of a beach.

The soft rays of the sun are beneficial. In too high quantity, they burn us.

### Where to use it in the transit zones?

Principally for its large luminosity, its brilliance, it will be used in an intense manner, closer to the pure tone in a crossing point from exterior to interior, in a diluted manner in places meant for waiting.

It is to be used also for "attracting the traveller within" because his eye is always attracted towards the most illuminated zone and humans have tendency to move towards light.

## Let us also state the impact of sand colour utilized frequently in stations.

At the spatial level, the sand shade creates less change given white increases the space visually and the colour yellow reducing it.

This colour does not modify thus visually the place creating soft warmth.

### Feelings generated by the colour sand:

The sand colour is a relaxing, warm colour with a lot of serenity.

Colour of waiting, it does not push towards action.

### Where to use?

Currently used in certain stations, often in the form of natural stone, travertine or marble, sand confers a calm and peaceful atmosphere.

It should be integrated in the global harmony and not associated with any shade so that it does not lose its characteristics.

Sand can also be a colour scheme, a guide leading from one place to the other.

We can also associate other shades with it; these meet the demand appropriate for each zone in a more specific manner.

## And what do we experience under the influence of green?

Green is the mixture of blue and yellow.

It represents balance and belongs to the palette of introversion.

### Spatial Impact

Without shading, it neither decreases nor increases space.

Whereas, light green will increase space by adding white, the pale green wall seems to be moving back. Its proportion of white leaves it a huge amount of luminosity.

### Feelings generated by the colour green

Impact of light green on ourselves.

Light green invites us to the relaxation to calm. It has an appeasing and balancing power; it is a refreshing colour that induces lightness. We perceive this calming effect in the nature.

### Where and when to use it?

Pale green is present everywhere in the nature and in large quantities.

This colour is to be used in the transfer zones and in large quantities without any limit, on the level of the wall.

It brings poise and protects the travellers. While maintaining certain lightness, it can integrate itself in a soft harmony or in contrast according to the specific demand of the place (see following chapter).

## As for dark green.

### At spatial level

Created with mixing of yellow from the warm palette and blue from the cold palette, its proportion of black will give one the impression that the space has decreased, and the surfaces are coming closer.

### Feelings generated by the dark green colour?

Dark green is a balancing colour, reassuring, deep and which re-comforts. It invites us to reflection, orientation. It evokes, moreover the traditional side, refined, reference to the past. It is a colour of orientation associated with balance and harmony. It is a colour that influences with its force.

### Where to be used and in what quantity?

Dark green has its place in stations composed of several levels. It is to be used in particular on the floor as anchoring place due to its psychological and impact of orientation and for its reference to nature.



It is to be avoided on the ceiling provoking a feeling of crushing.

### What happens with blue?

#### Impact on the space

The sky blue belongs to the cold palette, it increases space and moves back the walls. With addition of white, it gives the impression of lightness, freshness, space and reflects a soft luminosity.

It is devoid of any visual excitation.

#### Feelings generated by pale blue

It belongs to the palette called “cold” (blue-green) and invites us to introversion. Blue has a calming, restful, de-stressing effect. The skyblue radiates softness, it appeases and re-comforts. It allows us to be calm, relaxed; it decreases tension. Colour that shines, skyblue radiates a huge luminosity.

#### Where to use and in what quantity?

Blue is one of the rare colours that can be employed anywhere without danger and in large quantities, such as nature presents it to us. We find it everywhere without any limit in the blues of water and the sky.

### Where to use it in the transit zones?

It has its place in welcome zones. At for walls and ceiling, passage between exterior and interior, it connects with the omnipresent blue of the sky and attracts the passengers, thanks to its luminosity.

In transfer and waiting zones, we would place it principally on the ceiling, where it will create a large visual opening, favouring rest, relaxation, reducing the tension created by fear and waiting.

Do not place the colour at human level where maintenance would be too significant seeing its lightness.

### Dark blue

#### Impact on the space

Dark blue creates an impression of depth, brings out a huge force. Dark blue absorbs light, does not reflect it.

#### Sentiments evoked by the colour dark blue?

It brings out an impression of depth, knowledge, distinction and refinement. Dark blue creates estrangement, distance. It does not force us to action but pushes us towards introversion.

#### Where to use and in what quantities?

Observing its visual impact, it is preferable to use dark blue with discretion (as a Sapphire) and while associating it with other colours. It can be used for its refined, precious side, jewel-like during a temporary exhibition or for highlighting.

#### What does the violet-mauve vibration provoke?

The physical impact is difficult to determine. It touches us in depth particularly because it is deep and rich.

It can be oppressing in large quantity and intensities.

#### What does it make us feel?

Violet leads to creativity, meditation, elevation of spirit. It forces us to introspection and introversion, note, it detaches us from reality. It can destabilize us, make us insecure. It does not suit the anxious.

#### When and where to use?

In the case of transfer zones, it is inadequate and to be proscribed, in view of the imbalance it can induce.

It can be used in a momentary manner to suggest and reinforce a temporary artistic activity inside the station.

## What is the impact of grey?

### Impact on the space

This neutral colour, used alone, does not modify the space substantially. It neither increases the space nor brings it closer.

It will be, in particular, used to highlight other colours. Light grey neither disrupts nor interferes with other tones. It allows the combination of all the other colours.

### Where and when should it be used?

Grey will be used in order to allow a global harmony. In fact, besides the colour, the numerous elements of ceilings, pillars, structures, floors exist only in grey colour.

Grey becomes a neutral base colour for allowing homogeneity. This homogeneity is indispensable to create a well-being for the user. It can be used as a base for other colours, in floors, ceilings and walls.

## Dark Grey

### Spatial Impact

As for this colour, dark grey reduces space considerably. It imposes itself, brings the surfaces closer and stabilises space. It reflects only very little light.

### Feelings generated by the colour dark grey:

It gives the impression of order and strictness.

For all these reasons, it will be used mainly in small quantities to structure the space, in the building structures in particular. It will also be used to bring out the other tones.

## Summary: spatial level

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If we wish to reduce the space, lower the ceiling, bring closer a surface visually, two solutions are possible either use a colour from the warm palette, of extraversion (colour that overflows its limit) that will bring the coloured surface closer, thus reducing the space; or we choose a colour containing a large quantity of black which will also have the same characteristics.

Inversely, if we wish to increase the space:

We will use a colour from the cold palette, of introversion that increases space while moving back the element coloured; or we add white to the basic shade in significant proportion with which we push back the surface and thus increase space.

## Summary: feelings generated

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To encourage activity: one opts for a colour scheme from the warm palette, palette of extraversion that will force us to act.

To encourage rest: for relaxation we opt for a colour scheme from cold palette, that pushes us towards introversion.

We improve the choice of colour referring to the specific symbolic value of each colour.

These theoretical and psychological data should constantly be kept in mind when choosing colours as they are both indispensable to requests, in fact lots of examples show us that taking into account only one of these elements does not create the desired effect.

Moreover, the specific characteristic of each colour, the way to combine them is also important, while applying the rules of harmony and basic concepts.



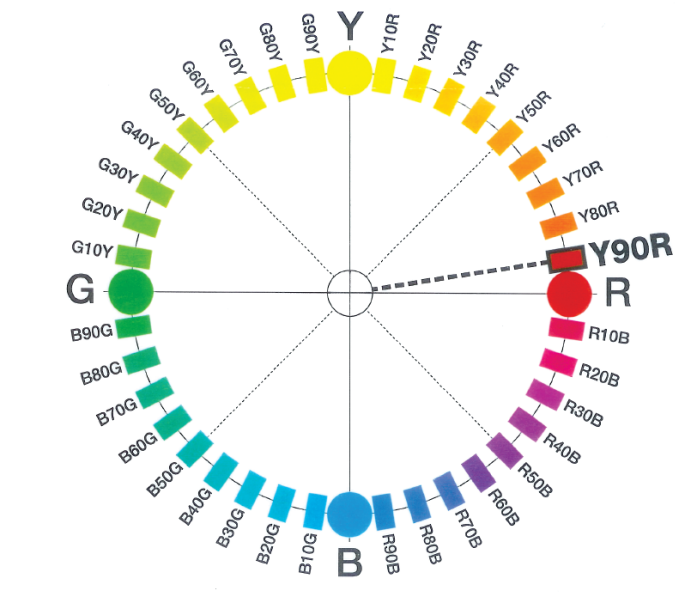
# How to combine colours?

In order to create well-being and security, the user should imperatively be in a harmonious “field”.

The colour scheme should be selected for its impact on space and on individuals, and should also be in symbiosis with both.

Following different needs, spatial needs or more personal needs of the passenger one would have recourse to different colour “combinations”:

In order to achieve this we refer to the concepts put together by the NCS (Natural Colour System <sup>(2)</sup>).



It is indispensable to refer to a choice of harmony and to conform to this, strictly, for the sake of homogeneity of the station.

**In order to create a soft harmony:**

We maintain a unique tone that declines in various nuances. Or we take the basic shade and with the help of chromatic circle, we choose the colours adjacent to right or left of the tone in the circle. We obtain thus a soft harmony instigating the effect of a dominating colour.

**In order to create a harmony in contrast:**

We take the complementary colour, contrary to the chromatic circle. We create thus a stimulating visual effect, a stronger vibration. The complementary colour is introduced in

small quantities or in weaker intensity thus reinforcing the dominating colour.

Two complementary colours should be present in equal quantity and same intensity, as the eye does not know where to rest and tires itself.

**In order to create a polychrome:**

We construct in harmony on the basis of three, four, six tones while basing oneself on the circle of colours and on the geometric forms: the triangle, square, hexagon.

Each of these colours can be reduced in different nuances.

## 4. Travelling in the metro

### 4.1. Important proposals for improvement.

While travelling in metro in Brussels, we observe and analyse the existing situations.



Outside:

What?

For this entry to metro, the colour scheme utilised pale yellow is not a signal, does not attract the eye.

Result from this:

All external entrance should be attractive.

Indispensable colour scheme, the pure bright red and yellow (and not softened with white), puts us in alert.

It will be detected by the eye first.

The surface will be changed following each specific case.

2.NCS Natural Colour System  
Head office in Belgium:  
Heysel esplanade de Heysel, PB/BP 55  
1020 Brussels  
Principal company: Stockolm-Suède



Photo 1



Photo 2

Photo 1:  
Spotted grey-beige floor, orange wall, dark green ceiling.

Photo 2:  
Spotted grey-beige floor, off white ceiling, orange wall.

See the difference between these two photos, only the ceiling is changed and the whole harmony finds itself changed due to this. Why?

In the case 1 and 2 the feeling of welcome is present.

In the photo 2, there is a soft harmony between the floor and ceiling creating homogeneity.

In the photo 1, the harmony is absent between the floor and the ceiling. There is a feeling of “disorder”, two tones are sufficient in this space.

The dark ceiling makes the whole surrounding heavy and gives a crushing feeling.

The off-white ceiling opens space.

The dark green does not invite us to enter the transfer zone.

## Conclusion

In the zone between natural and artificial light and any other transit zones, it is important to find and maintain a feeling of openness and space. On the one hand with a large luminous intensity and on the other hand by using the following colour schemes:

The colour schemes which have huge luminosity: white, yellow, orange and all colours of which the proportion of white is minimum 60% (light green, light blue etc.)

Knowing that the eye is attracted immediately towards the most luminous colour, the passenger will wish to move towards this light.

### Transit zone, corridor:

In the corridor zone clearly, the passenger should be invited to move quickly.

Several factors can intervene:

Create a soft harmony.

Use maximum two to three tones.

Transit zones, often low and narrow zones, require the use of a colour scheme from cold palette in very light shade that will allow the visual impression that the place has become bigger, avoiding the feeling of suffocation.

We will use the colour scheme of the cold palette from blue to green to be used in lighter shades, associated with a basic colour, white, sand, light grey.

We will also opt for a floor and a lighter ceiling with minimum 60% of white to avoid the feeling “of cave” and ensure a global harmony.

In terms of feelings that are generated, the option of cold and harmonious feeling, given by its tones will create coherence.

The transit in controlled zones will be globally treated as the corridor zone, except for a punctual sign visible at eye level.



The choice of a red shade is good but only a marking floor is not sufficient.

### Zone of waiting-platform

The colour scheme will adapt itself as per demand, considering each objective.

If the option retained for the station is a place full of life and animation, one can work with the colour schemes from the warm palette a pre-dominantly, strong harmony, complementary colours, or the polychromes but in a scrupulous manner.

It is important to produce coherence: all the colour schemes, of materials, floors, ceilings, structures, staircase, should be selected with a unique and similar aim.

If the option selected is of an art centre, gallery, we recommend the use of a soft harmony in backdrop in the neutral shades, leaving the whole place to the works themselves.

If the option is to refer to a city, a scrupulous analysis of the place is prepared, bringing out the visual, auditory, olfactory sense, not to create a copy but in direct accordance.

## 4.2. Signage System:

The signage system plays a dominating role in view of comforting the user.

A clear signage system limits incidents, stress; the person feels supported and due to this, more secure.

In order to favour the visualisation, colour has an important role.

There are different “types” of signal systems in the metro:

- Restriction and prohibitions:
- Warning, order.

Limitation at platform level, restriction limiting the controlled & paid zone.

-Indicate the way:

Notion of help, support.

Towards the underground entrances, towards different routes, towards the bus, train, tram, towards the rest rooms, towards, information counters, towards counters, towards different exits.

-inform:

Level and place where one finds himself, map, tourist information.

We have to make a choice of strategies in the selection of colours.

Ideally, each type of signage should correspond to one colour scheme, similar for the whole network, in order to create a climate where each one knows by way of repetition, the colour codes and can very quickly find the information that he/she needs.

Following the importance of the signage system, we make the choice to render it extremely visible, very visible, just visible etc.

The most visible colour schemes, red and yellow can be used, in lettering or as base.



A contradictory example:



The most vibrant solution and thus the most visible for the eye, in this example, is the yellow base with black writing but the term “metro-bus” leads to confusion.

Two elements were used: on the one hand the selection of yellow, and on the other hand the black lettering that creates a big contrast, thus reinforcing the dynamics.

This lettering can also be in dark blue, stimulating the vibration that creates the complementary colour scheme putting into presence one from the other.

The solution of a red square on white base, is visible seen the vibration from red, but can be reinforced by black, dark grey or dark green that will increase its impact by the contrast created.

#### As a general rule

The message delivered should be free from any ambiguity.  
The colour scheme employed in pure state, without addition of white and black (except the dark grey)  
Maximum contrast will be used between the lettering and the base.

#### How?

Either a shade in pure state on black base will be used and oppositely, or a shade in pure state and its complement; as an example red lettering on black, red lettering on dark green.

Moreover it is imperative, to check that these colours for signage should be distinct from the whole, otherwise their impact is lost.

## 5. Conclusion

Several elements intervene in the choice of a colour scheme.

The general procedure to follow will be the following.

Define for each zone:

### 1. The spatial need:

To open the space, expand or narrow it, to bring a surface closer or move it away

To make the space luminous or dark or punctuated with shadow and light

To create a soft harmony free from visual excitation or to create a harmony in contrast to produce larger dynamics  
Limit the importance of signage. At which level the signage system should be totally present or in comparison more discrete?

Mark the strategic places, specific zones where the user should be directed.

### 2. The more personal needs of passengers

Do we want him to move? To shift? Or on the contrary generate a calmer zone, relaxation?

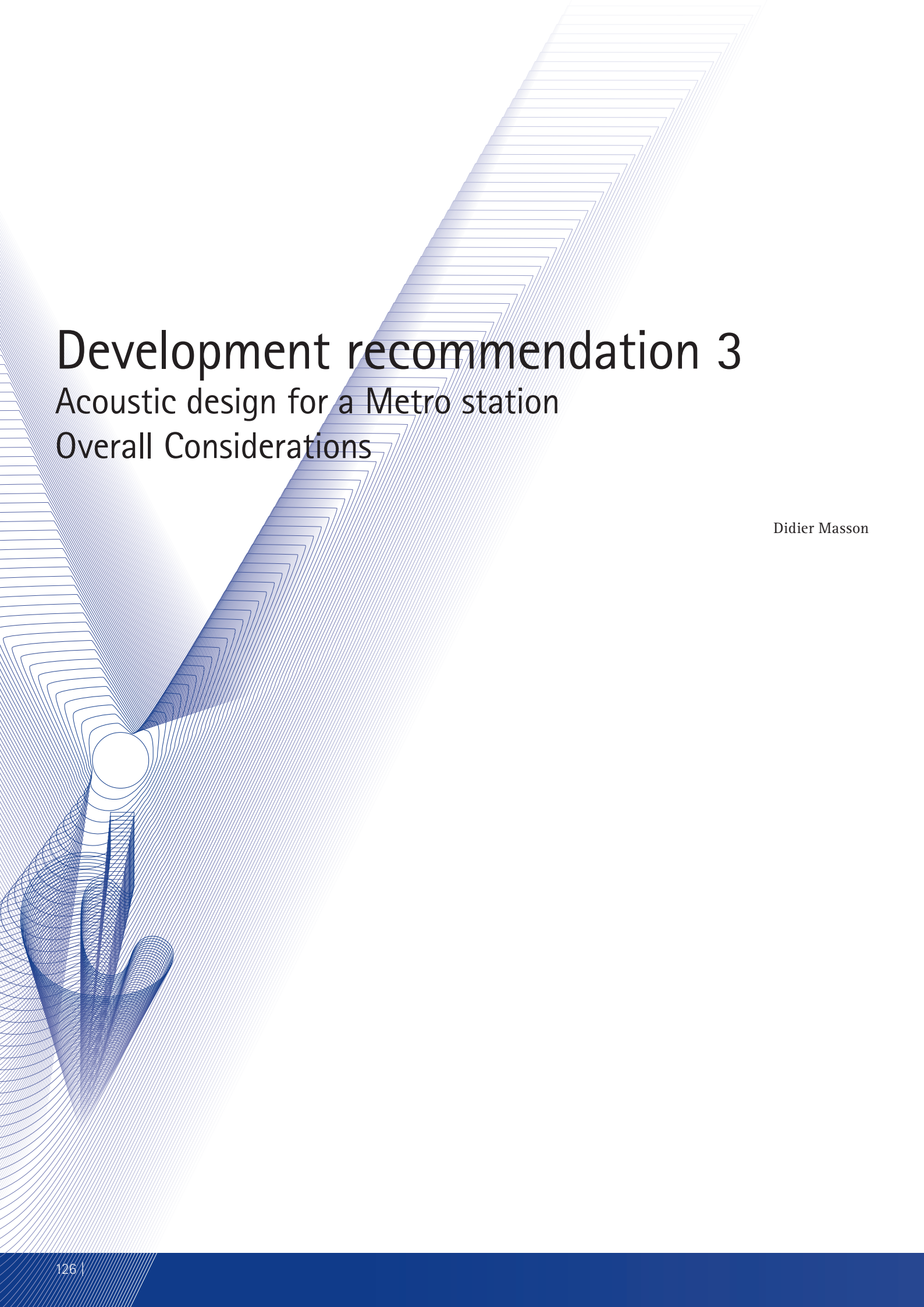
At which place, we encourage the exchange between the users or rather encourage the distance?

At which place should one, in particular, produce a context of order and strictness?

### 3. Reply in a substantial manner aiming for the objectives put forward.

Combine each colour judiciously with rules of harmony, giving thus coherence to the whole and producing a confident and aesthetic environment which “gives life” to us.





# Development recommendation 3

## Acoustic design for a Metro station

### Overall Considerations

Didier Masson

# Acoustic design for a Metro station

## Overall Considerations

### Acoustic Atmosphere

#### Ambient Noise

The ambient noise in a metro station can be split into two components (by a simple classification process):

Permanent background noise. This is the basic ambient noise due to ventilation, air flow, equipment operating continuously such as escalators, any background music, etc.

Sporadic noise due to specific events such as the operation of entrance gates (compressed air noises), announcements, a train arriving, doors opening, doors closing, doors closing, a train leaving, a train shifting rails or a bend, neighbouring conversations, etc.

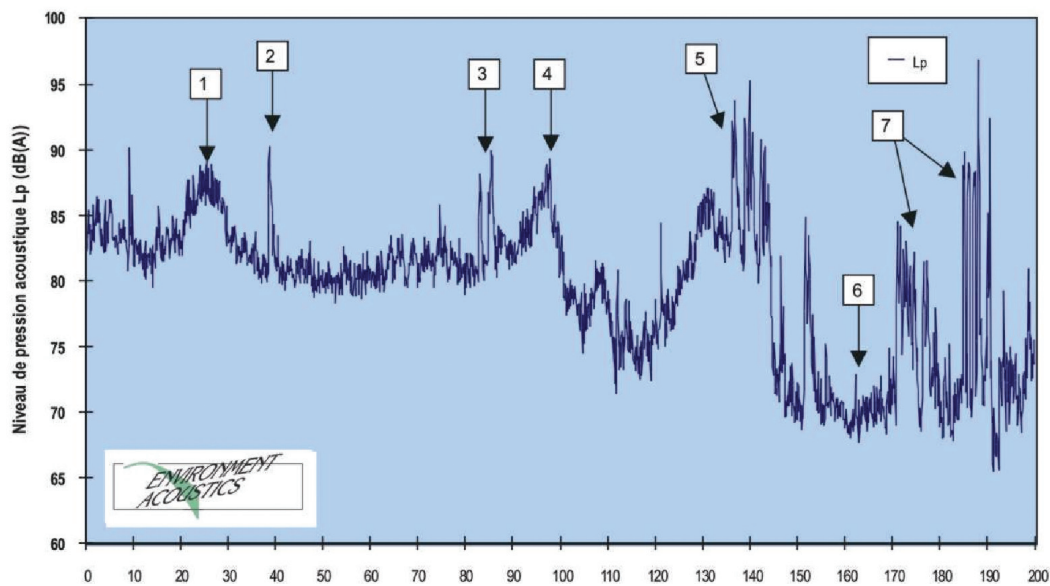
By way of illustration, the following noise levels (see column right hand side) have been observed in a number of Brussels metro stations (their values are indicative of an order of magnitude, since the readings are only representative of a situation at a given location at a given time).

Comment: it is interesting to note that the levels observed underground are paradoxically higher than those on surface. The reverse would be beneficial for the image of public transport and the stress generated by confined spaces underground.

| Location – Situation                                     | Noise level in dB(A) |
|--|----------------------|
| Simonis Station – outside                                | 66                   |
| Simonis Station – central hall / ticket office (outside) | 66                   |
| Simonis Station – underground corridor                   | 71                   |
| Simonis Station – train arriving                         | 90                   |
| Simonis Station – train waiting at platform              | 80 - 85              |
| Simonis Station – doors closing                          | 90                   |
| Simonis Station – train departing                        | 90 - 95              |
| Simonis Station – platform, normal activity              | 70 - 85              |
| Louise Station – exit to outside (underground)           | 65                   |
| Louise Station – central hall (underground)              | 70                   |
| Louise Station – escalators                              | 68                   |
| Louise Station – train arriving                          | 100                  |
| Louise Station – train waiting at platform               | 80 - 85              |
| Louise Station – doors closing                           | 90                   |
| Louise Station – train departing                         | 90                   |
| Louise Station – platform, light activity                | 63                   |
| Louise Station – platform, normal activity               | 70 - 75              |

The following graphs illustrate the acoustic signature of trains arriving and departing in the Simonis and Louise stations.

Station Simonis, Quai - Arrivée et départ de rames - Signature acoustique



level at time = 0: train 1 in station (compressor noise)

event 1: train 2 arrival

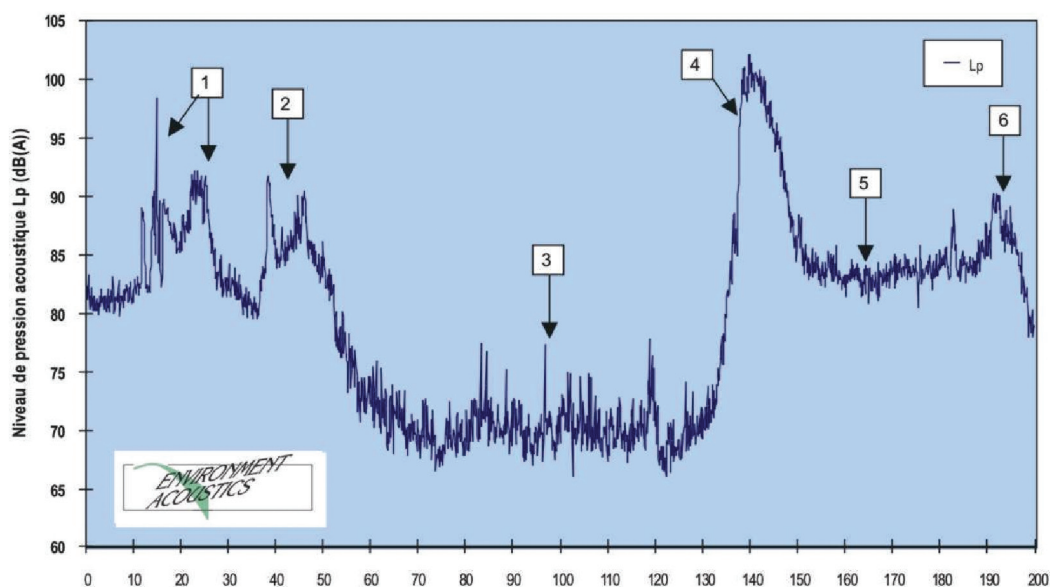
event 2: air discharge (air exhaust noise)

event 3: signal and doors closing

event 4: train 1 departure

event 5: train 2 departure

Station Louise, Quai - Arrivée et départ de rames - Signature acoustique



level at time = 0: train 1 in station (compressor noise)

event 1: signal and doors closing

event 2: train 1 departure

event 3: platform background noise

event 4: train 2 arrival

event 5: train 2 in station (compressor noise)

event 6: train 2 departure

# Noise Pollution – Impact on Health

Measured noise levels are high to very high. Peak readings exceed levels considered by health and safety at work legislation to be hazardous to hearing during prolonged exposure.

Besides the aspects associated with Audiology, the levels observed routinely are responsible for defensive physiological responses by the body. At 60 dB(A) and above, noise has an impact on the heart rate, blood pressure and production by certain glands. It is undeniable that this raises stress and fatigue levels. Quality of sleep is also adversely affected.

High noise levels, combined moreover with high levels of resonance which are typical of stations, affect one's sense of balance and orientation.

Noise pollution experienced in the course of using the metro cannot be simply weighed by the limited amount of time spent on the journey. In fact, studies show that exposure to a given noise is aggregated to other noise experienced through the day. It is the aggregate of these noises that determines the stresses and strains of our acoustic environment. Transport noises therefore play a direct and an indirect part in our quality of life, since their impact will extend beyond our presence in public spaces.

“Research has highlighted a synergy of exposure to occupational and road noise with the disturbance felt in dwellings. Where evening traffic noise exceeds 63 dB(A) Leq, the disturbance felt is greater for residents who have been exposed to high levels of occupational noise than for those not exposed to noise at work”. Bertoni, Franchini, 1990.

## Acoustic Treatment

### General

Three types of action can be taken and combined in order to reduce noise intensity (the quantitative aspect of the noise landscape):

Treatment at source: reducing the generation of noise through design incorporating acoustics (choice of equipment);

Treatment dealing with noise propagation: (absorption by walls, insulation of certain spaces);

Individual protection: ear defenders, ear plugs. This solution, used frequently in the industry, is more difficult to implement here for cultural reasons.

The second part of acoustic treatment applies to the content of the noise (the qualitative aspect of the noise landscape):

The use of iPods, MP3s and personal stereos may reveal a desire for social isolation, but it may also be an expression of a desire for isolation in terms of noise and for control of one's acoustic environment (intentional noise, even if it is more stressful physiologically speaking, will be more readily accepted than noise created by others and hence imposed).

The trend in noise over time and in terms of frequency also plays a part in perception of the acoustic landscape: a screech on the rails generating a sudden noise restricted to certain high frequencies will be more stressful than the arrival of a train, the noise of which is predictable, more gradual and is more balanced in terms of frequency.

The broadcasting of an intentional acoustic background (music, the sound of a water fall, birdsong or a transparent sound screen) enables the content of the acoustic landscape to be acted upon.

Improving the acoustic landscape derives from combined action on the two parts affecting the intensity and the content of the acoustic landscape.

### Equipment

Treatment at source encourages giving preference to the quietest equipment or designs. For instance, the choice of rolling stock will have an impact on the amplitude and quality of noise generated: a metro running on pneumatic tyres will have a different signature from that of a conventional metro on metal wheels.

Adopting less noisy equipment relies on conventional techniques used in industry (covers, soundproof encapsulation, etc.) or in building ventilation systems (silencers, acoustic ducting).



## Spaciousness

Spatial volume constitutes a major parameter in the acoustic rendering of the spaces. Given the same choice of materials, larger spaces will generally offer better acoustics.

## Reverberation

Underground areas of metros are almost always spaces which are particularly reverberant as a result of the hard materials selected. Corridors can thus propagate noise over considerable distances.

Amplification of the noise generated explains the particularly high noise levels noted in section 1.1.

It is recommended that these spaces be given absorbent treatment to limit resonance in the location and to cut down propagation and amplification of remote noise.

The robustness of the materials required by the intended purpose of the location rules out highly absorbent porous materials from the start, which would not withstand the mechanical stresses imposed by through traffic, much less by deliberate acts of vandalism.

Two options are therefore possible:

either to fit the absorbent materials to surfaces which are not accessible to people, such as ceilings or the upper sections of walls. Ease of maintenance (washing down required by deposits which are difficult or impossible to avoid) suggests giving preference to perforated metal elements with absorbent mineral wool mats placed behind them or to use strong and absorbent materials such as acoustic stone from Isover Saint-Gobain (Chromoroc) or from Sound Absorption Ltd (Coustone), see attached technical specification sheets.

## Isolation

Isolation consists of placing a screen between two spaces to be isolated. Restaurants and shops can thus enjoy a clean environment protected from ambient noise in the station.

Where ticket counters are fitted with protective glazing, this constitutes acoustic insulation for the staff. However, this approach makes communication more sensitive (and therefore affects the quality of customer service). It is advisable, as far as possible, to create a service area isolated from the rest of the station with open – and more user-friendly – counters inside (the configuration adopted in most SNCF stations today).

## Qualitative Treatment

Qualitative treatment will be all the more justified having implemented the quantitative treatment. The emergence of specific noises is actually reinforced once ambient levels have been reduced.

Acoustic packaging of spaces may involve adding audible signals and conveying information (music, birdsong) or conversely rely on neutral solutions (transparent sound screen).

A better overall sound environment also enables announcements or messages to be put out with enhanced intelligibility at less penetrating volumes.

## Application Example: Train Arrivals at Platform

Absorbent treatment of tunnel walls, over some ten metres from the end of the platforms, would enable the noise generated by trains running as perceived on the platforms to be cut down.

However, hearing a train arriving may be useful to passengers waiting or in the access corridors. Besides, braking and accelerating cause significantly higher noise levels than those of running in the tunnels. This being the case, treating the tunnels will reinforce the difference in noise between a train coming and its final approach.

Reducing noise during the braking or accelerating phase without taking any action at the equipment design stage is particularly hazardous since passengers waiting on platforms will be standing directly in the path of the noise emission. Any acoustic treatment of the platform will only bring about marginal improvement in this instance.

In order to reduce train noise towards the platforms significantly, it is advisable to set up a barrier against the sound waves. A transparent screen separating the platform from the track creates effective isolation from train noise. The concept boils down to extending to acoustics the idea of separation implemented on line 14 of the Paris metro, where a screen a few metres high is made up of platform-edge doors installed in this screen to align with the train doors.

This approach offers additional benefits besides: it enables the flows of passengers entering and leaving to be better channelled by indicating the positions of train doors on the platform; it increases safety by barring access to the track (trespassing in tunnels, accidents, suicide).



# Development recommendation 4

Metro....with an "O" like in mouth

Caroline Baeck

# Metro....with an "O" like in mouth.

## Access:

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When we enter, we do so from the top, dive in and are swallowed up. So the first contact is important for the confidence of our steps, of the air that we are going to breathe there, gladly or reluctantly.

When we enter we carry in the day's weather - damp, overly hot, too cold or deliciously spring-like. The first contact will have to reassure us (no I am not going to fall or slip) but also genuinely welcome people who are in a hurry without impeding them or dissuading the less stable.

When we enter, it is often by stairs. We descend into the metro. These stairs will be comfortable, very visible and well lit, if possible even at the level of the stairs themselves. Rain, snow or frost should not make them dangerous. Natural stone resists frequent transits well, and fades with the benevolence of natural materials that patinate without losing their intrinsic beauty under the assaults of crowds of frenetic humans. However, not all types of stone are suitable for this purpose. An overly porous chalky stone and the majority of marbles are too crumbly and fragile. Rubber inserts can prevent slips and brake the most unlucky shocks. Water can never be allowed to stagnate on these steps, so it will have to be evacuated through small holes or a small channel that collects the water to guide it to where it will not pose any danger.

The unstable looks for an ally. So there will be a handrail that can be gripped tightly, a handrail made for hands and why not a little sister just below for little hands? After all, it is not easy to go down adult stairs when you have children's legs. The material of the handrail will have to be pleasant, as this is the first tactile contact with the metro. A metal handle is hygienic but will accumulate all of the extreme temperatures - burning in summer and freezing in winter.

No, it is better to have wood, a living material which is more like a friend that really helps you to descend.

Then, the space welcoming your glance emerges. As in any location which you enter, you like to be well received even if you are just passing through. It is better for the space to be attractive, for the materials to be genuine and massive. Whether wood, stone or ceramics are used, they all have a language, a realization that can create a transitional environment between the street and the underground world fluidly, without a brutal break. Any formal brutality of language invites a brutality of gesture, a degrading reaction. Similarly, composite or overly fragile materials such as laminated panels, plexiglass, windows and complex assemblies represent so many invitations to prompt their faster deterioration because obviously they do not radiate the same benevolence as stone, wood or ceramics.

We need to have the fewest possible corners and points, which represent so many dangers that press ahead in this underground world. Why do the round linking passages in Paris metros not get so damaged? Because they are round? What is rounded does not create a wish to break it, as roundness is likeable, and resembles what we are.

## Underground

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Once the descent is completed, the traveller is frequently faced with the linking passages or an underground square where as well as having to become familiar with a different light, he has to find directions. Quite often a person's glance will only look for features that help him to find his way, without lingering on the space's appearance. Public transport often produces stress, either because it involves an occasional traveller who is unfamiliar with the place or the overcrowding creates tension, a feeling of unsafety or again urban stress which makes the constantly hurrying citizen aggressive and unheeding of others. Given

this psychological context, it is important to continue a welcoming, likeable and reassuring infrastructure inside the location. For obvious maintenance reasons, the materials will be sustainable and resistant to dirty marks. Whether they are tiles, natural stones or smooth screeds, they will always be pleasant to stroke mentally. Once again, insofar as possible, rounded features will be preferred to corners: dirt prefers corners and what is dirty is not respected.

For the floors, we will have to think of rolling luggage, high heels and leather soles....but also of the cleaner who will not like unsticking chewing gum from between different grooves and lozenges. The only reliefs on the floor should be reserved for the visually impaired who also have to cope in this world with different landmarks. These reliefs will succeed by being planned in a lively colour to orient those who still capture certain images and to help the sighted to assist the blind.

Poured materials are often preferable to laid materials because once again joints are synonymous with dirt and ageing. They are calmer visually and visual calm must be supported by materials.

Visual calm will also be pursued in terms of the vertical cladding. Only the structural information (emergency exits, useful equipment, toilets) and functional information (ticket office, signposting of tracks and directions, exits) should be highlighted at places where travellers have to make a choice or find a service. Excessive visual stimulation is disorienting, and it increases stress plus all the negative sensations that this produces. The partitions of the areas of choice and service will simply be calm and cheerful. Materials will be chosen depending on the incorporation of equipment (miscellaneous distributors, lighted indicators, etc.). Anticipating the renewal of this equipment would lead to very expensive choices in terms of implementation (versatility and modularity are often very expensive for durable cladding) but areas holding such equipment will be fitted with cladding that will be renewed without eating into budgets. They will have decorative tiles rather than rare natural stones in large formats. Every treatment of the location that helps the traveller to become oriented will be welcome. Whether this is a link with the world 'above' or a decorative story specific to the metro itself, the important factor is to offer visual landmarks, because there are no church spires or petrol stations to act as a guide in the metro. Without landmarks, this world has few distinguishing features. Just the names of the stations are inadequate. It is necessary to be able to recognise a colour, a drawing or a decor. The use of materials participates in this recognition of the location. The choice of type of landmark will frequently determine the choice of its carrier.

Ceilings are the kingdom of technical features. A simple,

solid protective trellis to prevent any unfortunate exploration should be sufficient. Technical interventions and dirt due to the frequency of transits and air movements make all false ceilings fragile and perishable.

## Corridors:

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The passageways to the platforms, the underground linking passages, the corridors, horizontal or vertical routes gain by being involved in the orientation, by being an integral part of the landmark. As in a corridor doors can be assigned a language which, without using written signposting, evokes the nature of the space hidden behind with sufficient obviousness and even in a metro station can tell a traveller that he is in a specific station without the person necessarily having to read it. This will reassure him, and intuitive recognition of the location will occur more easily. Here again, the materials will follow the concept. Stones, tiles, enveloping and decorative coatings are more at ease here than panels of particles covered by glued decors and other lighted windows. Manoeuvring underground means travelling in an organic, troglodyte world. You do not have your feet on the ground, you are actually in the ground, you are surrounded and protected by it. Far from emphasising claustrophobia, this alliance between the human and the earth benefits by being reflected in the treatment of the site. The earth hosts us in itself, let us know how to respect it and adopt its shapes which are also ours.

## Platforms:

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The platforms are an end, the only place where we really stop, where we have a break. We walk, but for the first time since taking the access stairs, we think of sitting down. In any case, we stop for the first time. We often observe others as if we were just aware of their presence. The use of materials will not be fundamentally different from the previous zones but the different space-time opens up other options: art, advertising, animated information... The visual information benefits from the greater availability of our glance, of our mind and can seek our attention more. This should not lead us to forget that platforms are also synonymous with danger and that an accident is always possible. Everything will therefore be done to avoid it: reliefs on the floor for the visually impaired, contrasts of didactic colours for the very young, there will neither be steps or obstacles near the edge of the platform. Once these safety considerations are finished, we will deal with the look, the way the space is perceived. It is a place where the person stops, and therefore also a place where he can get bored, and want



action or a pastime. It is therefore essential for the space not to offer cladding or equipment that too obviously prompts vandalism. It is therefore also essential for the location to be attractive. It is less easy to attack a nice environment. The vertical materials here will very certainly be smooth and not porous. The soot from the tracks and sizeable draughts cause significant dirt that has to be easily removed. The advertising media and other supports will also be designed for easy cleaning.

#### **And metro stations that are open-air?**

An increasing number of metro stations are located on the surface. The snake leaves the earth and encounters other elements such as wind, sunshine and natural light. Some meetings are welcome and others much less so. The metro lives day and night. Beneficial daylight converts into worrying shadows at night. Large glazed units will face onto animated, lighted areas. Recognition and orientation are also more stimulated as soon as the user leaves the underground context. Underground we agree to be carried without any recognition other than metro stations. On the surface, we have other landmarks and other reflexes. The link with the exterior will therefore also be important, not only in the stations but also between these. Transparency plays a role in the decor, which extends towards the now-visible outside world.

This makes it possible to make the materials more sober and less decorative because the outside world is participating here in full. However, the care to be provided remains the same: everyone must feel well, hidden from draughts and excessive heat, in a well lit location that is part of an environment.

To sum up, the metro is a stress-generating area of transit. It will be designed with a constant concern to reassure through the clarity of the signposting, and creating a decorative language that supports orientation and a concern for aesthetics.

The use of materials will follow the natural route:

The exterior is the world of the air and sky - The access to the metro is the entry underground, we cross the plant border and will find a lot of wood, a friendly material, that is outstandingly warm - The internal junctions will be primarily clear and visually very quiet in terms of surfaces to allow fast orientation. From here on, the materials will be rather likeable and related to the earth, i.e. poured, with smooth coats and baked earths - The corridors are the roads in the earth, paths in the clay, they are round and reassure us about our destination because they are recognisable through their decorative handling - The platforms are the culmination, the treasure chamber and will mainly be attractive but always smooth....to stay beautiful.

So... :

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The background features a series of thin, parallel blue lines that create a sense of depth and movement, resembling a stylized 'V' or a wing. In the lower-left corner, there is a blue wireframe shape that looks like a hand or a finger reaching upwards.

# Development recommendation 5

## Light in the metro

Barbara Hediger

# Light in the metro

## Anecdote.

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Esquirol, an 18th-century French psychiatrist, advised his patients afflicted with depression in winter to go live in the sun until the good weather returns. Since that time, lamps used in light therapy have brought us this luminosity which is so sorely lacking during the dark days of winter.

It seems that the phenomenon of light therapy is given very little thought or at least under-utilised in studies of lighting for daily life in places of work and traffic.

## Light.

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**Definition:** n. Radiation given off by bodies brought to a high temperature (incandescent) or by the excitation of an atomic system (luminescence) and which is perceived by the eyes.

**My definition:** An element that is imperceptible, impalpable, invisible yet essential for life.

We must distinguish several important phenomena for which light constitutes a primordial element in the architectural design of a metro:

Light may be seen from the following perspectives:

- \* Functional
- \* Artistic
- \* Theatrical
- \* Event-based
- \* Security
- \* Economic

These days we find ourselves caught up in a very simple spiral involving the architectural plan, the specifications, the costs of the sub-contractors and the cost of equipment. This phenomenon does not take into account the attention that ought to be paid to lighting, and the influence that light can have on human behaviour.

We make sure we provide a certain lux level, a uniformity everywhere that leads to overconsumption, a uniform light that is reduced to its simplest role of “light up in order to see and provide security”.

Lighting in the metros should (must absolutely) be able to follow a simple and perfectly legitimate rule, that is, to guide passengers through the labyrinth of corridors in our metros, and to improve the passenger’s morale.

## Making the metro underground warm and peaceful.

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To achieve this result, light is not sufficient to make metros pleasant and safe; the concept of artificial light must be supplemented by several other elements such as:

- the spatial dimension: height-width-depth
- making spaces more airy with openings that allow an interplay of natural and artificial light
- the cleanliness of the spaces
- the beauty of the stations, produced by a harmony between light and the architectural elements as well as by the high quality of materials used.

Light will be the sole element linking and playing with all the architectural features; this life-giving finishing touch will be decisive as the finishing touch to the quality of life in our metros.

The lighting in metros should be capable of fulfilling 3 functions:

- 1- Functional and providing security (\*)
- 2- Artistic (\*\*)
- 3- Spatial (\*\*\*)

### (\*) Functional and providing security.

Economical lighting system that is indispensable given the grandeur of the architectural creations. We could easily make an in-depth study of this lighting by linking light therapy with the functional.

Important influence on human behaviour, bringing in daylight without UV rays.

### (\*\*) Artistic

Decorative lighting system with coloured light for all neutral walls, or “neutral” light for coloured walls.

Tell a story through the corridors by means of the colours. Bring works of art to life in the corridors, allowing commuters to arrange meetings there, to stop and create a world, spaces for themselves.

### (\*\*\*) Spatial

Several methods are used in this area:

- Reflection from the horizontal lines of the ceilings.

Indirect light from below going upwards.

Amplifies the heights.

We can breathe in the spaciousness.

- Reflection from the horizontal lines of the floors.

Directly streaming light.

Blinding light for the purpose of security, illuminating obstacles (e.g. stairs, platforms, etc.)

The ends of the corridors are outlined.

Spaces are collapsed.

- Reflection from the heights of the walls.

Indirect light from the floor towards the walls.

Indirect light from the ceiling towards the walls.

Light becomes a material substance on the walls.

Gives depth to the corridors.

The direction of the rays influences the reading and interpretation of space.

This phenomenon is very difficult to manage, and requires the introduction of concepts of lighting very early in the architectural study.

Light and the architecture must absolutely be linked at the stage of the initial study.

In many cases in public spaces, the lighting apparatus is like an iceberg. That is, 80% of it is embedded under the surface in the floor, a wall, a ceiling, and is therefore almost invisible. But it is primarily this part that requires an increase in energy of an idea, efficiency, humility.

“Light must absolutely remain at the service of the architecture and of human beings.”

We are at the dawn of new technologies, and the major projects being undertaken will have to take account of energy efficiency and the protection of our environment. An excess of inappropriate light will not necessarily provide a solution to the issue of security in metros.

The engineer and the lighting designer will have to work in concert to conceptualise the lighting from the very beginning, and not at the end of the process as is often the case today.

Let us count on the wisdom of the various parties involved (conceptual designers, engineers, creators, project authors, investors, manufacturers) to make their choices based on the criteria of quality.



The background features a complex, abstract design. A series of thin, parallel blue lines radiate from the top left, creating a sense of depth and movement. In the lower-left corner, there is a stylized, wireframe-like shape that resembles a hand or a cluster of fingers, rendered in a darker blue. The overall aesthetic is modern and technical.

# Development recommendation 6

## Behaviour of people in crowds

Jacques de Kegel  
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# Behaviour of people in crowds

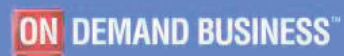
- Avoid by all means (design, ... ) to have people behaving like crowds
- In case this behaviour cannot be avoided (fire, earthquake, tsunami, explosion, ... ), adapt architecture in such a way that people and infrastructure have minimal damage of (temporarily) crowded behaviour.
- Experiments have shown that one solution is to build a partial barrier in front of the exit. It could absorb pressure from the crowd that can become strong enough to crush a person, break a brick wall or bend steel.
- Have evacuation routes very well indicated and use signage that has some independence from power supply (in case of power failure, ... )
- Plan from time to time controlled evacuation exercises. People don't like losing time, but on the other hand realize this can save lives and thus is worth spending the time. Nowadays, people also participate in evacuation exercises in offices and are familiar with the procedure.
- Avoid panic situations by identifying terrorists or hooligans and isolate them before they can execute malicious acts. One way is to train Metro operators to identify abnormal behavior, like Darting eyes, hand tremor, nonverbal behavior, thin lips (angry), increasing blink rate (nervous), eye widening (excitement – fear), carotid artery jumping out of neck, ...
- Once isolated and interrogated, use rapid-fire questioning techniques to identify inconsistent stories (e.g. a low-paid service worker, who paid cash for a business-class ticket)
- Train Metro operators to identify Micro-expressions ( < 0.2 seconds), like a momentary downward twist of one end of the mouth, demonstrating contempt, or a quickly suppressed smile
- Complementary to these measures, install Intelligent Video Monitoring Systems, who are capable of identifying lost objects, doing face recognition, doing behaviour analysis, people counting, etc ...
- Actual systems are capable of doing Facial Expressions Analysis and identify feelings, like Happiness, Sadness, Disgust, - Anger, Surprise or Fear
- Have a system where, at any moment, Metro operators – who are allowed to do so – can get access to particular camera images at any moment (e.g. via mobile device and WLAN, via IP telephony devices with image display, ... )



## Behaviour of people in crowds

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## Behaviour of people in crowds

### Origin

1. **Disaster**
  - Fire
  - Earthquake
  - Flood
  - Tsunami
  - Explosion
  - ...
2. **Human behaviour**
  - Rush for seats
  - Discount shopping
  - Pushing (concerts, ....)
  - ...
3. **Without (real) cause**
  - Panic, due to fight (US Night Club, ...)
  - ...

## Behaviour of people in crowds

### Some well known examples:

- Crest Hotel – Antwerp
- Volendam
- Rock Festival - Copenhagen
- Hadj - Mecca
- Heizel drama – Brussels
- 9/11
- ...

*Most modern buildings are designed on the assumption that crowds flow through the exits like fluid through a pipe. This traditional approach assumes that the crowd is made up of identical, unthinking elements. A fluid particle cannot experience fear of pain, cannot have a preferred motion, cannot make decisions and cannot stumble and fall. The new computer models are especially useful because they consider individual actions within the group.*

*David J. Low, civil engineer at Heriot-Watt University, Scotland*

## Behaviour of people in crowds

### How to avoid or reduce impact?

#### 1. Reduce impact

- **Proper planning & design of venue layout**
  - Night Club
  - Football stadion
  - Ballroom
  - Train station
  - ...
- **In case of mass panic**
- **To speed up an orderly evacuation**
  - "One solution is to build a partial barrier in front of the exit, the researchers said. It could absorb pressure from the crowd that can become strong enough to crush a person, break a brick wall or bend steel" – according to Dirk Helbing.

#### 2. Prevent Panic

- **Anticipate terrorism**
  - Observation of behaviour, body language, face expression, ...



## Behaviour of people in crowds

### How to reduce impact?

- Concrete (physical) forces
- Abstract (psychological) forces
- It all comes down to:
  - Distance (from others)
  - Size
  - Velocity
    - At normal evacuation, there is a given speed of evacuation
    - But once there is panic:
      - Individuals increase their speed
      - But, overall evacuation speed decreases, due to
        - Bumping
        - Friction
        - Violation of individuals space
        - ...

## Behaviour of people in crowds

### How to avoid?

#### By quickly identify suspected persons (by human beings)

- Through Behaviour analysis
  - Darting eyes
  - Hand tremor
  - Nonverbal behaviour
  - Thin lips (angry)
  - Increasing blink rate (nervous)
  - Eye widening (excitement – fear)
  - Carotid artery 'jumping out of neck
  - ...
- In such cases: rapid-fire questioning to identify inconsistent stories
  - A low-paid service worker, who paid cash for a business-class ticket
- Micro-expressions ( < 0.2 seconds)
  - Momentary downward twist of one end of the mouth demonstrating contempt
  - Quickly suppressed smile

*The brains of all people are similarly wired to the muscles under the skin of the face. Our lips get thinner when we're angry. Our blink rate increases when we're nervous. Our eyes widen with excitement or fear. Our nostrils flare when we're aroused and blood flow increases, reddening our skin when we're preparing for a fight, whether it's of a physical or mental nature. It's hard to suppress these expressions.*

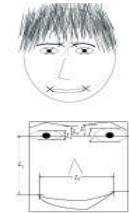
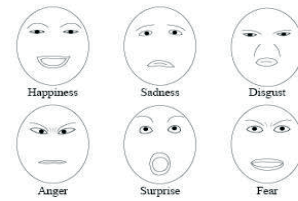
*Dr. Paul Ekman, Psychologist at University of California at San Francisco  
1978, Published the Facial Action Coding System (FACS)*

## Behaviour of people in crowds

### How to avoid?

#### By quickly identify suspected persons (by computers)

- Through Face Capture and Facial Expressions Analysis
  - Happiness
  - Sadness
  - Disgust
  - Anger
  - Surprise
  - Fear
- Based on positioning of the 6 Facial point Features
- And the Distance Features in the Neutral Face Detection System.
- Where a normalized face is divided into 3 x 3 rectangular zones of  $a \times a$  pixels each, whereby  $a=d/2$ .



## Behaviour of people in crowds

### How to avoid?

#### By quickly identify suspected persons (by computers)

- It's all about making distinction between Neutral and Non-neutral Faces
- Test results at IBM Thomas J. Watson Research Center are very promising
- Test 1: Cohn-Kanade database (faces of University students – psychology)

Table 1: Neutral and non-neutral face classification results on Cohn-Kanade data set  $A_2$ .

|                     | Total | Correct | Wrong |
|---------------------|-------|---------|-------|
| Non-neutral         | 332   | 325     | 7     |
| Neutral             | 204   | 196     | 8     |
| Total               | 536   | 521     | 15    |
| Classification rate | 97.2% |         |       |

- Test 2: Yale Face database

Table 2: Face classification results on database  $B$ .

|                     | Total | Correct | Wrong |
|---------------------|-------|---------|-------|
| Non-neutral         | 39    | 38      | 1     |
| Neutral             | 25    | 23      | 2     |
| Total               | 64    | 61      | 3     |
| Classification rate | 95.3% |         |       |

## Behaviour of people in crowds

### Applications of Smart Surveillance Systems

1. **Real Time Alerts**
  1. **User Defined Alerts**
    1. Generic Alerts
    2. Class Specific Alerts
    3. Behavioral Alerts
    4. High Value Video Capture
  2. **Automatic Unusual Activity Alerts**
2. **Automatic Forensic Video Retrieval (AFVR)**
  1. **Spatio-Temporal Video Retrieval**
  2. **Surveillance Video Mining**
3. **Situation Awareness**

## Behaviour of people in crowds

### Architectures of Smart Surveillance Systems

1. **Basic Smart Surveillance Architecture (BSSA)**
2. **Active Smart Surveillance Architecture (ASSA)**
3. **Distributed Smart Surveillance Architecture (DSSA)**

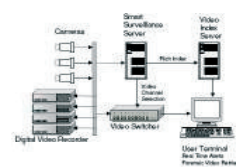


Figure 1: Block diagram of a smart surveillance system.

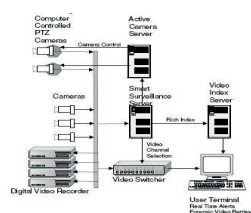


Figure 2: Block diagram of an Active Smart Surveillance System.

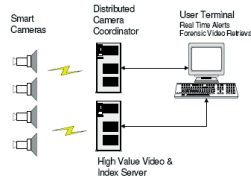


Figure 3: Block diagram of a distributed smart surveillance architecture using smart cameras.



Sensor and Actuator Solutions



# Thank you !

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