

Towards A Better Relation Between The Institution And The City

The first report

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Delft is a city where the existence of its university cannot be ignored. Their relationship becomes more complicated and intertwined after different periods in the history. When the university is reintroduced into the city centre, it cannot show up as the original form.

Different groups of people in the city have different expectation of the project. It is important to explore its future images that satisfy all these demands from different users, and in turn benefit a sustainable development of the city and the university in terms of economic, education, sociology and urbanism.

After an analysis of the existing problem for these two actors from the perspective of history, this essay aims at exploring the possible future images and scenarios for the project, with a focus on its different user groups. A comparative study on the city of Bilbao and Barcelona would be discussed as reference for the case of Delft.

Previous Struggles

From Industrial City to Knowledge City

Delft, locating in the South Holland, was known world-widely for its trading and industrial activities. Delft pottery, also known as Delft Blue, is the outcome of the international trade with Chinese and local industrial experiments. It also plays an important role in the Dutch culture, not only because of its bond with the House of Orange, but also due to the influence of its local painter Johannes Vermeer.

The establishment of Delft University of Technology, former Royal Academy for military and civil engineers dating back to 1842, offers the city enormous economic, educational and cultural opportunities to develop. The development of the university turns Delft city into a city of knowledge, where knowledge becomes capital for its future regeneration.

The Bond Between the City and the University

The relationship between university and its host city has been widely discussed by different researchers. It has been argued that the university played an important role in the cultural, economic and spatial aspects¹. In the case of Delft, the university supports the city by offering scientific studies and well

¹ Bender, 1988.

trained experts². This bond was shortly interrupted by the de-industrialization movement in the period of 1960 to 1976, after which great importance has been re-attached to their relationship. The government launched several projects that attempts to use the university to create the future image of the city, such as “Delft City of Knowledge Strategy” and “Delft Kennisstad: City of Technology”. However, as the geographical distance between these two becomes bigger than the past, their relation turns weaker for mainly focusing on the level of official level — exaggerating the effect of “top-down” policy. The collaboration in the social level, in other words incorporating the “excluded groups and individuals in various spheres of society”³, would create a better community. If we fully understand their relation, we would expect a better integration of the university and the city in the future, where to some extent all the people could be regarded as the student of the university, and the citizen of the city at the same time.

When we look at the map of the city of Delft, it is hard to ignore the spatial influence of university to the city and not to imagine its social impact. Students of the university play an important role in the city. There are 20,980 students enrolled in the university in the year 2015 while the population of the whole Delft area is around 101,044.⁴ Students share the same scenery of the canals of Delft with the locals and numerous tourists from all around the world and in some way they are competing for the limited spatial resource. It is unwise to exclude one group in the project. Therefore a democratic architectural that offers accessibility to everyone and balances their interaction would be highly recommended.

Future Images

So far we have discussed the changes in the relationship between the city of Delft and Delft University of Technology, and the problems they brought. When we try to construct the future images of a more appealing Delft, it is wise to borrow the wisdom or lesson from some president cities.

² Van Geenhuizen, Nijkamp, 2012.

³ Moulaert, Martinelli, Swyngedouw and González, 2005.

⁴ www.tudelft.nl; www.delft.nl.

Bilbao and Barcelona might be two of the cities that we are looking for. Bilbao used to be known as a “seemingly provincial industrial city in Spain”⁵, but now is presenting itself as a “cultural vibrant and attractive place”⁶. While Barcelona, similar to Delft in the sense that there is a significant image of a leading artist, and a leading university in each city, are famous for its urban regeneration in different time periods, i.e. the 1992 Olympics period witnessed its clever transformation with cultural policy, tourism and urban renewal⁷.

A lot of academic studies about the urban regeneration of these two cities provide us different perspectives of solving the problem, and making the project successful economically, socially and spatially. Further elaboration concerning the future image of the project in the city of Delft, would be followed.

The Tourist Attraction

Tourism could serve as a significant catalyst in the urban regeneration. In both precedents, tourism brings in a great number of economic opportunities and cultural revival. It is convincing that being a tourist attraction would bring in numerous economic benefits for the city. But how to make the project into a tourist attraction, remains a problem to be clarified. Even though we don't have a clear answer, the study on these two cities would be inspiring for the case of Delft.

Despite the similarities, a constant comment from the scholars and professionals shows that the scenarios of the two cities cannot be exactly duplicated in other contexts. However, several scholars have argued the rise of the so called neoliberal urbanism, which cannot be understood as an immutable and top-down phenomenon, but rather as an “assemblage” of different ideas. It gives opportunities to different groups of people in the city, such as local politicians, private investors, international organisation and etc. González (2011) argued the main idea is to evoke these different groups to participate into the process, allowing flexible and mobile collaboration and interaction. The success of these two cities, are closely related to the careful consideration on their political and institutional contexts. The specificities of the localities are given highly concerns.

⁵ González, 2011.

⁶ Lord, 2007: 32.

⁷ Marshall, 2004.

Therefore I think in the case of Delft, the involvement of different users would be crucial for its tourist attractiveness. The convergence of the user groups should be well designed to maintain the specificities of Delft, making the project one of the collection in the list of Delft's must-go.

Besides, the “Bilbao Effect” and the “Barcelona Model” not only introduce notable economic boost into the city, making them into “places for consumption”⁸, but also bring in a phenomenon “urban policy tourism”⁹ which means short trips of policy makers with a clear purpose to learn from the regeneration of Bilbao and Barcelona in the past 15 years. Almost 5000 professionals visit these two city as the policy tourist flow, according to González’s research. Such trips with a strong academic purpose bring an inspiring educational atmosphere to the city, and moreover stimulate the local economy in a good way.

The introducing of the university back into the city centre could also learn from the “urban policy tourism”. Since the project is highly related to TU Delft, which has a great reputation for its academic achievement, the factor of science and knowledge could also attribute to its tourist attractiveness. If the archive provides an intellectual centre for gathering the scholars to learn from each other, and offering the public to learn from the professionals, in other words, to make a knowledge exchange, it would not only keep the dynamic within the archive, but also be beneficial for the city’s economy — and thus fulfils the image of “a city of knowledge” designed by its city council.

The Social Interaction Dynamic

There are many ways to describe the expected image of an architectural project. Economic factor, as has already been discussed, is not the only one. In order to make the future image more stable and positive, as also a way to make the tourism effect more sustainable, other dimensions, such as the social dimension, are welcome to take a part.

The social dimension plays an important role in the urban regeneration, because it (re)defines the relationships of different groups of people in the city. As a cultural project, it is unwise to ignore effect of the social dimension¹⁰. Being a community centre for the collision of all various and dynamic social

⁸ Urry, 1995

⁹ González, 2011.

¹⁰ Zarlenga, Matías I., Joaquim Rius Ulldemolins, and Arturo Rodríguez Morató, 2013.

interaction, could benefit a sustainable development and enhance its cultural value for the project in its urban context.

Some scholars in such field have investigated different clusters in Barcelona and their different social interaction dynamics¹¹. The standard for dividing the clusters is due to its core user, in other words the main factor contributing its establishment: (1) the official policy that enables a new sanctuary for a kind of cultural value that usually is of great significant to an area or a whole nation; (2) the economic demand that arouses new urban configurations where the focus is a cultural theme (or multiple related themes) with certain generally accepted values; and (3) the informal organisation whose members gather on one common ground with one shared interest that is of a certain cultural value. While the former two are mostly relied on the “top-down” strategy, the third one is more of “bottom-up” strategy, which develop a spontaneous sense of community among its users. The comparison of these three types shows, the project developed by the drive of community is positively productive space on a cultural level, because it forms its local subculture and thus a sense of community and materialises it into rich and distinctive expressions.

Such findings are helpful for realising the social image of the project in Delft. We can divided the people in the building into the visitor and the maintainer from the perspective of a single building. However, in the urban context, the categories are different: residents, students and tourists. These two kinds of division are contradicted, when an urban character could play both roles in the building. But the overlapping brings unexpected social interaction dynamic into the building and therefore generate creative community-type dynamics and accordingly unique architectural space. Besides, if different user groups can all to some extent regard themselves as the maintainer, it would increase their social responsibility for the coming community. Therefore, analysing the existing behaviours of different users, and offering space and program for them to interact within the building would be of great help.

A possible scenario for the project could be (but not defined as): While the collection necessitates space of a certain type for the students involving in the programme, the students are served as archivists for the archive. Their projects would be part of its collection that never stops collecting. This would be the stable part of the archive. However, such activities of students may lose their attraction to the residents or the tourists if they are too internal. Therefore

¹¹ Zarlenga, Matías I., Joaquim Rius Ulldemolins, and Arturo Rodríguez Morató, 2013.

different public science workshops would be one of the bridges connecting the scholars and the public. Besides, the archive would be more attractive if the activities that interest the residents and the tourists, such as the popular Antiques, Bric-à-brac and Book Market¹², are introduced into the site on some occasion, making it into a democratic public building and constructing a stable community.

¹² www.delft.nl

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The Analysis Of The Location And Its Users

The second report

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This report aims at discussing about the context of the site: the location and the user. In the first part of each sector, the current situation would be analysed. The influence to the site and the possible solution would be discussed as followed.

Urban Fabric

The Canals

The city started its history from the development of its oldest canal: Oude Delft, which runs from north to south through the city centre. The city's enthusiasm in the canals makes it sprawl along the canal. The linearity encourages a linear pattern, from north to south, through out the city centre. The buildings contribute to a continuous urban facade on the canal side, strengthening its linear character.

The continuity is important to the city of Delft. It contributes to an identity of the city of Delft: the canals. The width and length of the canals, the pavements on the street, the distance between the water and the building, the view that a pedestrian sees when he walks along the canals... These defines the urban character of Delft. It is not hard to imagine that, even one obvious opening on the canal side would damage the purity and intensity of the role that canals play in the city. Sometimes when two adjacent buildings are not connected, a narrow passage with a door on an exterior wall would be added to fill the gap and keep the continuity. This passage is not only meant to benefit the transportation between inside and outside for serving the owners programmatically, but only a loyal response to the urban fabric. The wall is about 3 metres high, enough to keep the unbroken view for the pedestrians along the canal. Many paintings depicting the life of Delft, including *Het Straatje* by Johannes Vermeer, reflect this continuity honestly (fig. 1).

The facade of the building on the canal side becomes important because of its urban meaning. As the separation between the public and private world, it is symbolised and even extracted from the building itself. The facades are not always truthful to its interior: they appeared to be more monumental and decorative, in order to create an impressive view of urban interior. Reading the facade of the building is not only a research in its architecture, but also a reflection on the city of Delft.

This effort was kept as a tradition for a long time, even in spite of the development of the technology and economy. The building, Museum Lambert van Meerten on the Oude Delft is an ideal example. Even though at that time the technology had enabled the designers to use stones instead of bricks as the main material of its facade, it still followed the urban principles: continuous and monumental. It connects its southern neighbour with a small passage connecting the street and its back garden. Its stone-made facade represents monumentality through its layout and proportion. (fig. 2)

The Courtyards

Delft is a city of courtyards (fig. 3). In fact its city centre is defined by broad roads and a wide canal on the east and south side, turning itself into a vast ‘courtyard’ in a bigger context. The courtyard, most of the time, is related to an interior space, which indicates isolation and privacy. Reading its courtyard means reading its intimacy rather than publicity.

This intimacy can be easily understood in most cases. The buildings sprawl along the canal, developing with a linear pattern and a thickness. Through the linearity the buildings construct a continuous exterior, which is mentioned before. While within the thickness, the buildings create an inner courtyard with a(n) regular or irregular shape. This inner world is isolated from the public



fig.1 Het Straatje, Johannes Vermeer



fig.2 The facade of Museum Lambert van Meerten, delftopzondag.nl

street. Pedestrians who have no access to it, have no idea about this private world. This private interior is usually divided into several back gardens by fences for the buildings connected. But interestingly, some gardens are shared by several buildings, which makes it more public than private. Figure 4 shows the courtyard that is shared by a kindergarten and an architectural firm.

Such exceptions lead us to a question: what kind of public space does Delft city centre offer? As a city of courtyards, Delft provides public space in the form of courtyards, extracting publicity out of intimacy. One of the most important public spaces in the city centre, the Markt, is surrounded by buildings with a similar height and canals. These elements define the boundary of the ‘courtyard’, and indicate the intimacy of the inner space. But two public buildings on this courtyard, the Stadhuis Delft and Nieuwe Kerk, and the large open space in between, amplify the publicity of the space. Its spatial quality and programmes make it a significant public node in the city centre.

The Site

The site, located between Koornmarkt and Brabantse Turfmarkt, encounters several urban problems after its historical development. Facing two canals, it used to be consist of an enclosed courtyard and surrounding buildings. However, several urban transformations changed the spatial quality of this area, demolishing several buildings and



fig.3 Figure ground diagram, Space of Collection studio



fig.4 Shared courtyard, achterdegevelsvandelft.nl

creating large opening to the canal. The inner courtyard is nowadays a forgotten space, used for temporary parking, which is somehow controversial to the general city planning of Delft. While in the future image, the city centre of Delft should be car free and all the cars can be parked underground where there is enough space. The building left next to the opening is Zusterhuis, a massive volume emphasising its horizontal division instead of vertical ones as in general case. Its long facade is plain and straightforward, which distinguishes itself from its neighbours. The renovation plan for the site is suspended due to the complicated political and economic issues.

Even under such complicated conditions, the site is still seeking a way to fit into the urban context. The huge opening on the west was still sealed by a long wall, as an attempt to keep the continuity of the facade along the canal. The parking lot, which serves as the public facility now, is still trying to hide itself from the public street.

In my opinion, such efforts to keep the site to fit in the urban context should be preserved and emphasise. The spatial language of the project should be harmony with the urban presence: continuity and monumentality, as we discussed before. The opening on the front should be re-filled and the new facade of the archive should be humble in its neighbourhood. As a public building, it may entitle the intimate courtyard to an unusual role in developing its publicity, as most of the public space in the city is doing. In the ideal scenario, it may serve as the important node and a singular open space in the project, constructing a monumental void.

User Focus

The Student and the General Public

There exists a singular gap between students and the general public due to the existing layout of Delft. As seen from the map of Delft, the university, Delft University of Technology, occupies a significant part of the city. This significance, on the one hand, turns its texture into a crucial part of the context of the city. On the other hand, it indicates a huge isolation between the university and the city.

Such spatial patterns suggest the intricate relationship between the different user groups who are involved: the collision and the isolation.

The collision mainly happens between the student and the citizen. As the university introduces a large number of students to the city, especially its central part, how students live begins to shape the city gradually. The influence that students bring in is not limited to their life style: drunk students yelling on the quiet street in the city centre after mid night, are complained frequently by its local residents. Besides, young students have a different requirement for its spatial environment. They require more public space for studying, socialising and entertaining. However the plain and direct openness of the public space is controversial to the essence of Delft. That is the main spatial difference between the campus and the city centre of Delft. It may blemish the authentic quality of the city if the city centre is turned into the extension of the campus and loses its spatial legacy of history.

The isolation is reflected by the way how students use their educational space in Delft. It requires the institution to be more independent and autonomous. At the campus, different faculties occupy different buildings which are hardly connected. For the possible reasons of space, management and confidentiality, the educational buildings of Delft show a preference for major solitude with proper openness for its public function. Students studying in such building tend to lack a sense of a bigger context where they are working. At the same time the lack of common space disturbs the interaction between students and general public. Long-term speaking, it would affect the students' judgement about the practicability of their research. Besides, the general public have no idea about what the students are doing at the moment, and their windows to an advanced science education are therefore shut down.

The Site as a Bridge

Re-introducing the university into the city centre would be the initial attempt to bridge the gap between different user groups. That would be a bold move without further consideration of current situation.

In order to deal with the collision between different user groups, the cohesion of the community need to be introduced. The new building need to respect the legacy of Delft, being humble to its urban presence while being open as a public institution. The project is built in the name of the university of Delft, while it occupies a significant location between two canals in the city centre and therefore is expected to maintain the character of the city. In doing so, the project transmits a positive signal: being friendly to the general public of the

surroundings, including the residents and tourists. Besides the spatial language, the collision could be eased by bringing in the activities for the general public. In analysing the ground floor programmes of the public spaces in the city centre, most public spaces are surrounded by retail stores and restaurants, i.e. the Markt, the Beestenmarkt, the Bastiaansplein and etc (fig. 5). Such programmes could be introduced into the ground floor layout in the project, in order to attract the general public. Temporary activities, such as the flea market and antique market, which are popular among tourists and locals, could be held occasionally in the inner courtyard of the project.

By the spatial and the programmatic language mentioned above, different users may be brought in the site. An interaction among different user groups to break out of isolation, would be benign to a more sustainable development. The interaction between the student and the general public aims at eliminating the distance between the educational institution and the society. The public is welcome to take part in the discussion of the students' research. Through this kind of communication, students develop an awareness of the marketing. Besides, through the interaction the general public acquires an easier access to the further education in their daily life. The interaction also means the interdisciplinary collaboration between different faculties. As we all know, different faculties have their own ways of analysing and solving the problems. Borrowing others' methods would benefit thinking outside of the box. Moreover, the collaboration could make education more enjoyable. For instance, the knowledge of outer space or nano science is hard to understand for the general public, partly due to the difficulty to observe the object in real life. With the help of multimedia, posters and physical models, it would be easier for them to understand the 'invisible'.



fig.5 Programmatic maps of the Markt, the Beestenmarkt, the Bastiaansplein,
Space of Collection studio

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“Science is not just for scientists.”

- Imran Khan, Chief Executive of the British Science Association

1

Introduction

This research explores the possible ways to bridge the gap between the general public and knowledge institutions, with the city of Delft and Delft University of Technology as an example. Such a gap is represented but not limited to the increased geographical distance between the two, considering that the university used to be in the city centre. It indicates that citizens living in the city centre no longer have the easy and direct access to the educational institution as they used to. The 'cost' they need to spend on approaching knowledge is increased as well.

Such geographical separation between the university and the city centre results in the disconnection between the general public and the knowledge institute. As they have lost their easy access to cutting-edge scientific research, the general public gradually fails to retain the ability to understand it, since this requires proper professional knowledge.

Moreover, the disconnection brings mutual effects. For the knowledge institution, researchers lose their access to the general public as well. This causes a disorientation in the marketing and assessment of their scientific studies. Researchers find it harder to make sure the outcome of their research is understandable to the general public and practical in daily life.

Some preliminary attempts at closing such a distance have captured some attention, but unfortunately failed prove effective enough, among which The Space Study Collection is an example. It is a collection about the Delfi satellite programme in Aerospace Engineering Faculty, TU Delft. A wide range of spacecraft hardware and scale models concerning the programme are collected and exhibited to the public, so as to rebuild the connection. However its influence is limited, or simply said, its name still remains unknown to the majority, probably due to the display's size, monotony and remoteness from the city centre.

Such a gap indicates an inconsistency with the mission statement of the university. The University, as a public entity, has a certain social responsibility as its mission. The lack of understanding and involvement between the general public and the scientists undoubtedly endangers the fulfilment of the mission.

TU Delft's mission is to make a significant contribution towards a sustainable society for the twenty-first century by conducting groundbreaking scientific and technological research which is acknowledged as world-class, by training scientists and engineers with a genuine commitment to society and by helping to translate knowledge into technological innovations and activity with both economic and social value.

Therefore the main question of this research is: how can we encourage the interaction between the layman and the professional, so as to popularise scientific education and benefit cutting-edge research?

The aim of the research is to gain knowledge about possible solutions that bridge the gap between the general public and the knowledge institution in question. The solutions could be approached in two different categories: the social and the spatial. The social aspect refers to the events, methods and programmes where the two communities exchange ideas and stimulate each other; the spatial aspect applies to the architecture where such events take place and its role in a bigger context.

2

Research Method

The research consists of two parts: the interview and the case study.

Part I

In the first part, an interview was conducted with Chris Palmer, a current master's student from the Aerospace Engineering faculty, one of whose mentors is involved in the Delfi programme. He has a wide experience in space science and how it is communicated to the public. He participated in the European Researchers' Night, 2015 in Granada, which was held through the collaboration of scientific educational institutes across Europe, with the purpose of highlighting the important role that research plays in our daily lives as well as how science is pursued as a career.

With the interview I tried to get an understanding of several points: the programme of the European Researchers' Night, which aims at exploring science through fun learning; the forms and effects of the events dedicated to popular science and fun learning; the societal role that science is playing in our life; and the possible ways to encourage effective interactions between the professional and the layman.

At the end of this part, the role of the Space Study Collection plays in popularising science is discussed, including its advantages and the disadvantages. A further discussion on how to make cutting-edge science more interesting and easily understandable then follows.

The interviewee's concern about the importance of the interaction arouses another question: what is the proper scenario of a successful science museum? This question is further discussed in part II.

Part II

The second part of the research consists of thorough reading and study of several cases that aims to connect researchers and the laymen. The individual programmes or projects they offer are examined and discussed in this part. Such programmes or projects are successful in either attracting public involvement in scientific activity, or offering researchers a new perspective of looking at their work.

Moreover, the ambition of encouraging the interaction between the public and the professional can also be seen in the spatial strategies of cast studies. These approaches are also discussed in this part.

To conclude these two parts of the research, solutions from the social and the spatial perspectives will be provided, which per the discussion are recommended as being the most effective ways to integrate the public into the scientific world.

3

Interview

3.1 Introduction to the events

3.1.1 European Researchers' Night

The European Researchers' Night is a collection of events held across Europe. It is organised by the Research Executive Agency through a series of competitive calls for proposals. The programmes of the event thus vary from year to year. The European Researchers' Nights have been organised every September since 2005. The interviewee, Chris Palmer, participated in this event in Granada, Spain in 2015 when it celebrated its 10th anniversary with about 1.1 million citizens and 18,000 researchers taking part in scientific activities in different cities throughout Europe.

For citizens the European Researchers' Nights appeals to people of all ages 'intrigued by how things work and by what science means for their lives'. It consists of a variety of events focusing on popular science and fun learning, which provides visitors a platform to meet researchers and find out what they really do for society. The method of communication between the professional and the layman is interactive and engaging. Instead of static exhibitions, 'hands-on experiments, science shows, learning activities for children, guided visits of research labs, science quizzes, games, competitions with researchers and more' are more frequently used in the events.



Fig 1. European Researchers' Night: exploring science whilst having fun. (c) European Commission.

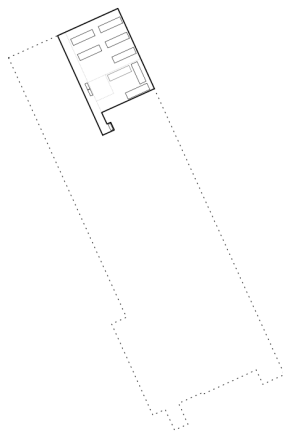
For the researchers, it is an opportunity to examine their work from an unconventional perspective. Different researchers from different disciplines use this platform to exchange ideas and inspire each other. The public offers a view from outside, which may enrich their research. The events are supported by the European Commission as part of the Marie Skłodowska-Curie Actions, which is an EU programme to boost European research careers.

3.1.2 Space Study Collection

The Space Study Collection is a collection of space hardware and scale models curated by the chair of Space Systems Engineering of the Aerospace Faculty, TU Delft. It is part of the Study Collection of the faculty, which is generated by the works of the students. The Delfi Space programme, the small satellite program for education, technology demonstration and to enhance capabilities of very small satellites, contributes to the majority of this collection.

Delfi Space has already launched Delfi-C3 in 2008 and Delfi-n3Xt in 2013, which both achieved their mission objectives during the first three months in orbit. The working prototypes of the satellites and other items produced during the research phase are collected and exhibited in the glass showcases in the Aerospace faculty building. It is not only a representation and conclusion of outstanding student works in the programme, but also a welcome gesture to attract visitors.

Besides showcases, deeper communication and interaction are expected between the student and the visitor. The guest is welcome to meet and talk to students in the project in the study space, and watch them working in the clean room through large windows.



left Fig 2. Plan of Space Study Collection in the AE faculty building. Drawn by author.

right Fig 3. View of the Clean Room through windows. Taken by author.

3.2 Interview

1. The European Researchers' Night that you took part in, took place at Plaza del Humilladero in Granada, Spain. Could you explain how it works? How was the plaza organised to accommodate the researches and the visitors?

The European Researchers' Night is organised by the European Commission. I attended as I was working at the Institute of Astrophysics in Andalucía (IAA) and was invited by my supervisor, who was presenting, to help set up our tent. The plaza runs parallel to the Genil River in the centre of the city, a site which is often used for public festivals and markets and which is easily accessible by foot and by road. Tents were set up along the park to house displays from various faculties and institutes from around Granada. Most of the tents were lined with researchers' posters, and contained a projector screen and a small number of chairs so that the public could come and listen to the researchers give short (15 minute) talks about their work. We also had more chairs set up outside the tent around large scale models of satellites and talks were given here too. Other faculties had hands-on activities for visitors as well as musical performances by staff.



Fig 4. Plaza del Humilladero in Granada. (c) Bing Maps.

2. The visitors are of different ages and educational background. How can the organisation make sure that they can all participate into the offered activities? To what extend was the public involved in the activities?

The displays catered for a wide age range. Adults enjoyed the short lectures which were not too technical while children were more attracted to the experiments. These demonstrations were chosen to be entertaining, there were lots of small explosions, the firing of a jet engine as well as the chance to make ice cream using liquid nitrogen. There were plenty of research students on hand to help answer questions and run experiments, and where possible the visitors were encouraged to do things themselves, by lighting reactions for instance.



Fig 5. The activities of European Researchers' Night in Granada, 2015. Taken by Chris Palmer.

3. It seems to me the event wanted to build a connection between our routine life and science, revealing the role of science in the world by showing behind the scenes. What do you think was the purpose or the meaning of it?

I think that it is incredibly important for the public to engage with science. Most people are interested in learning about scientific discoveries when they appear in the news, for instance, but this interest may not resonate with their memories of science as taught in the rather sterile environment of a school classroom. Exhibitions such as the Researchers Night help to illustrate science as it is understood and enjoyed by those who pursue it professionally, as a

highly exciting and valuable human pursuit. Science is about figuring out how the universe works and, given that much of it is publicly funded, the public has a right to know!

4. Whilst the visitors were enjoying the understandable science presented in the event, did the public also make a contribution to the works of the researchers?

During the event itself this wouldn't really be possible, but if we consider the long term relationship between those who attended and the researchers then I am confident that the event helped to inspire some of the younger visitors, who may well go on to contribute to scientific knowledge themselves in the future. From my own experience, having personal contact with working scientists from a young age at informal events such as these can have a massive influence on a child's interest in science.

5. I am interested in the spatial form of the event: the tents of different disciplines. But did it also harm the possible interdisciplinary interaction between researchers on site?

I thought that the organisation of the different disciplines into tents was an effective way of separating the groups without isolating them. The tents were open structures and the researchers were free to move between them and look at what the other faculties were displaying; it thus facilitated an excellent environment for networking.

6. This spatial configuration is totally different from the Space Study Collection in your faculty which is more like a laboratory requiring more privacy. What do you think of the public involvement in the exhibition?

The Space Study Collection at the aerospace department is primarily aimed at current students and visitors to the department, but not really the general public. The collection's accessibility is limited by its distance from the centre of the campus as well as its location on the 9th floor of the department's building. It holds an interesting display of spacecraft models (both rockets and satellites) as well as examples of satellite hardware. There is, however, a large rocket nozzle on display on the ground floor as it is too big to fit in the main exhibition floor. The display can be used effectively during open days for prospective students as it showcases satellites built by the department, but it is not very accessible beyond these times to the general public.

7. Now visitors can only observe the process of satellite manufacturing from the passage outside through the windows. Entering the clean room also requires a lot of complicated procedures, which also makes it less attractive to the public. What do you think can be done to live up with the concept of 'going behind the scene' in this case?

Unfortunately, the procedures for entering the clean room are necessary to protect the microelectronics. Building a satellite is expensive and the presence of any unwanted debris can damage the devices, so the room will always be somewhat off limits. However, I would encourage the department to host more open days to the general public and then have television displays of activity within the clean room to show in the corridor.

8. What do you think are the major benefits of encouraging the public to become involved in scientific research?

Science is an important part of the human story and one whose truths are independent of political or cultural biases. We are told nowadays that we live in a 'post-fact' age, but such relativism thankfully doesn't (or at least shouldn't) exist in the pursuit of scientific knowledge. I wish more of the public would rally around a vision of science as a unifying force and a shared experience as we collectively understand our position in the universe. With the invention of the internet it has become possible for the general public to contribute to real science through crowdsourced projects like SETI@home (which uses your home computer to search for alien radio signals) and GalaxyZoo. GalaxyZoo is a particularly impressive example, the project aims to survey the types of galaxies found in thousands of telescope images, be they spiral, elliptical or merger. This is something which would be too time consuming for the astronomers to do all by themselves, and difficult to train a computer to do accurately. Humans are very good at pattern recognition, and with a short tutorial, amateur users can identify the galaxy shapes and contribute to real science.

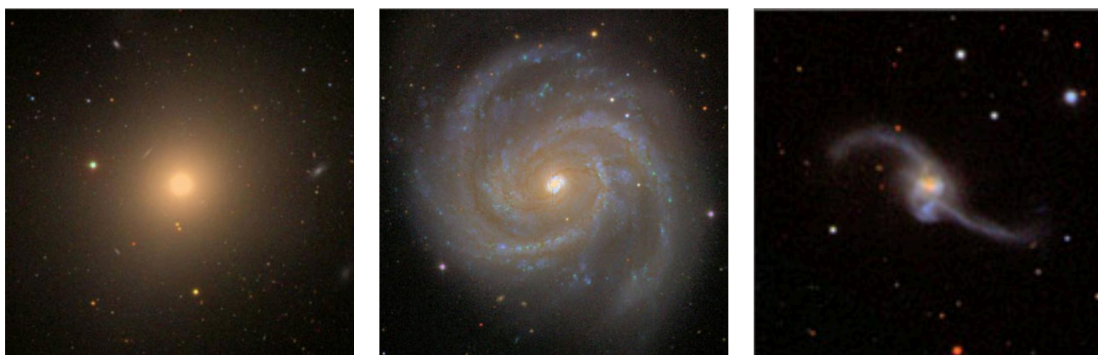


Fig 6. Visitors are guided to distinguish between different types of galaxies. (c) GalaxyZoo.

Engaging the public in this way increases their scientific literacy which should trickle down into public policies. It is important for everyone to understand the care which is taken to generate good research so that results can be trusted when they impact all our lives, for instance the unanimous consensus on man-made climate change within the scientific community is something which really shouldn't have been muddled by politics.

9. What else do you think would help to build the bond between science and life?

I think that science should appear more often in the lives of those who may not seek it out themselves and should be presented at an accessible level. As Imran Khan, the CEO of the British Science Association said recently 'science is not just for scientists'. The festival in Granada was effective because it was a site that a visitor could stumble across and perhaps see something that they'd never experienced before. Often it seems that only the arts can cater for public entertainment, but a connection with science can be just as transformative. If it was up to me we'd have at least one night a year where we turn out all our streetlights to see the universe as it really is.

4

Case Study

Three cases are carefully selected in this section: Jodrell Bank Observatory near Manchester, NEMO Science Museum in Amsterdam and Science Gallery in Dublin. With a common focus on the connection between science and the general public, these projects are all associated with a local university respectively. Each located in different contexts, they have developed their own techniques to deal with the communication of science to the public.

Jodrell Bank Observatory, run by the University of Manchester, presents science to the general public in the form of music festivals; NEMO Science Museum, supported by the University of Amsterdam, explores the new relationship between scientists and citizens; Science Gallery Dublin, funded by Trinity College Dublin, finds its niche as an urban institution with a social responsibility.

In this part, each case is studied with a similar procedure. The programmes are analysed, followed by their schematic plans to compare their respective scales and locations. In the end, inspiration for the Delft model is drawn from the successful aspects of each.

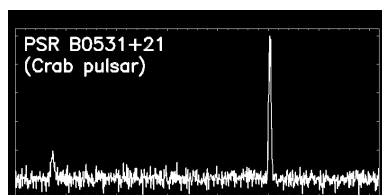
4.1 Jodrell Bank Observatory, Manchester



Fig 7. Master plan of Jodrell Bank Observatory. (c) FCB Studio.

Jodrell Bank Observatory, located in a rural area near Manchester, UK, is one of the most famous and largest radio telescopes in Europe. The University of Manchester has held several successful music festivals at the site. The festivals are science themed and the organisers pick performers whose musical styles suit the location.

For instance, in 2013 the university invited Sigur Ros, an Icelandic alternative instrumental group, to headline one such event. The band was asked to integrate a recording of the radio signal from the Crab Pulsar while it was being received live by the telescope. The image of the Crab Nebula was projected onto the telescope's dish and used as the background to the performance.



left Fig 8. The visualisation of Crab pulsar received by Jodrell Bank Observatory. (c) Jodrell Bank Observatory.



right Fig 9. The festival (Transmission 006) with a background of Crab Nebula. (c) Jodrell Bank Observatory.

During the festivals, many workshops and exhibits are set up in tents around and between the stage areas. These temporary tents, set within the natural landscape, serve as small exhibition and workshop spaces. They contain displays of examples of current research carried out by the University of Manchester and are manned by its students, who are there to answer questions from the public.

Moreover, Jodrell Bank Observatory also provides various activities and lectures about space as part of its daily role. However, since the observatory places strict demands on its surroundings in order to guarantee the accuracy of its observations, the exhibition pavilion in the park operates within strict limitations of size, height and function. It is a small bungalow near the Lovell Telescope, which contains a cafeteria, offices, classrooms and limited exhibition space.

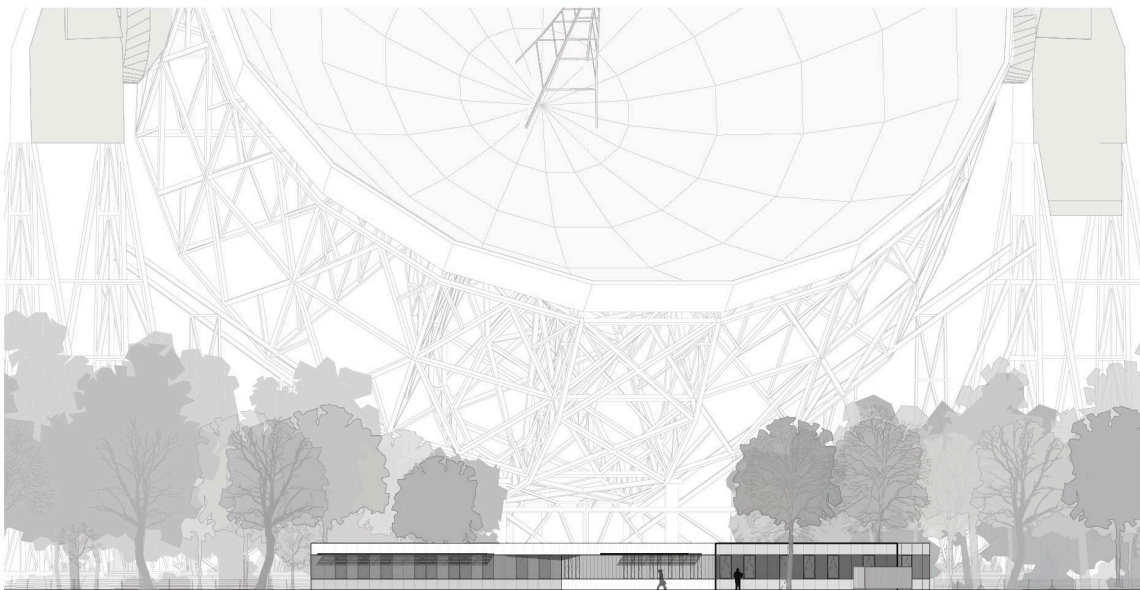


Fig 10. South elevation of Planet Pavilion. (c) FCB Studio.

Programmatic Characteristic	Spatial Characteristic
<ul style="list-style-type: none"> + The interdisciplinary corporation visualises 'invisible' science into 'visible' art. + Through music, a form of art that is relatively friendly to the public, it made its research in the outer space understandable to laymen. + The cafe provides a place for casual meetings. 	<ul style="list-style-type: none"> + The Lovell Telescope (76.2m) creates an unique and dramatic space for the event. +
<ul style="list-style-type: none"> - It mainly focuses on single topic (outer space), which can attract only certain visitors with such interests. - The majority of visitors attracted by the music festivals may not be interested in space. 	<ul style="list-style-type: none"> - Setting in a rural area, it is relatively hard for visitors to access. - Faced with limitations for better observation, the exhibition space ends up to be unattractive.

4.2 NEMO Science Museum, Amsterdam

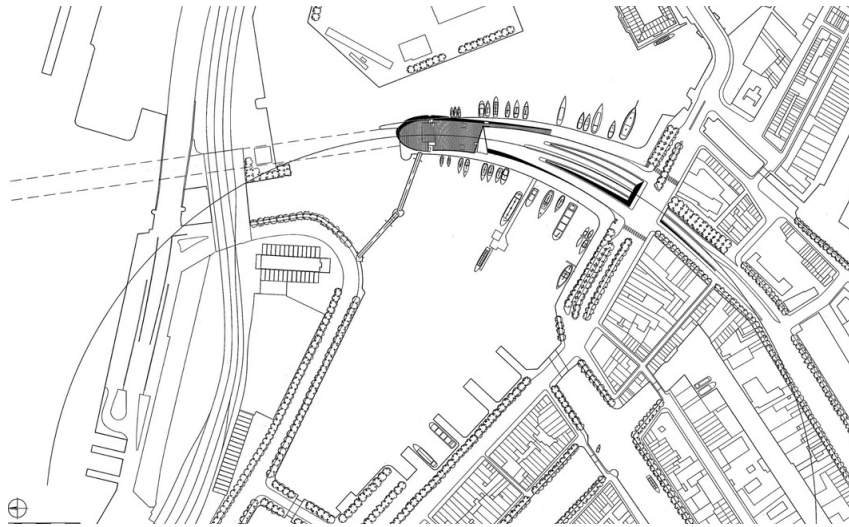


Fig 11. Master plan of NEMO Science Museum. (c) Renzo Piano Building Workshop.

NEMO Science Museum in Amsterdam reflects on the relationship between scientists and citizens and proposes a new interactive dialogue between the two. It is not only an informal and fun scientific classroom for the public; but also a research hub where the public acts as a research population, especially for sociology researchers.

Visitors are able to visit exhibitions, conduct experiments, listen to lectures and participate in workshops there. It offers different activities for people of different ages. It has a strong collaboration with universities in the Netherlands, especially the University of Amsterdam, whose professor, Maartje Raijmakers is in charge of the research programme in NEMO. She



Fig 12. The public as a research population. (c) NEMO Science Museum.

focuses on informal learning outside the classroom. NEMO conducts several programmes, such as Science Live and NEMO Research & Development, that aims at providing researchers a platform to interact with a broad section of society, so as to better carry out their research. Its visitors can sign up to be a test subject in a research study, as a research population. For instance, Tessa van Schijndel conducted several stimulate exploratory experiments with visitors In NEMO Science Museum, in order to investigate how different ways of verbal guidance may be used in the classroom for a better educational outcome. In such programmes, scientists have direct contact with visitors by giving talks and answering questions.

NEMO aims at bringing science and technology closer to the public in an interactive and accessible way, as a public entity. Its ambition is also indicated in its architecture which was designed by Renzo Piano. Its enormous roof terrace, which you can access for free, demonstrates its urban role in the city. A pedestrian ramp leads up onto the building's sloping roof and serves as a public piazza for visitors and as a social focus for the neighbourhood. Piano wrote, 'Amsterdam is a one-dimensional city' because unlike a lot of cities it was missing a square overlooking the city. Therefore he tried to change that by adding the big roof terrace which could house a variety of events. At the time of writing, an open-air exhibition 'Energetica' is held on the roof. Occasionally, NEMO organises open-air films on the roof. Piano thought that interaction should be an important element of the piazza, with full scope given to the interplay between man and the elements. However, acclaiming that the wonder of visitors deserve undivided attention, Piano therefore opted for a design that filters out any distractions, with a plain exterior of minimum windows. Though such approach satisfies the programmatic demand from the inside, 'the noble factory' that he created also isolates the inside from the outside, ignoring its near neighbours unexpectedly.



Fig 13. An open-air movie night on the roof terrace. (c) NEMO Science Museum.

Programmatic Characteristic	Spatial Characteristic
<ul style="list-style-type: none"> + Its 'fun learning' programmes attracts thousands of visitors. + It creates a research hub for the research, where the public is involved actively. + The cafe provides a place for casual meetings. 	<ul style="list-style-type: none"> + Its roof serves as an urban figure in a bigger context.
	<ul style="list-style-type: none"> - Its exterior walls shows an ignorance of the possible communication with its surroundings. - Intentionally designed for a science museum, the interior of the building however lacks a distinction from other museums.

4.3 Science Gallery, Dublin



Fig 14. Master plan of the Trinity College Dublin Campus. Illustration by author.

Science Gallery Dublin, located at the corner of Trinity College Dublin, is a new type of forum where ideas from white-hot scientific issues and art meet and opinions from a variety of visitors collide. It houses art exhibitions and activities that focus on elaborating the role that science is playing in some of the most pressing social topics, such as data privacy, human migration, modern warfare etc. Social responsibility plays a vital role in its curatorial work. In *The Guardian's* word, "Science Gallery provides the intellectual space necessary to initiate and sustain society's essential conversations."

There is not a fixed exhibition at Science Gallery Dublin. The curators there cooperate with relevant scientists, researchers, artists, inventors and entrepreneurs, so as to carefully organise an event every three months. They interpret the topic, which is of current social interest, in the intersection between science and art. For instance, artificial intelligence (AI), which is attracting seismic attention in the world today (especially after AlphaGo's unexpectedly victory against Lee Sedol, who ranked 1st in international titles at that time, in the board game Go in 2016), will be the next topic of the gallery. At the event, visitors will have access to all kinds of inspiring hands on activities about AI technology, which are produced by both scientists and artists (e.g. a machine that can produce an artistic portrait painting on site when a visitor sits in front of its camera). Moreover the gallery offers a platform for different visitors to express their ideas from different perspectives, through the form of lectures, seminars, workshops and especially their Makeshop, a workshop where people are provided with tools, materials and guidance to release their creativity into the real world. Lynn Scarff (2017), the director of the gallery, regards the gallery as a platform that brings in different disciplines together to 'solve some of the challenges of the society'.

Before 2008, the location of the gallery was a forgotten corner of Dublin, occupied by car parking - a similar situation with the design plot in the studio. The building, on the north east corner of the campus, adheres to the masterplanning of the campus by Scott Tallon Walker in 1985. Its volume acts as a barrier in the corner that contributes to the continuity of the street and privacy of the campus, while at the same time, its transparent facade at the street level offers a welcoming gesture to the public.



Fig 15. Science Gallery Dublin on Pearse Street at night. Taken by Cathrine Kramer.

Moreover, the gallery building stays humble and respectful of its urban setting. In Walker's planning, he abandoned an earlier proposal to demolish the buildings on the east side of the campus and widen the neighbouring street, and instead proposed an internal student street next to the eastern buildings. The building of Science Gallery opens a passage on the ground floor, connecting the external urban street and the internal student street. The entrance of the gallery is also on this passage.

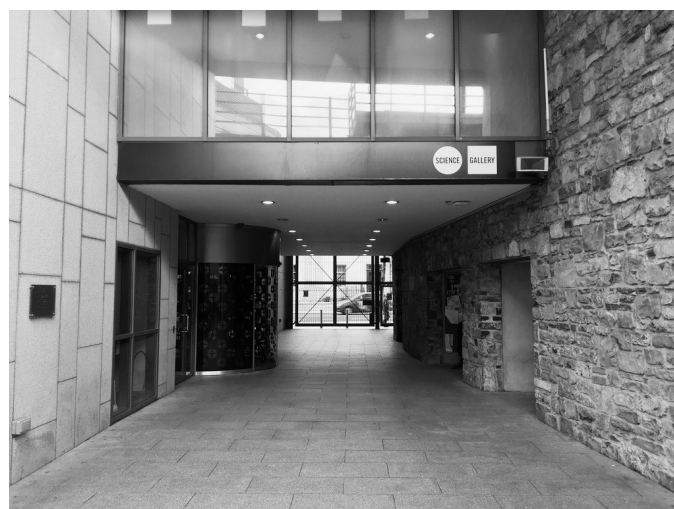


Fig 16. The passage connects the street and the campus. Taken by author.

Programmatic Characteristic	Spatial Characteristic
<ul style="list-style-type: none"> + Its ever-changing programmes indicate its focus on current social challenges. + The conversation between different disciplines results in the attractiveness to the public. + The cafe provides a place for casual meetings. + The workshop provides an opportunity for visitors to take part in the process of making. 	<ul style="list-style-type: none"> + The glass wall on the lower levels facing the street provides transparency to the user. + The passage, where the entrance of the gallery is located, connects the street and the campus. + It stays humble and friendly to its urban context.
<ul style="list-style-type: none"> - On its brochure, it says it mainly focuses on people aged from 15-25, lacking consideration for other age groups. 	<ul style="list-style-type: none"> - The gallery is on the ground floor and the first floor of the building, which was not specifically designed for exhibition space. Therefore, it lacks detailed architectural consideration from light, structure, material etc.

5

Conclusion

This research aims at finding out what kind of programmatic and spatial characteristics of a knowledge institution best encourage interaction with the general public.

The interview with Chris Palmer provides a positive perspective from a researcher on the feasibility and preliminary propositions of connecting the public with the university's current research and researchers. Space Study Collection, the existing science exhibition of his faculty, is deprived of proper methods to attract a wider audience. Moreover, he also explains the possibility that too close an interaction with the exhibition material can cause damage to research. The precariousness in such approaches is to facilitate public involvement while filtering out the unnecessary distraction and any negative influences — in other words, to find a proper scenario where the public and the professional can benefit from each other.

The analyses of the precedents can be regarded as the exploration of such proper scenarios. The programme (or the social aspect) and the spatial aspect are two main parameters in the research, which could inspire my design of the science centre in the city centre as the 'extension' of TU Delft. These insights could be listed into two main categories as below.

- Programmatic Characteristic

1/ Interdisciplinary collaboration

The science visualised by art is generally acknowledged to be more friendly and accessible than the one conceptualised by equations. The collision of science and art unleashes their combined creative potential through the unexpected fun of the experience. The interface between science and art, where exhibitions, events, workshops and performances are easily accessed, contributes to a unique urban educational institution for the general public.

2/ The public involvement

While some scientific projects require a certain professional knowledge to be involved in, some other projects (e.g. the Galaxy Zoo project and the sociology project at NEMO Science Museum) would stand to benefit a lot from public involvement. The public are welcomed to

take part in such projects by giving data, samples opinions, etc., so as to contribute to a broad section of scientific disciplines. In doing so, visitors can catch a unique glimpse of the scientific process, while researchers acquire access to a large cohort of willing subjects who are truly interested in understanding and contributing to their work.

3/ Social responsibility

Delft University of Technology is one of the world's leading research-intensive universities, where not only academic research, but also that with great social concern are dynamically conducted. So as to promote the positive social identity of the university and even contribute to the image of Delft as a city of knowledge, a new type of urban venue that allows visitors to participate in and facilitate social reflection is needed.

- Spatial Characteristic

1/ Programme-Friendly

Firstly, it is worthy to point out the importance of the consistency between the programmatic and the spatial characteristics. The space of the design project space should be able to facilitate the social interaction between different users and objects. It is a pity that the nozzle of the Space Study Collection has to be displayed apart from the main collection due to its exceptional height.

2/ Urban Context

According to the precedents, it is suggested that fitting into the context could benefit the project from attracting more visitors. By being open and transparent to its near neighbours (e.g. Science Gallery Dublin), the building may place itself as a key entity in the urban life. The project could also be a reflection on the urban context, as the NEMO Science Museum creates a singular roof plaza for Amsterdam, which is claimed to lack such public space according to its architect, Renzo Piano.

3/ Particular Design

However, all of these three precedents shows a lack of particular concern for the interior. In other words, their exhibition space still look appropriate if they are used as any other museums instead of science centres. It is a pity that their plain and ordinary architectural language do not interact actively with their unique scientific theme. The architectural elements (scale, light, structure, material, etc.) are worth consideration, so as to create an authentic and unique space for unleashing the potential combined power of scientists and citizens.