

A META-SYNTHESIS OF ARCHITECTURE

MD BAIYAZEED HASSAN

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Student: Md Baiyazeed Hassan
Examiner: David Andreén
Supervisors: Elin Daun & Gediminas Kirdeikis.



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Abstract

The built environment will soon continue to develop as virtual and augmented reality become increasingly integrated into how we work, play, and learn.

My degree project explores the many possibilities of combining architecture with augmented virtuality by looking into this new medium of technology that is constructing mixed reality with the built environment.

It talks about the metaverse in brief and it's the physical attributes like augmented and virtual reality, that make up the metaverse. Furthermore, it briefly mention the computer science behind this technology.

Continuing from there, we discuss the impact of augmented virtuality on existing urban infrastructure, and how such programs can enhance urban conditions. As a result, the research study explores new methodology of designing public domains using spatial experience ladder - meaning how to make new forms of public interacting spaces using mixed reality.

In order to strengthen this study, I talk about past architectural projects and concepts that is relevant and incorporate some of the concepts into the research. I have arranged a case study in Malmö, Sweden, between the people of Sweden and Iraq living in Malmö. In the case study, I design a new form of public space that is meant to explore new social cohesion between the mentioned groups. The design discourse formed using spatial experience ladder is used as an exploration tool to the case study.

In the end, the thesis concludes by presenting potential design forms and ideas that could be further explored for future design using mixed reality and other similar technology with the built environment.

Introduction

Metaverse, a complete world where you can see, hear and (possibly touch) anything virtually. You can go there to experience things you could never do and see in the real world. The metaverse is a virtual space where each of us can create and collaborate from wherever we live. Hence, the metaverse is a new potential way of forming or enhancing communities. Metaverse is not singular rather it is the sum total of all the interconnected worlds that make up the Internet.

This trending platform could bring new opportunities to the Internet all over the world by introducing itself as Web3, which is a new block-chain based iteration idea for the World Wide Web that combines concepts like decentralization and a token-based economy.

The physical attributes that make up the metaverse are Augmented and Virtual reality. Coming to a midpoint between the two mediums is called Mixed Reality. Mixed reality is being considered as the metaverse that will be the new label of the Internet in the future.

Thus, this research study explores mixed reality and the possibilities of integrating it with the built environment.

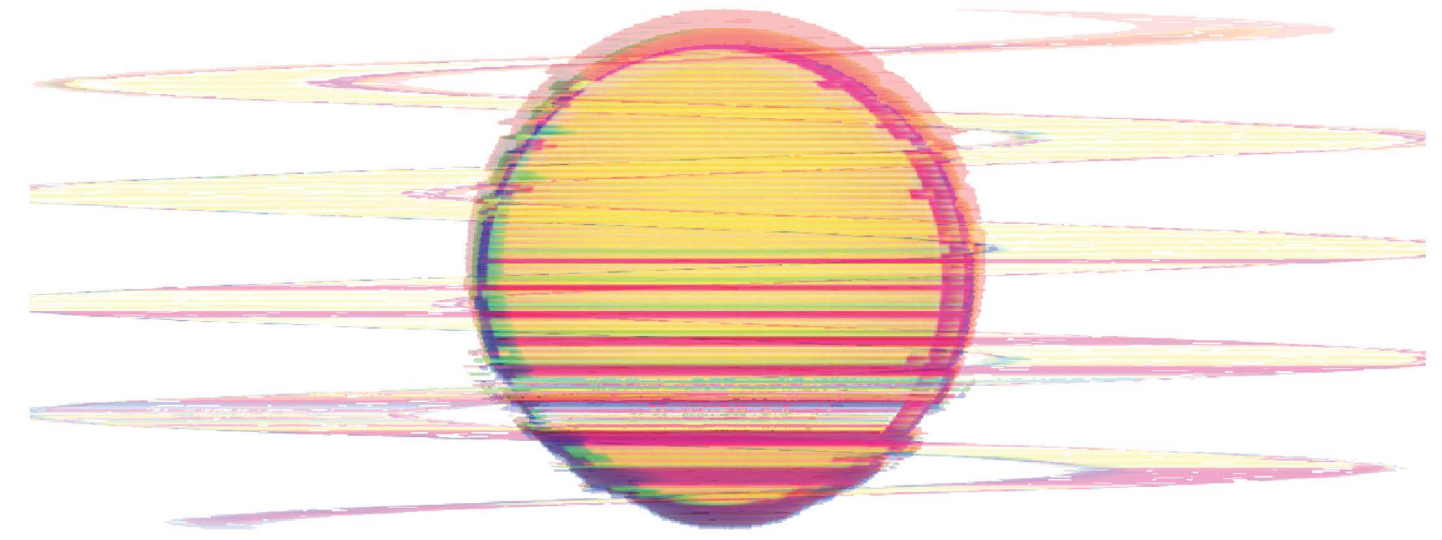


Fig.1 : Illustration of the Metaverse

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CHAPTER 1

BACKGROUND

1.1 the Metaverse

As mentioned earlier in the Introduction, the Metaverse will take place in a cross-platform universe, primarily through AR, VR, and MR; so that people don't have to block their view to interact with this world.

The concept of the Metaverse was first introduced in 1992 from a novel called Snow Crash by Neal Stephenson. In 2011, another novel called Ready Player One, written by Ernest Cline has caught attention of movie director Steven Spielberg, which was turned into a hit movie in 2018 [1]. Both the novels described the Metaverse as a Utopian(/Distopian) digital world where people live as avatars, operating under a token based economy [1].

Virtual Reality (VR) and Augmented Reality (AR) are the foundation to this medium and they have exciting potential in the future of gaming, marketing, e-commerce, education, and other industries. Both technologies are known for their rich experiences that combine virtual and real worlds with enhanced 3D visualization. Other hardware development are focused on sensors and immersion with haptic technology [1].

The features that conceptualize the Metaverse has already been introduced in 2003 by virtual games like Second Life. Later many games has reached mainstream media like World of Warcraft, Mine-craft, Fortnite and Roblox. In recent years, Facebook has integrated this technology and sub-branched to a social VR world called Facebook Horizons [1].

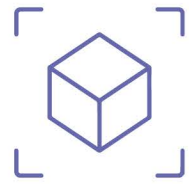


Fig.2 : Illustration of Mixed Reality

1.2 AR, VR & MR

AR – Augmented Reality

It is an interactive experience of a real environment, where real-world living objects are enhanced by computer-generated perceptual information, sometimes through a variety of sensory modalities including vision, hearing and touch. Designers make digital elements that are overlay upon real-world views with the primary motive of interactivity between the two mediums often via smartphones [2].



VR – Virtual Reality

Is a simulated experience that may or may not be completely different from the real world. Virtual reality applications include entertainment (especially video games), education (such as medical or military training), and business (such as virtual meetings). Designers create immersive simulations that makes the user experience isolated from the real world or in a different geographical context, often via headset devices [2].



MR – Mixed Reality

It combines the real and virtual worlds to create new environments and visualizations where physical and digital objects coexist and interact in real time. Mixed reality is a combination of augmented reality and virtual reality, as well as occurring in the physical or virtual world. Designers create contents with the intent of combining AR and VR contents so that digital elements that are interacting with the real world could be experienced more immersively.[2].

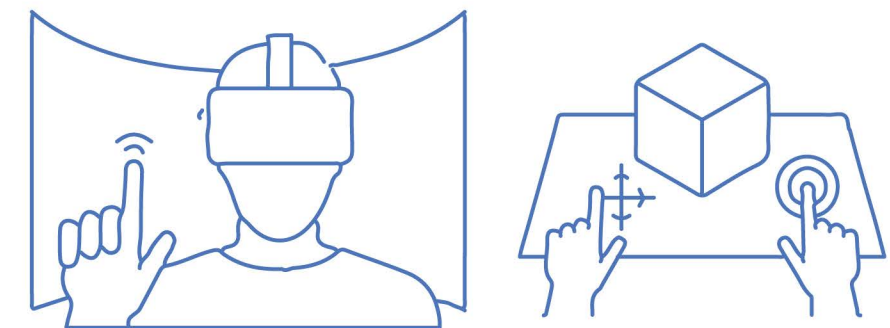
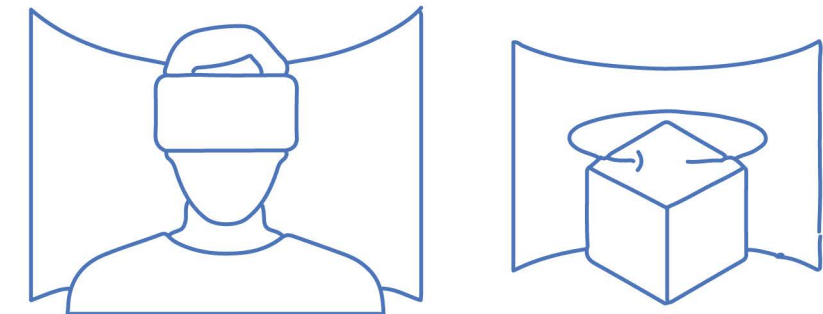
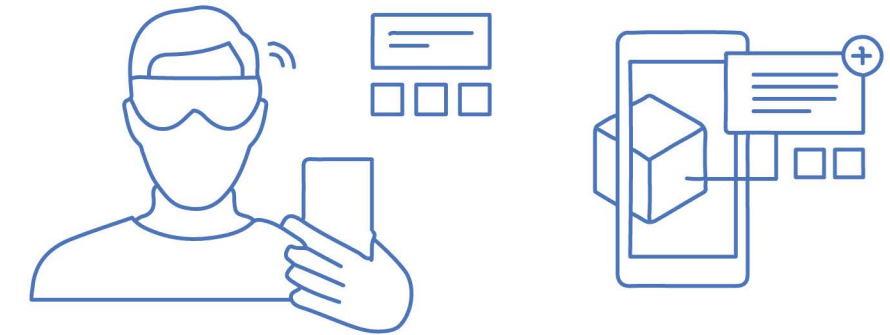
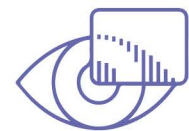


Fig.3 : Illustration of Augmented, Virtual & Mixed Reality



CHAPTER 2

RESEARCH

2.1 Augmented Reality

Augmented reality is a form of experience where creators design digital overlays upon physical matters with the aid of computer-generated inputs [2]. Defined as a system that integrates three basic functions: fusion of real and virtual worlds, real-time interaction, and accurate 3D recording of real and virtual elements [3]. Creators design variety of inputs ranging from sound to video, graphics to GPS overlays etc, and all these inputs are determined in real time by the user's influences and corresponding environment [2]. The development of augmented reality is slowly blurring the line between real and virtual life. It is blending the digital elements like visual overlays, haptic feedbacks and other sensory projections into real-world environments [3].

In history, the concept was first introduced in 1901 as science-fiction, later in 1990 Thomas Caudell termed this as technology when designing to aid Boeing employees in visualizing complex aircraft system [2]. In 1992, Louis Rosenberg made paradigm advancement in the technology while working with the US Air Force. Following from there, AR was introduced to the consumer market in 2000 as notable ArQuake game and in 2015 Microsoft HoloLens carved on stone and made significant impact to the mainstream media [2].

Currently the U.S. Army is using AR tools for digitally enhanced training missions for soldiers. In the future, Wearable AR glasses and headsets has the potential to help in faster decision on the fly [3]. Other than that, in the Netherlands, people can use a mobile app called Layers where the app uses the mobile camera to overlays information like navigations and informations around the pointed area [3]. In 2018, an art and culture organization called Mural Arts Philadelphia created a gigantic interactive outdoor murals, where viewers used their phones to view various holograms and listened to the attached audio to gain a fully immersive experience [3]. As this technology is becoming more accessible and integrating to general use, countless innovative mobile apps are popping up everyday that potentially compliment our daily lives.

In classification, there are two groups of Augmented Reality: marker-based AR and marker-less AR.

Marker-based AR is the primitive form of the technology. It is dependent on images (markers) to position objects within the user's field of view. So, applications are dependent on specific physical image pattern or markers in a real-world environment to overlay the 3D object upon it. This requires several modules like notably a camera, image capture, image processing and marker tracking [4].

Marker-less AR allow 3D objects to be positioned without the need of a physical marker. This is possible by examining the data of the context in real time [4]. This is possible by hardware advancements of a smartphone - camera, accelerometer, sensors and AI algorithms [4]. It uses simultaneous localization and mapping (SLAM) to scan and map the environment on which to place the 3D contents. Marker-less AR has four categories: *location-based AR* - is the combination of

virtual objects placed in the physical space of the user's current location; *projection-based AR* - used to project data upon a stationary object allowing users to move freely around a specific area where the projector and tracking camera is placed; *overlay AR* - is used to replace the original view of the physical object with updated form of the object virtually for the human eye and *contour AR* - used to outline environments or objects with line to accompany specific solutions like car navigations [4].

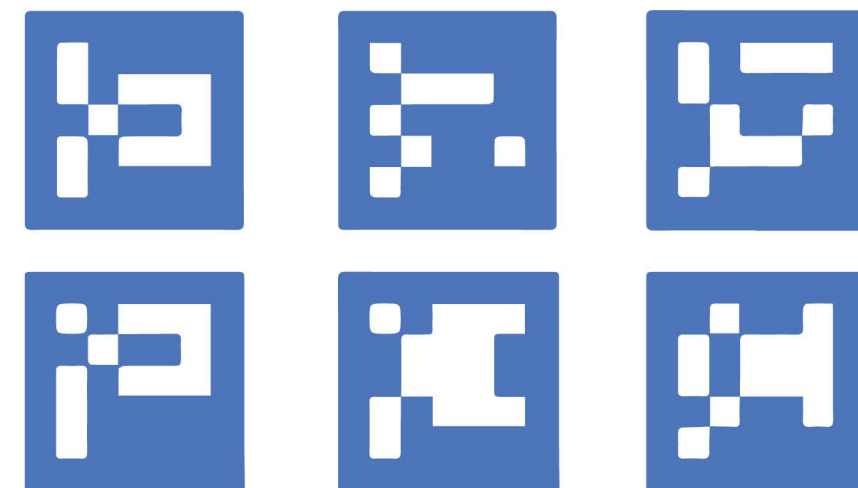


Fig.4 : Types of AR markers used for tracking a three-dimensional object.

2.2 Virtual Reality

Virtual reality is the technology that can replicate artificial reality in a 3D space in which the participant can interact and be immersed exploring it [5]. Virtual Reality is primarily experienced via VR headsets. The basic components attributing to VR headsets are: *array of sensors* - to immerse into the virtual world vr headsets come with number of sensors, gyroscopes, accelerometers to track head movement and to reposition the display accordingly; *lenses and screens* - stereoscopic lenses placed between the screen and user's eyes with the intent of distorting a projected image into appearing three-dimensional; *immersive audio* - VR headsets produce a more layered sound with 360 degree or spatial audio system where audio is directly linked to the perception of distance and space; and *controllers* - single hand motion controllers that act as a bridge between the two realities [6].

For prerequisites, the frame rate should be a minimum of 60fps with equally standard refresh rate while a desirable 180 degree field of view but not less than 100 degree. These prerequisites are vital in order to avoid latency and to fully convince the human brain, the response time should not be less than 20 milliseconds [6].

Initially VR was conceptualized in 1960 as simulators for learning flight, driving cars, tanks and shooting artillery [5]. It entered the commercial market in 1980 as games, exhibitions and aerospace simulators [5]. VR has gone through various phases of integrating with the world [6]. Here is a timeline of it:

- VR started from late 80's and early 90's
- VR trade shows, VR conference and VR magazines
- VR in the 90's helped develop immersive interfaces – manual tracking and haptic feedback – first person gaming – consumer haptic joystick, mouse and steering wheels.
- Late 90's – major medical schools use high fidelity VR hardware to train doctors and perform surgical procedures.

Virtual reality applications include entertainment (video games), education (medical or military training), and business (virtual meetings) [6]. There are multiple examples VR Learning like, Titans of Space, Starcharge, Multiverse, Apollo 11, National Geographic VR, Tilt Brush and Sculpture VR [6].

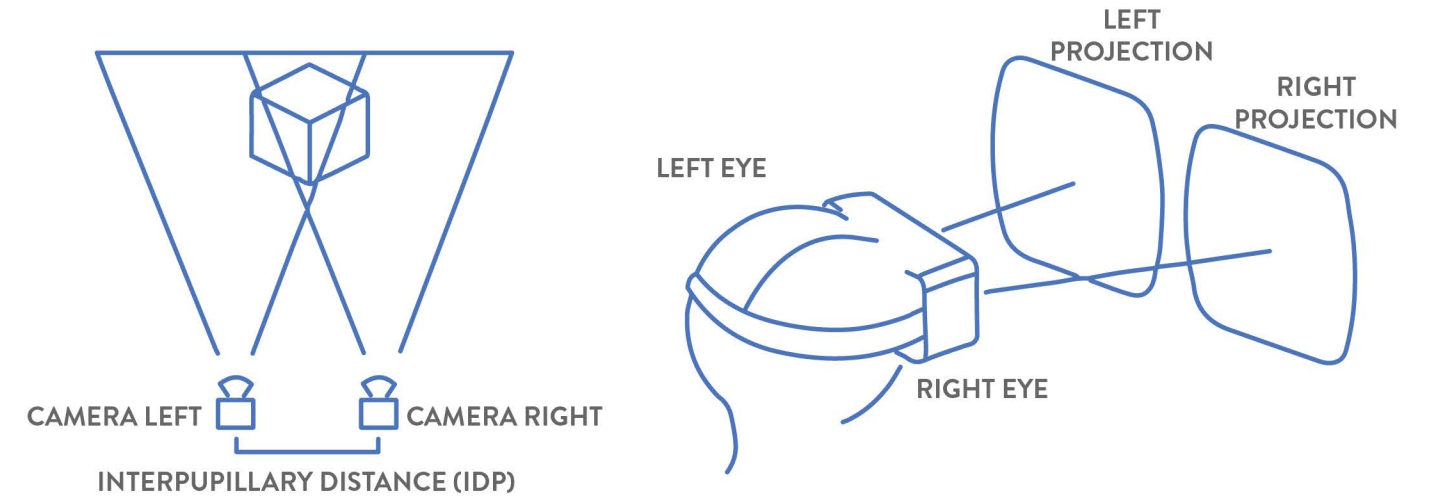


Fig.5: Illustration demonstrating how stereoscopic 3D images are created



Fig.6: Video demonstration of Virtual Reality in 1991

2.3 Mixed Reality

It is the dematerialization of physical space, distance, and object. All these elements merge to create a complete and immersive world that matches the physical world. This immersive experience called Mixed Reality (MR) includes virtual and augmented reality interfaces.

Mixed reality has become one of the most trending technologies, “catching” the attention of industry and academia [1]. It is predicted to be on par with flat media by 2030. Reports show that by 2024 there will be 1.73 billion enhanced users worldwide - an increase of 293% between 2019 [7] and 84 % of the world’s population now own a smartphone.

Examples of video games like: Fortnite, Beat Saber and Pokemon Go! ; for educational purposes such as: Microsoft Hololense - medical students to learn anatomy; virtual assistants such as: Amazon Alexa and Apple Siri; mobile socialization applications such as: Assembly Hall; training applications on mobile phones such as: Peloton; digital workspaces such as: Meta Horizon Workroom and Zoom; and fashion like: Carling Clothing - AR design on white t-shirt.

Some predictable startups in Mixed Reality of 2022 are in Sports, Clothing and Fashion, Food and Food Delivery, Tourism, Child and Pet care, E commerce, In the Workplace, Gamification, Social Media and Healthcare.

Till now, the present characteristic of Mixed Reality is to:

- Emphasis on activities
- Immersive places
- Link and embed immersive, emergent contents



Fig.7 : RV continuum ranges from completely real to completely virtual environments and encompasses AR and Augmented Virtuality (AV).

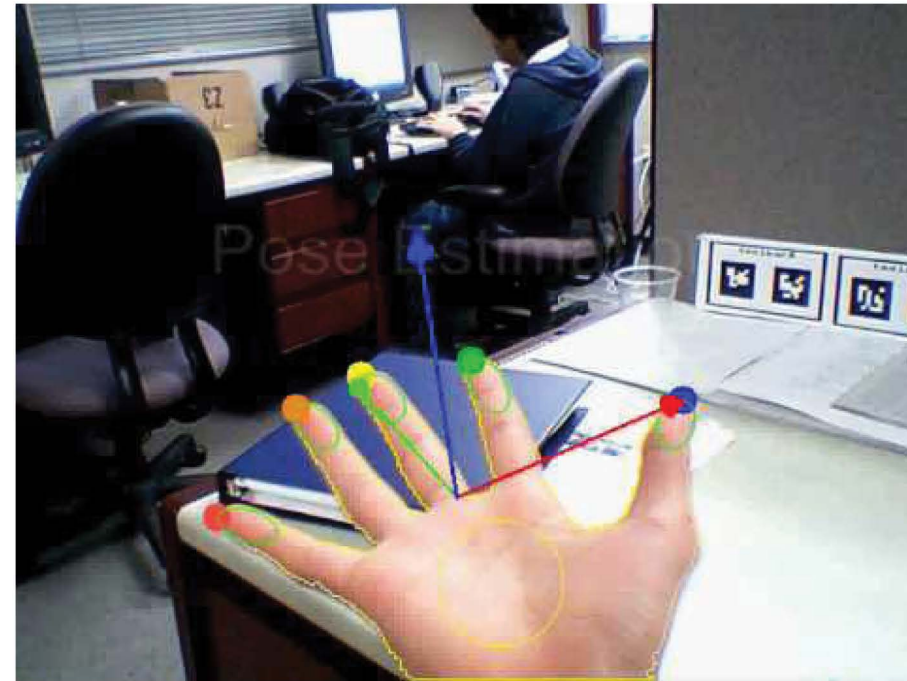


Fig.8 : Augmented Reality – virtual graphics on the user’s real hand

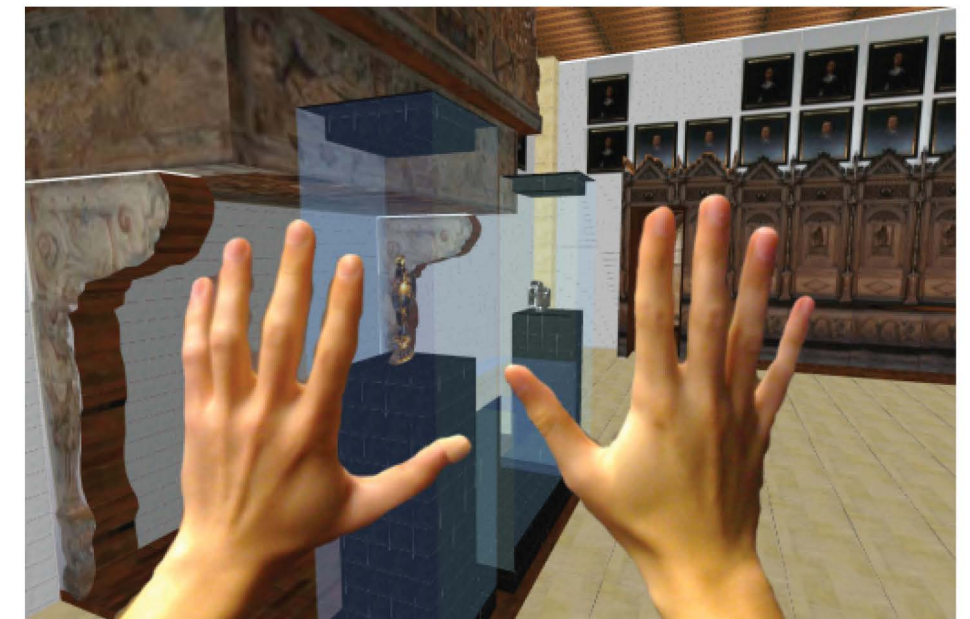


Fig.9 : Augmented Virtuality – the user can see video of their real hands in a VR view

2.4 Spatial Computing

In order to apprehend the connection among digital applications and architecture, it would be relevant to talk about spatial computing.

Spatial computing is the digitalization of activities of machines, humans, items and the environments wherein they take place to allow and optimize movements and interactions [8]. In today's world, we can expect most households to own a smart speaker for voice-activated searching and our use of AR filters in Instagram and Snapchat is increasing along with integrating virtual reality with video games [9]. Spatial computing has evolved the technology in computer system. We can find computational devices in everything from smart glasses to intelligent assistants in our phones [9]. This technology can potentially aid in digitizing industrial enterprises and optimize operations for their front line workers [8]. Many companies like Google and Microsoft have been providing such technologies since 2013 with Microsoft HoloLens and Google Glasses [8].

In the current moment, spatial computing is mostly used to optimize productivity in factories, worksites and warehouses. The technology is starting to enter the mainstream media when Facebook has re branded the company as Meta and introduced the digital realm as new form of social media of the Internet. Introducing this digital realm is bringing along all the physical attributes to mixed reality and thus spatial computing will be gaining popularity in the near future.

Spatial computing was first defined in 2003 by Simon Greenwold in his futuristic thesis to MIT Media Lab. Only recently this has been made tangible due to advancement in technologies: artificial intelligence, camera sensors and computer vision that track environments, humans and objects. Internet of Things (IoT) that monitors and controls products and assets, and augmented reality (AR) provides the user interface. With spatial computing, the collaboration between man and machine will be coequal, as well as enhancing each party.

The distinction between conventional computing and spatial computing is that conventional computing has records and common sense involved, and with spatial computing, 3D places are introduced to the equation. With this, spatial computing offers variety of technology advancements to haptic feedback system, edge computing, machine learning, robotics and IoT [9].

There are a lot of opportunities for spatial computing in the communication and collaboration space as remote working and the globalization of the workforce is becoming more popular [9]. It has the potential to substitute traditional educational methods to immersive training sessions with extensive experience with the help of wearable devices at a distance [9]. With haptic feedback and 360-degree cameras could deliver the sensation of stepping into a workspace without physically being there [9]. Long distance teams could easily gather around into virtual collaborative spaces to simultaneously explore new design opportunities and discover more unique ways to work together remotely [9]. With this technology in the future, there is no doubt we will be seeing legacy companies offering services that focus on augmented workflows, immersive training that would result to more office productivity, data visualization and more [9].

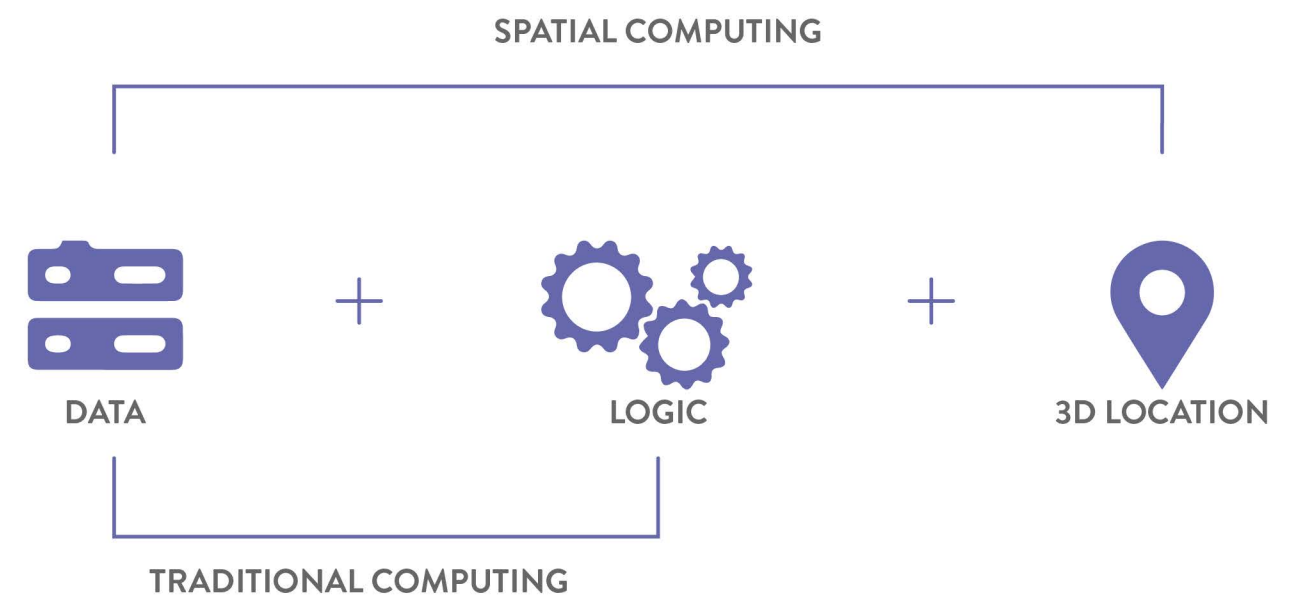


Fig.10 : Simple Spatial Computing Equation

2.5 Augmented Virtuality & Urban Design

Even though augmented reality has been around for a while, what pushed augmented reality to mainstream recognition is by the hit mobile game Pokemon Go in 2016. Pokemon Go used location based markers and integrated itself all around the globe, making player turn into Pokemon trainers and travel around to catch different Pokemon, specifically located in different locations. This type of augmentation technology is called Geo AR [10].

Geo AR: Primarily a location based augmented reality, lets in participants to connect, interact and benefit from virtual contents to geo primarily based markers. Geo AR is totally based on Image Tracking and Object Tracking. Since it does not require a physical marker to cause the AR experience, the augmentations are connected to and seem at precise predefined locations. With a smart device, users can test geographically linked places to view or have interaction with variety kinds of contents like 3D augmentations, video, text, audio and links [10].



Fig.11 : Geo AR augmenting directions to nearby hotspots

Pokemon Go did not only affect within the AR community; it has also impacted as one of the most successful mobile games ever created. Players throughout the globe use the app to find out virtual Pokemon connected to unique points of interests in their respective cities as they discover the set arena around them [10].

As a result, the game has demonstrated new forms of activating, enhancing existing urban typologies from public spaces to public domains in a way that questions the traditional architectural discourse [11]. People follow their typical routes to catch a Pokemon, even exploring new areas with a new perspective, converting their daily commutes into adventures. Pokemon Go is based upon a simple game of treasure hunt, however digitizing the game made it's contents dematerialized and infinite, giving scope to infinite number of players to participate [11].

The fulfillment of Pokemon GO opened doorways and incentives to many investments in Geo AR gaming and location-primarily based AR use in general. That is why geo primarily based augmented reality apps may be determined in numerous sectors: entertainment, navigation, retail, tourism, communication, actual estate, and more [11].

Similar to Pokemon GO, there are other Geo AR applications that do not rely on any pre made markers or any sort of custom establishment. It has the flexibility of setting itself anywhere. Hence, virtual programs that can expand the opportunities of traditional applications in phrases of adaptability, flexibility, and temporal, except the interactions of users leaves no mark of its

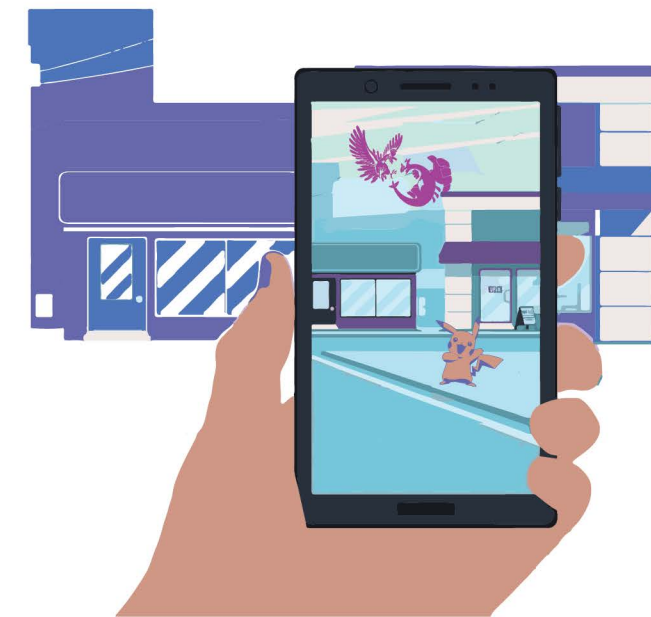


Fig.12 : Geo AR augmentation demonstrating Pokemon Go

Augmented Virtuality & Urban Design

existence. It determines human behavior from an invisible layer upon the city fabric [12].

These virtual applications has integrated itself into the stacked layers that shapes a city: *physical environment* (natural and build structures), *physical infrastructure* (logistical and economical supply), *physical programs* (architectural and urban), along with the digital iterations of the physical: *digital environment* (google maps), *digital infrastructure* (the Internet, radio, cellular networks, televisions, etc), and *digital programs* (AR apps like Pokemon Go). These digital programs enhance the physical forms not by visibly changing form, rather it is niche by participants with the help of mobile devices or other peripherals [13].

Any new virtual program introduce new sets of potential interactions and determine public behavior. These programs can integrate themselves into the urban experience - like with social media we carry friends and online communities, mobile games as alternate realities and navigation services that accumulate previous user experiences and generate a more personalized urban atmosphere.

From the game Pokemon GO, the random placement of the Pokemon within cities all over the world has contributed a new spectrum to any sort of designers' perspective. The app converted mundane locations into interplay hotspots among the two physical and virtual worlds.

These interface or mediator perform as the bridge/connection between both the realities. However, it does not completely transforms or modifies the two worlds, rather the digital is complimented by the actual and the actual is complimented by the digital. As a result, our notion of the surroundings perception is widened via way of means by the interface [13].

Virtual and augmented realities would soon evolve to simulated situations and interactions as a layout and a mode of interaction, that would integrate as a vital part in the urban infrastructure [13]. They are potential non-static communication tools and simulators that could get us closer to a time-space related reality than just a two-dimensional scenario.

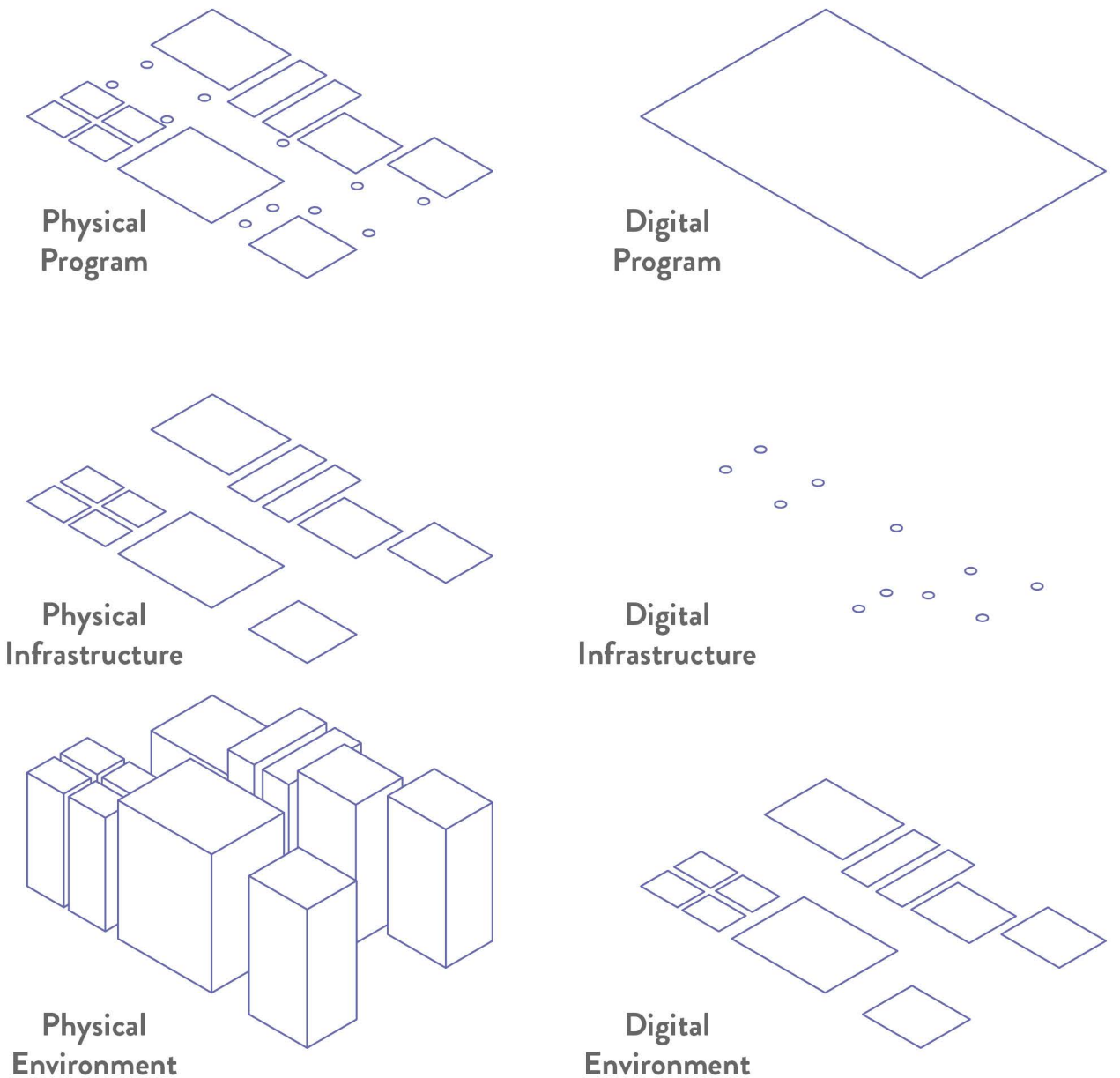


Fig.13 : Illustration of building facade enhanced by Augmented Reality

2.6 Spatial Experience

As mentioned earlier, mixed reality is becoming very popular among various industries that it will be substituting flat media in the near future. After seeing the influence of AR games like Pokemon GO upon existing urban system, many designers and developers are investing in this new technology. As computer technology is advancing, spatial computing is able to expand towards consumer market, hence more digital programs are able to integrate into our daily lives, getting us closer to a time-space related alternate reality than just a two-dimensional scenario.

Spatial Experience is a conceptual study by Fadi Chehimi explaining a three way experience where users inhabit through various digital forms, extending their human perception to actively participate and explore it [15]. His research enlightens the concept on how it is extending our perception further to 3D realms where our senses are continuously engaged with the cyber spectre [15]. To design such spectrum where human senses are engaged on psychological and physiological levels, designers need extensive ways of thinking of the context-of-use and deeper empathy with people [15].

To design with spatial computing, Chehimi has ruled out some key factors to observe in order to help organize the mindset of designers when creating experience for virtual worlds: Mixed Reality (MR), 3D Web, or the Metaverse. Something with the goal of immersing people's complete sense of the digital world and make them engaging participants [15].

There are 3 predominant elements in designing: *Perception Design*, *Spatial Experience*, and *Participant Experience* [14].

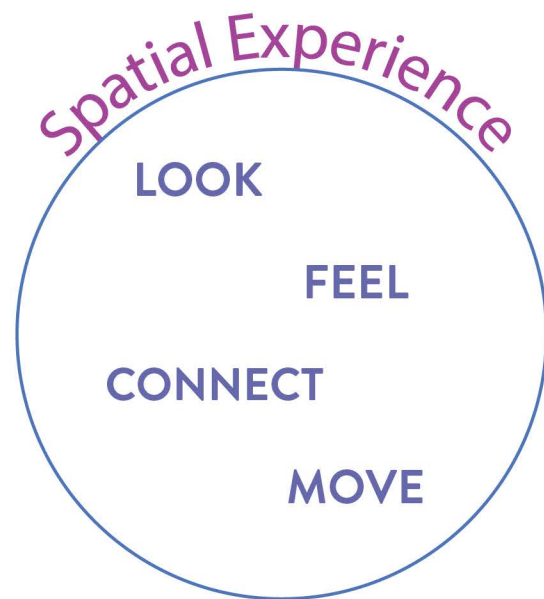


Fig.14 : Key words to Spatial Experience

Perception Design:

Perception design is a fixed set of ideas that concentrate on the physical, behavioral, emotional, and cognitive factors of the human notion to create intuitive spatial experience for participants in this cyber worlds [14].

Spatial Experience:

Spatial Experience is a three way experience where users inhabit through various digital forms, extending their human perception to actively participate and explore it [14].

Participant Experience:

For participatory experience, designers need to transact their focus from user experience to inhabitation, switching the design attention how participants would inhabit the synthetic spaces [14].

According to Chehimi for efficiently designing, mimicking natural human perception of acknowledging the physical world is considered when design the virtual world too [14].

To achieve this, here are five parameters to consider:

- multi-sensory signals – expectations
- innate emotions – familiarity
- intuition and past cognitive memories - intuition
- personal and social behavior – experience
- acquired motor skills - anatomy

Key note at the end, designers cannot literally design an experience, but they can by considering the corresponding factors and parameters, and using them as an exploration tool to design a dynamic digital experience [14].

2.7 Spatial Experience Ladder

Extracting all the information from chapters 2.5 and 2.6, I would present my first concluding question:

“Can designers extend their mindset from questioning ‘how users would use’ the design to ‘how they would inherit it?’”

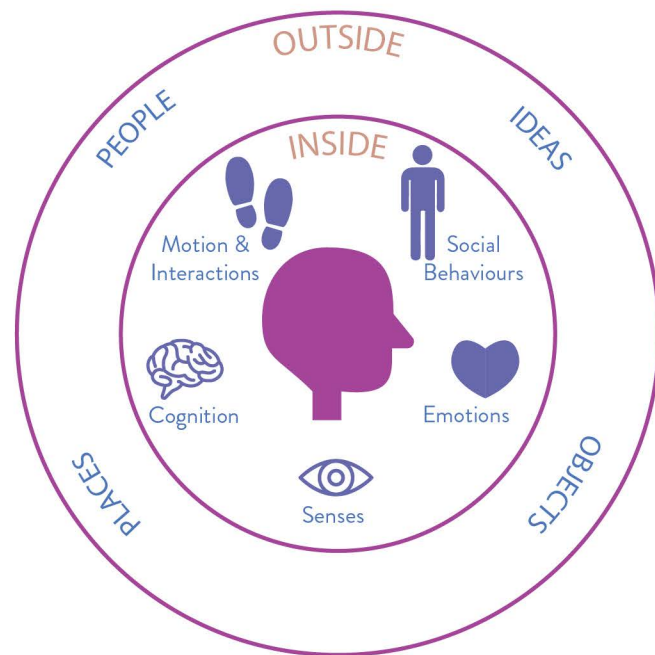


Fig.15 : Core framework of Spatial Experience Ladder

To design efficiently, Chehimi mentioned that mimicking natural human perception of acknowledging the physical world is considered when design the virtual world too [14]. So, to immerse people into the digital realms, we consider the facts that participants would inherit and interact using their physical, emotional, sensorial, social, and behavioral systems [15]. Their perception are also determined by several external parameters like people, places, ideas and objects [15], which all are predetermined by the physical world.

Fadi Chehimi organized all the factors into a framework that helps designers categorize the type of experience they intent to incorporate. He labels this as the Spatial Experience Ladder [15]. He describes it as a scaling system that could be used as an exploration tool to set the degree of immersion the participants would experience [15].

In this ladder, there are four categories: *Interactive*, *Emotional*, *Immersive* and *Presence*. Each category has its own set of parameters of Perception Design (motion, emotion, senses, social and cognition) and all the categories are arranged in a levels set on top of the previous one. Meaning,

the higher levels converts the user experience into participants inside the spatial design.

Interactive - it is meant to only expose richer information through the user’s fixed point-of-view with higher visual fidelity [15]. This has less cognitive requirement and often limited by the field of vision [15].

Emotional - focuses more on the psychological and social aspects of human behavior heavily on creative capacities like, visual designs, 3D contents, ambient environment, and spatial audio [15].

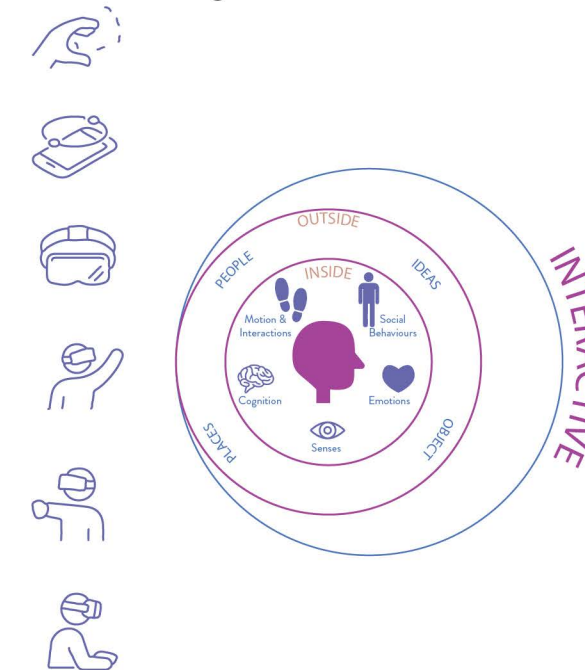


Fig.16 : Expected level of influence: low sensory manipulation, small cognitive processing, low motor processing, and low inspiration needed. Almost no social interaction and no emotional simulation

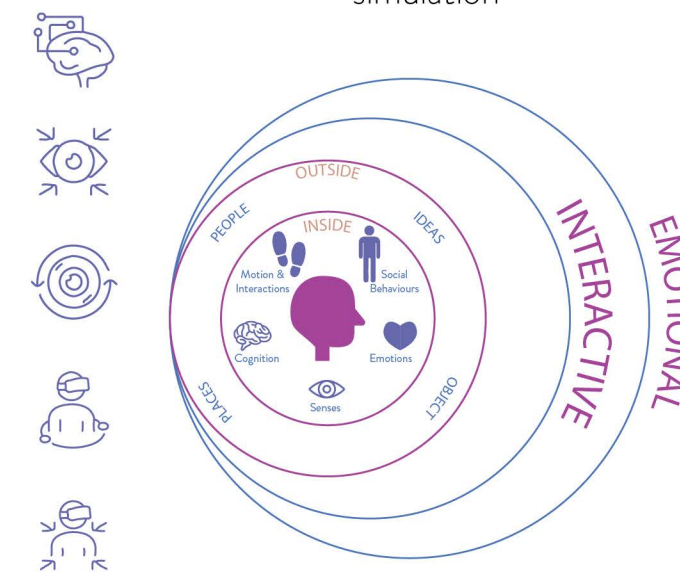


Fig.17 : Expected level of influence: high reliance on evoking emotions and inspiration, medium social and sensory input, and low dependency on cognitive and motor processing

Spatial Experience Ladder

Immersive - range at which once censorial channels are substituted and engaged with simulated cues. Interaction, social, emotional stimulation are all parts of immersion [15]. This leans more towards the technical aspect than creativity like Emotional level [15].

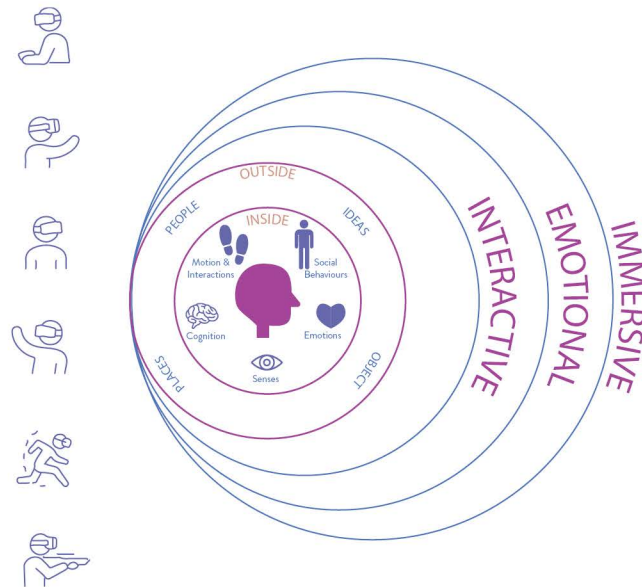


Fig.18 : Expected level of influence: full reliance on evoking the senses, high cognitive and motor processing dependency, medium emotions and social input and low inspiration needed

Presence - it is the degree at which the brain suspends any disbelief of the censorial substitution and accepts them as real. Immersion is the precursor to presence [15]. At this level, all the previous levels compliment each other to achieve this level of experience.

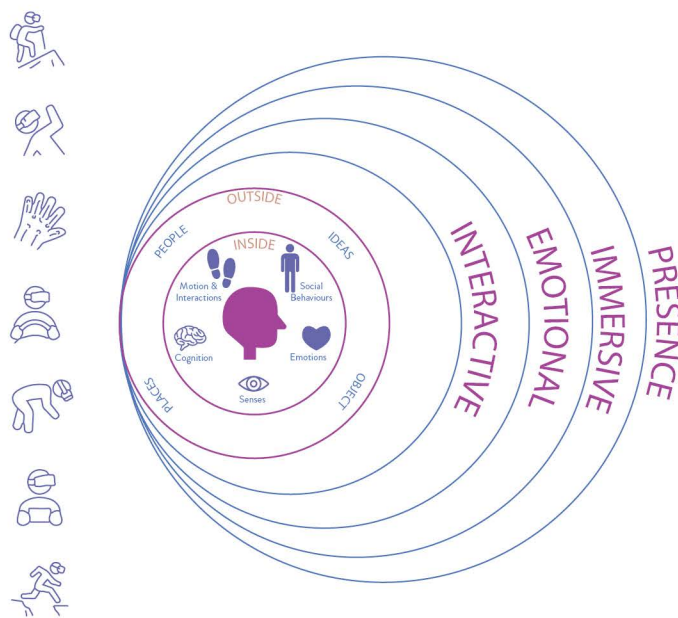


Fig.19 : Expected level of influence: full dependency on inspiration, emotions, senses, cognition and motor skills, and high reliance on the social factors

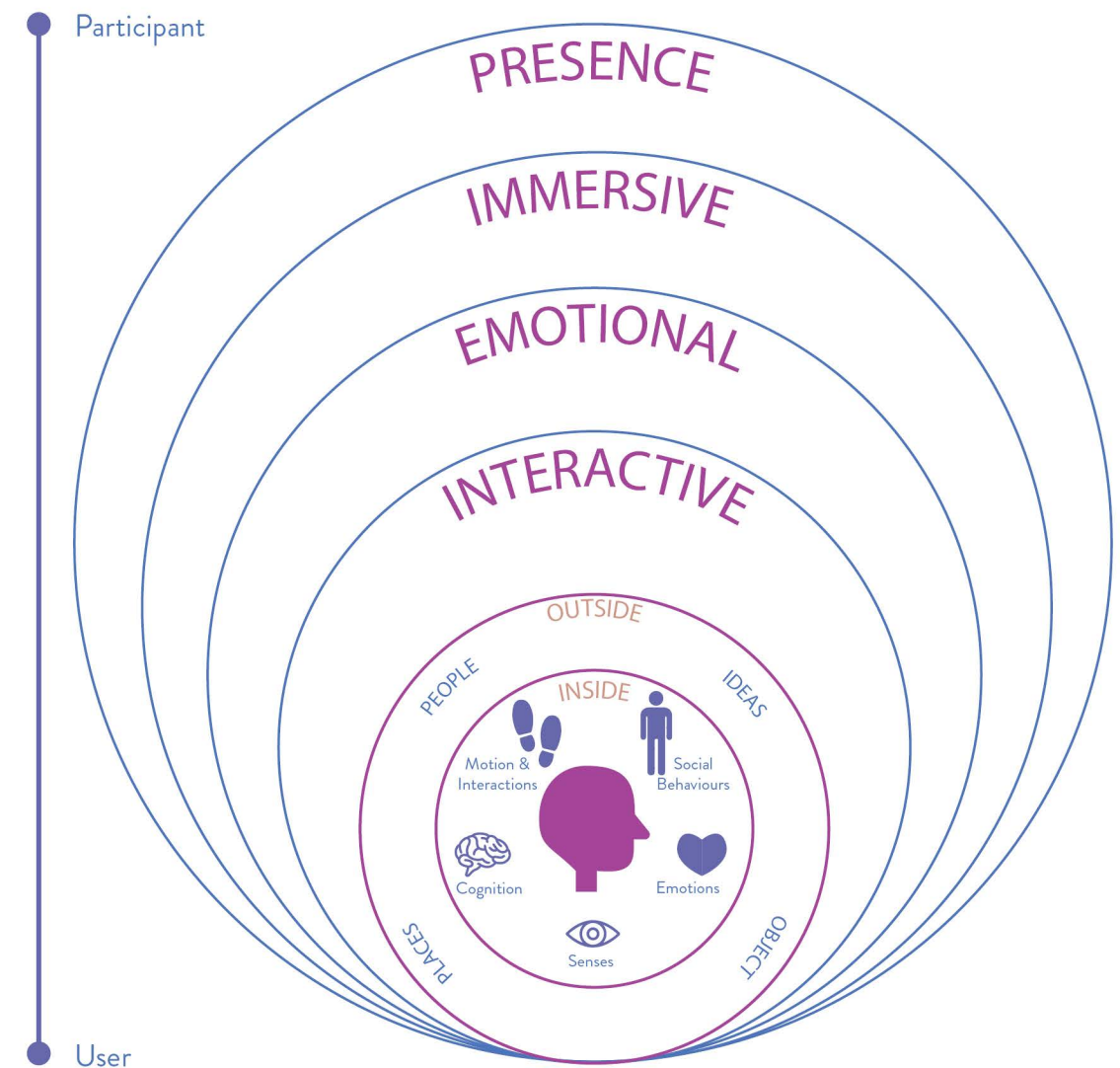


Fig.20 : Spatial Experience Ladder

As noted by Fadi Chehimi, Spatial Experience Ladder is meant to categorize user experience rather than measuring the immersion [15]. The whole chart is used as an exploration tool for designers to induce the expected parameters in order to achieve the intended experience level [15].

This tool is still being perfected by the author, but he mentions how the tool is gathering influences from others like film industry, video games, advertising, theatre and architecture [15].

2.8 In Search of New Public Domain

Using Spatial Experience Ladder to design and compliment an existing urban context, it is necessary to understand the dynamics of urban systems. Chapter 2.5 mentions about how virtual and augmented programs may evolve to simulated modes of interactions and navigation in the urban system. It also has the potential to be part of the design parameters in future urban arrangements.

'In Search of New Public Domain' written by Marten Hajer and Arnold Reijndorp, is integral to this research. The text explains the numerous design discourses that can be used to produce a successful *public domain*.

A public domain is a category of public space where exchanges of different forms of cultural/social activities harvest.

Here are some relevant information that can reflect to the research are:

- **Public space** - public spaces is in essence a space that is freely accessible for everyone [16].
- **Public sphere** - public spheres are the arena where individuals gather under similar will or interest and which could lead to future society. It is where we encounter the proverbial other and our opinions are open to others behavior, ideas, and preferences [16].
- **Public realm** - public realm is the sphere of social relations going beyond our own comfort zone and stepping towards exploration. The idea of the public realms is to harvest with ideas to aid individuals who are eager to connect through experiments, adventure, discovery, surprises [16].

Also there are four key concepts that reflect on this research: *Theming, Compressing, Connecting & Framing*.

When designing a public area, there are numerous features that spark various casual events and programmed in such ways that protects these events from any such intervention [16]. Throughout the text, the authors talk about how people consume and improvise public spaces. The concept of *theming* is mentioned as it focus on creating places meaningful to specific groups and mark these places as 'spheres', which implies how a space can develop to its own meaning without the need of architecture. This concept is mentioned by the authors and encourage designers to think critically when designing public domains.

Public spaces often assume the ability to break certain codes. When a place includes some of spheres, one set can also additionally dominate the other, even as any equal time, the opportunities of various operations (or expressions) are preserved [16]. The concept of *connecting* is implied as it emphasize the cohesion among different spheres. This relates to the wide influence of Pokemon Go and how people started utilizing public spaces into a newer form of public domain. Meaning, the already existing spheres in public spaces have to connect with the new sphere of Pokemon Go in a

provocative manner. Other form of connecting is seducing. As more programs will enhance public spaces with the integration of augmented reality, designers can contribute to a connection that makes it possible to consider oneself conversant with the cultural dynamics in different spheres.

With the trending culture of the metaverse and immersive media, there is the potential to develop newer forms of public domains as newer forms or minority group will emerge and the concept of connecting will help designers to bring the cohesion with existing minorities that will start to express their interests differently, just like Pokemon Go as an example.

The production of means of public space generally takes place in the chaotic space between domination and in exchange with different companies and activities. Thus, a successful public space requires an extremely strong organization, without its position leading to exclusion and repression [16]. The concept of *compression* is used here as designers need to know which elements would be complimentary among groups. As the word defines, compressing would imply the activities or spheres would connect cohesively in close proximity, meaning some parts are intertwined and not clearly separated.



Fig.21 :Pokemon GO players in public squares and parks

Public domains have three characteristics: Social Community, Cultural Identity and Geographical Community. Social community and cultural identity talks about similar factors of how minorities collectively form in urban arrangements and dominate public spaces. According to the authors that is how public domains are formed when people of similar interests share activities which result to attracting more people of different minorities and collectively take part in their own activities.

So, in order to acquire the social cohesion among the opposing bodies, cultural geography talks about the technical and functional spatial orientation of space and neglect all cultural construct of the place that is already designed with it owns meaning [16]. This is another way to imply the concept of *theming* as it emphasize the spatial orientation of spaces to demonstrate it's own meaning.

In Search of New Public Domain

With cultural geography, there is a noticeable relation with mixed reality and its capabilities of integrating into the discourse of designing public domains. As cultural geography talks about the interrelationship of places and non-places and how it is accepted by the consumers, for the cultural meanings of locations produced which isn't in reality decided through the architects, however through the customers and as a result, we will possibly attain a greater sensible view of the means of those new areas as public domain [16]. These are the noticeable dynamic capabilities of mixed reality that can help explore newer forms of public domains.

Followed by the inter-relationship of places and non-places produced by the consumers and the variety of cultural influence that can inhabit within a proximity (compressing and connecting concepts and implied to this text), would create a network society - forming a new metropolitan by connecting the urban, rural and suburban environments that is seemingly structureless accumulation of functions [16].

Last concept to note are fences which is the literal definition to the concept of *framing* which mean an indicator of categorization of specific activity in public spaces. So it helps shaping public spaces for social interaction and devising a visual representation. Framing is a overall concept holding three more concepts - theming, compressing and connecting. The authors of the text demonstrates framing as different 'safe' public spheres within parks where corresponding groups all have their own and ample visual connections among other groups.

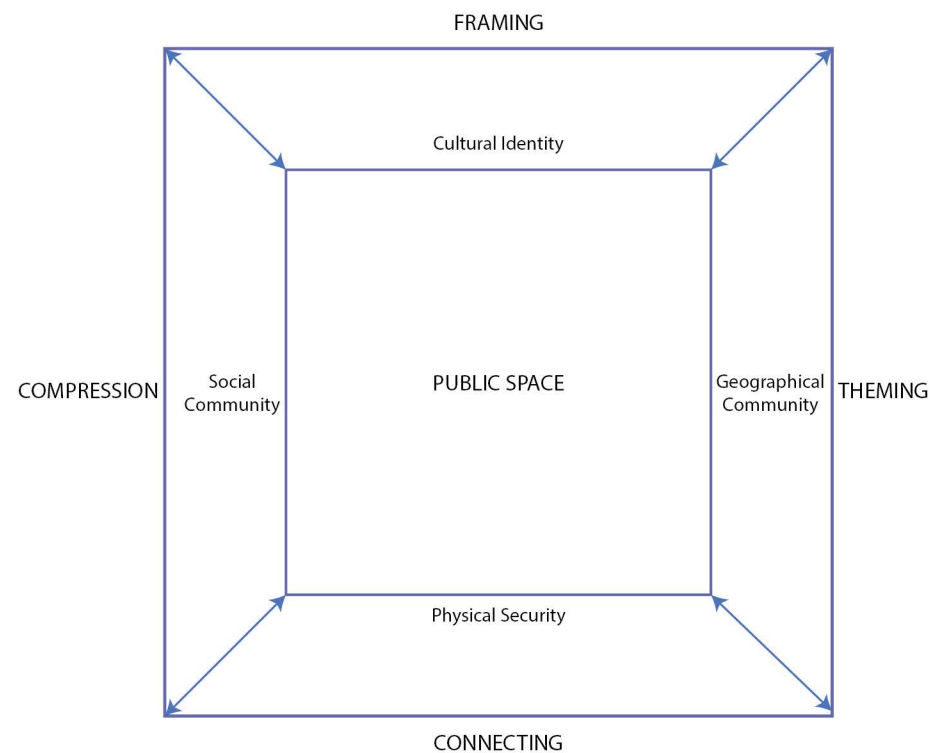


Fig.22 : Fencing demonstrating literal meaning of framing

To end this chapter, I have come to my second concluding question:

‘Can mixed reality create new or enhance social cohesion among different communities upon an established urban platform?’



Fig.23 : Fencing demonstrating literal meaning of framing

2.9 New Public Domain with Spatial Experience

Finding the answer to the corresponding question has become the objective of this research. To my speculation, introducing mixed reality to the design discourse of a public domain can produce interesting results with possibilities of designing a virtual space. Using mixed reality as a design strategy, we can create newer forms of interactions and storytelling in a more broader aspect, securing stronger social cohesion.

Chapter 2.7 (Spatial Experience Ladder) can be the guiding tool to help set the level of immersion we choose for the participants to experience. We see the possibility of mixed reality incorporated into public spaces by Pokemon Go, but according to the Spatial Experience Ladder we can rule out that the game only reached the first level of the ladder (interactive). So the objective of this research is to design an experience to reach full capacity of SEL "Spatial Experience Ladder" and following the methods how Pokemon Go has achieved with public spaces, Chapter 2.8 (In Search of New Public Domain), can aid in setting the foundation/platform to design upon. To entertain this idea, we can use the parameters of SEL (interactive, emotional, immersion and presence) as the base tools of the experiment and use the key concepts of a public domain (theming, connecting, compressing and framing) as the guiding tools of the experiment. Note before, that this is my personal observation and reflection upon two opposing frameworks that are from independent field of study.

To begin, the concept of *framing* is used to set the perimeter of the installation. Adding the concept of *connecting*, as mentioned in previous chapter, connecting could be done in two ways: seductive or provocative, to blend with the context. To do so, temporary fences can be installed that will have projection based AR with the parameter of *interactive* to perform as a welcoming part of the design.

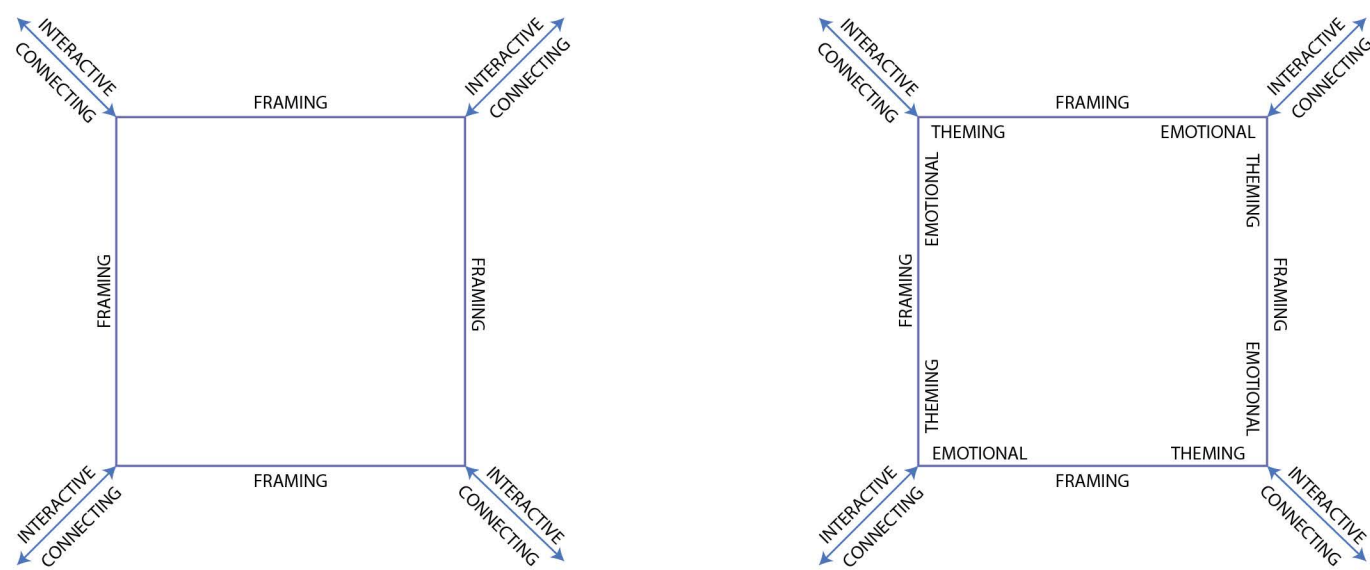


Fig.24 : (L) Framing, Connecting and Interactive set as first stage to the chart
(R) Theming and Emotional are added as the second stage to the chart

Inside the frame, we can apply the concept of *theming* with design and arrange the level of immersion: *emotional*. Aiming to match theming with emotional is to encourage spectator to participate in the designed experience. This could be done so learning about the locals and their interest and what limits their activities, whether socially or economically etc.

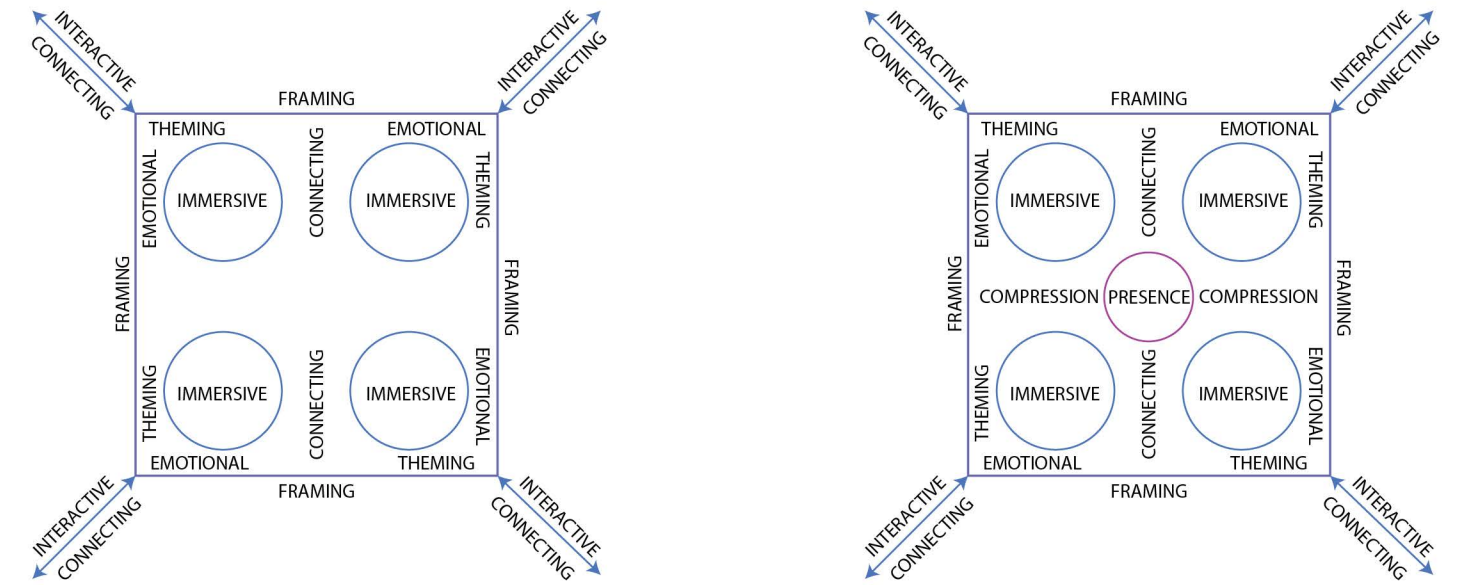


Fig.25 : (L) Immersive and Connecting are added as the third stage to the chart
(R) Compression is added as the fourth stage to the chart, achieving Presence

The dedicated spaces can be arranged in a way catering to locals' interests and spectators can participate in their desired way. Grouped spaces can be dedicated for different kinds of activities, creating sub-themes that contribute to the global theme. The *immersive* level (third level of SEL) can be incorporated to each grouped spaces to let spectators experience according to the sub-theme, for example each space can dedicated to different activities but all under one theme. Spaces could have their own bubble literally or boundary that do not overlap others. I believe these physical conditions could help set the immersion levels to the desired parameters.

Setting the immersive scale independently to each grouped spaces would result to the immersion to break constantly when participants move from one space to another. This is where I believe the concept of *compression* fit the role to set the cohesion among the grouped spaces. Connecting will also act to set the bridge among the groups, seducing spectators to each spaces, maintaining a steady traffic flow. We can set tunnels or a sort of path that can project augmented transition of one space and the next, keeping the participants engaged.

To my understanding, maintaining all three concepts (connecting, theming and compressing) and all three parameters (interactive, emotional and immersive) within the set parameter (framing) can possibly result to achieving *presence*, the final level of SEL. Making spectators convert into participants as they experience to be inside a walled garden and also by the help of the physical

New Public Domain with Spatial Experience

settings, can disconnect them from existing context. Maybe one can entertain the idea of my strategy of designing a public space combining with mixed reality, considering my speculations that could possibly help in the future. The strategy that I explained here is intended by my opinion of using mixed reality as a enhancer to harbor social connections.

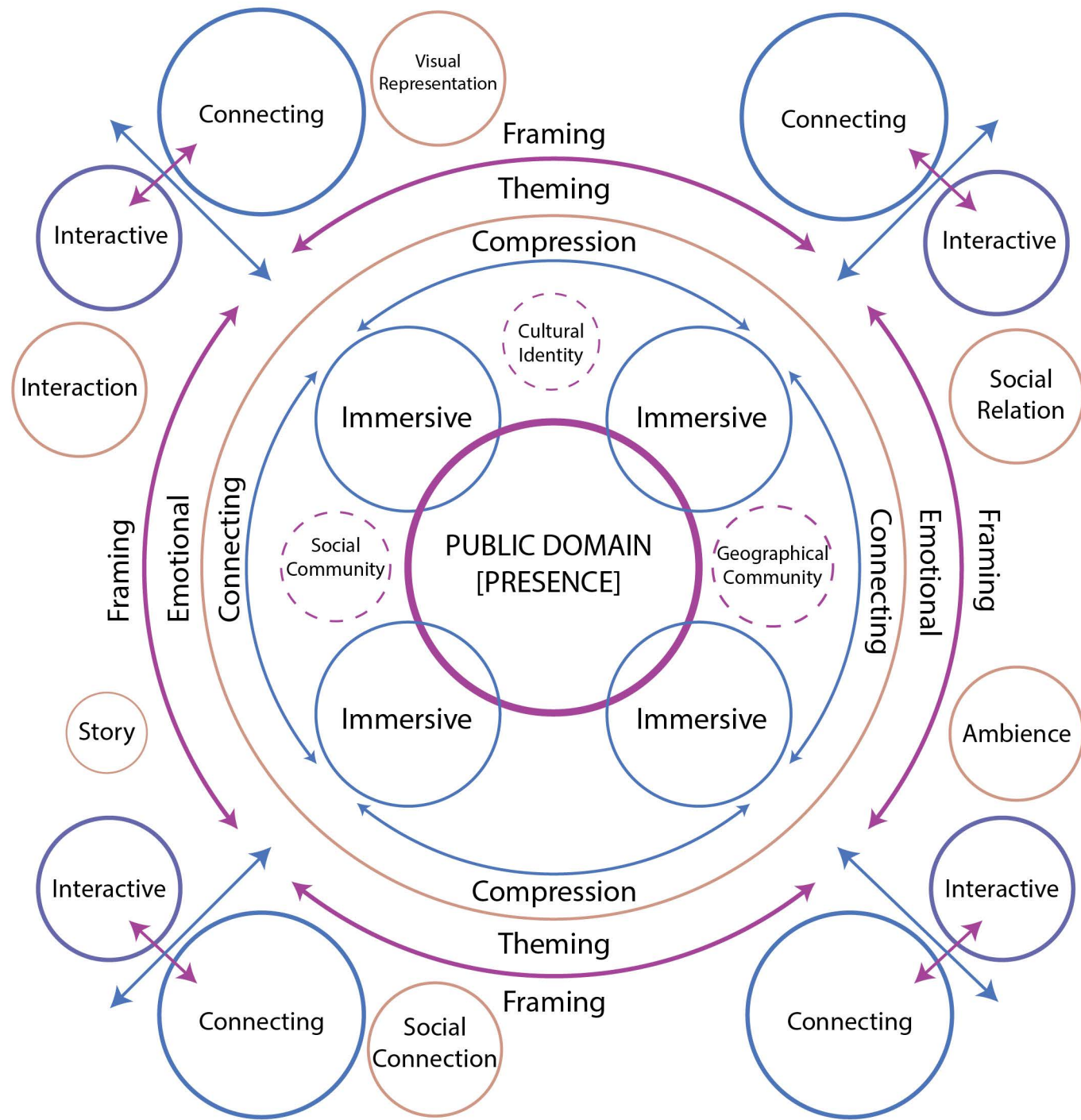


Fig.26 : Chart demonstrating the combination of features between Public Domain and Spatial Experience Ladder

3.0 Reflection

By theory, achieving *presence* would indicate that the participants are under complete immersive experience. I believe this would also indicate the participants understanding the true role of a group expressing their identity in a public domain. A successful public domain needs an expressive group without the group losing its ground of its acclaimed space in that domain [16]. The elements (*social community, cultural identity and geographical community*) that consist in the concepts of a public domain will help the participants express their activities in the designed domain.

Social community defines the social interaction among groups. Looking into Spatial Experience Ladder, *interactive* tells how mixed reality can be used to create social communication among participants. Hence, create new methods of communication among groups.

Cultural identity defines how groups express their interest and heritage in forms of storytelling. With Spatial Experience Ladder, *emotional* seems to resembles as it is comprise of storytelling to capture the psychological aspect of the participants. Hence, mixed reality could create new ways for participants to capture the emotion of the spectators, contributing to better meaning to their own grouped space.

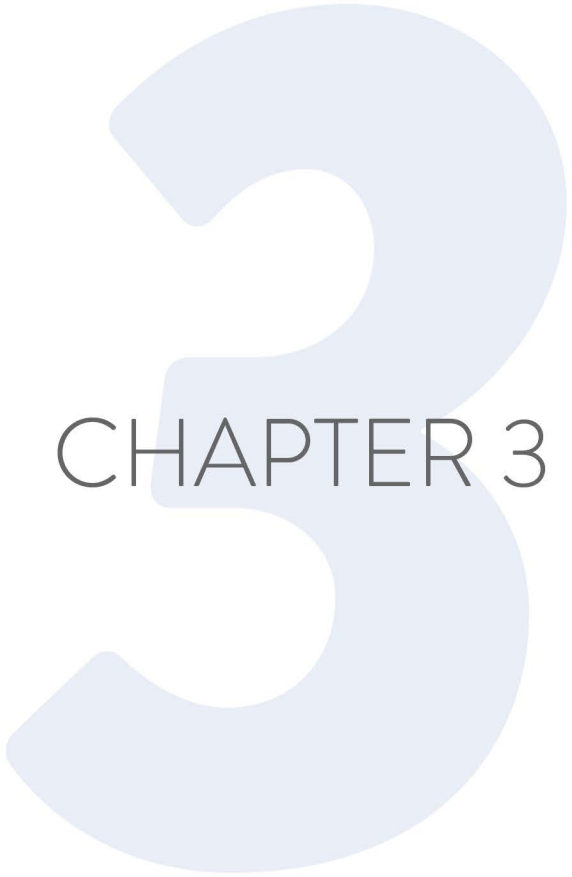
Geographical community explain the inter-relationship between spaces and non-spaces. It is the bridge of presenting the meaning of tangible spaces expressed by the participants. Meaning that geographical community is the by-product of social community expressing the participant's cultural identity set within the allocated space. Similarly, *immersive* is the upper level which can be achieved after *interactive* and *emotional*. So, to demonstrate geographical community with mixed reality, could lead to more dynamic forms of art enhancing the allocated setting, that could capture the attention of the spectators and bring more meaning to their space.

Therefore demonstrated in the chart to the left, the connection between Social Community and Cultural Identity could result to newer social cohesion and connection between multiple groups.

The chart shown to the left is not meant to be used as a direct tool for designers rather to explore the inter-relationship between the subject and objective pointed in this research. It can be used as a guiding tool to design a public space and set the intended parameters to make the participant experience the features of mixed reality.

Following from the accumulated contents, I come to my third concluding question:

**'How can mixed reality be treated by architects and designers?
Will it introduce new strategies in conventional design process?'**



CHAPTER 3

PRECEDENCE

3.1 Introduction

So far the thesis progressed to have a subject, exploring new design strategy for public spaces, and a corresponding research objective - enhancing public spaces using mixed reality with the help of Spatial Experience Ladder.

In order to make a tangible conclusion, the gathered contents need to be evaluated through experiments. From Chapter 2.4 (Virtual Programs and Urban Design), speculating how an AR game has impacted upon the urban horizon, shows the potential of the technology and game development can enhance modes of interactions among humans in urban arrangements. Seeing the gaming industry has convinced other industries like tourism, education, entertainment etc, to invest in the technology. Hence, architecture or urban design are deemed relevant as the technology relies upon physical spaces to operate. As the subject of this research is to explore how architecture can be deemed to relation to mixed reality, experimenting in that discipline seems reasonable.

To continue, the need for precedence study is to acknowledge past design methods can help navigate the research process. Since mixed reality is still in 'test the waters' approach, there might/ (not) be any present architectural project. Hence, the projects selected for the precedence study are historical projects that have influenced/introduced high-tech architecture.

The projects suitable for this thesis are within the styles of futurism, modularity, digitalizing and deconstructivism. Architectural projects by Archigram are convenient to this sort of design exploration. Also, architectural concepts by Late Cedric Price contributes too. The selected projects are presented from next page.

3.2 Instant City by Peter Cook



Fig.27 : Architectural diagram of Instant City by Peter Cook

Instant City (1968-70) by Peter Cook

Instant City was an approach to philosophical dilemma concerning architecture. It is the first example of network architecture, even before the birth of the Internet. It is a type of architecture that transform a space into a situation and a reactive built environment. Peter Cook developed the idea with a traveling metropolis, a package that temporarily infiltrates a community. It has parasitic characteristics with transportable kits that can be quickly assembled anywhere, making it a nomad, and provide the inhabitants of a remote town with access to materials and elements giving way to the image, and audiovisuals representation, to gadget and other environmental simulators to experience living in a large metropolis. To my understanding, Instant City was a early demonstration of cosmopolitan architecture, a city superimposes, for a time, new spaces for communication onto an existing city.

3.3 Fun Palace by Cedric Price

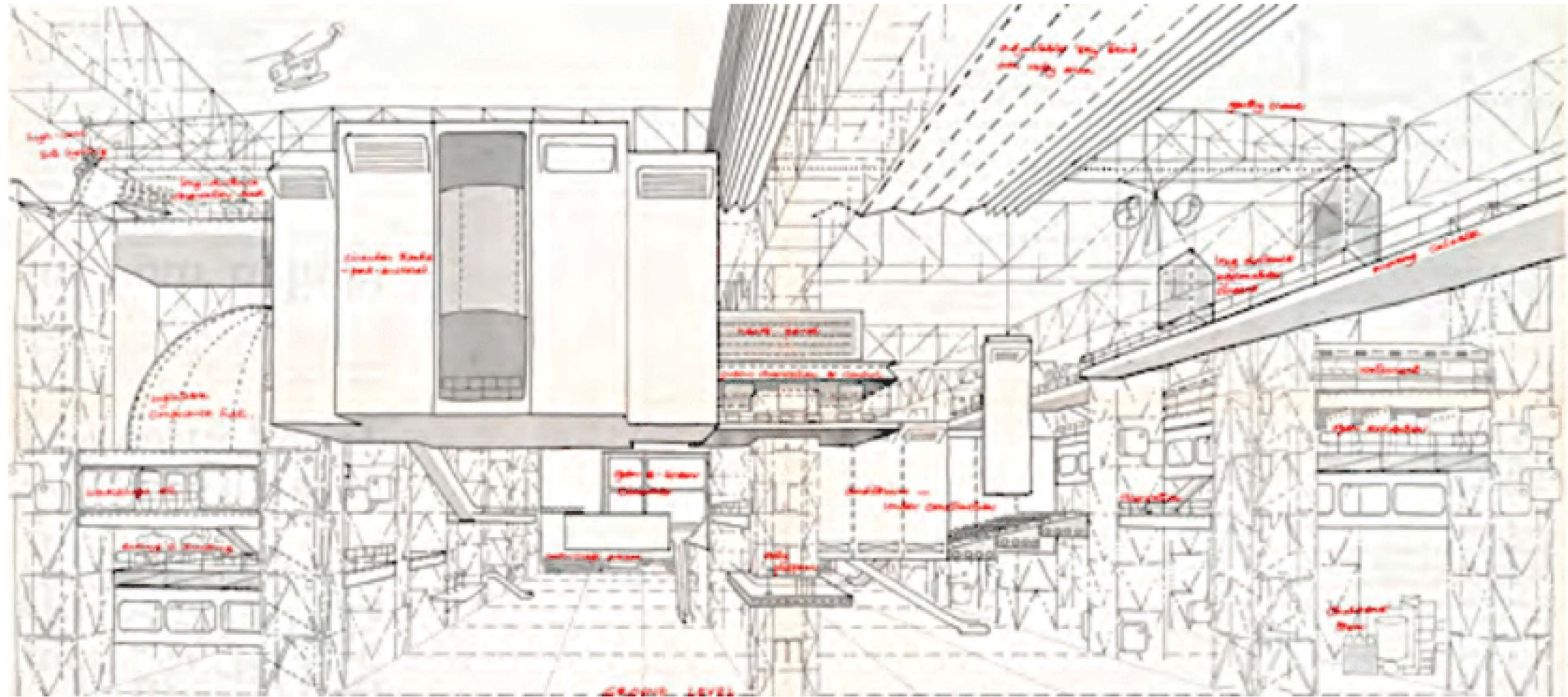


Fig.28 : Architectural diagram of the Fun Palace by Cedric Price

Fun Palace (1961) by Cedric price and Joan Littlewood

Fun Palace demonstrated a new field of cybernetics, game theory and computer science mixing with architecture. The thought process of making structures that could adjust according to different users inhabiting it. Making it an interactive and adaptable, educational, and cultural complex to be located in London. The operation of the structures are not constructed by time, meaning that the structure can shape shift for numerous users at any given time. The conceptual design developed to create a modular construction that could erect on any suitable site.

3.4 Plug-In City by Peter Cook

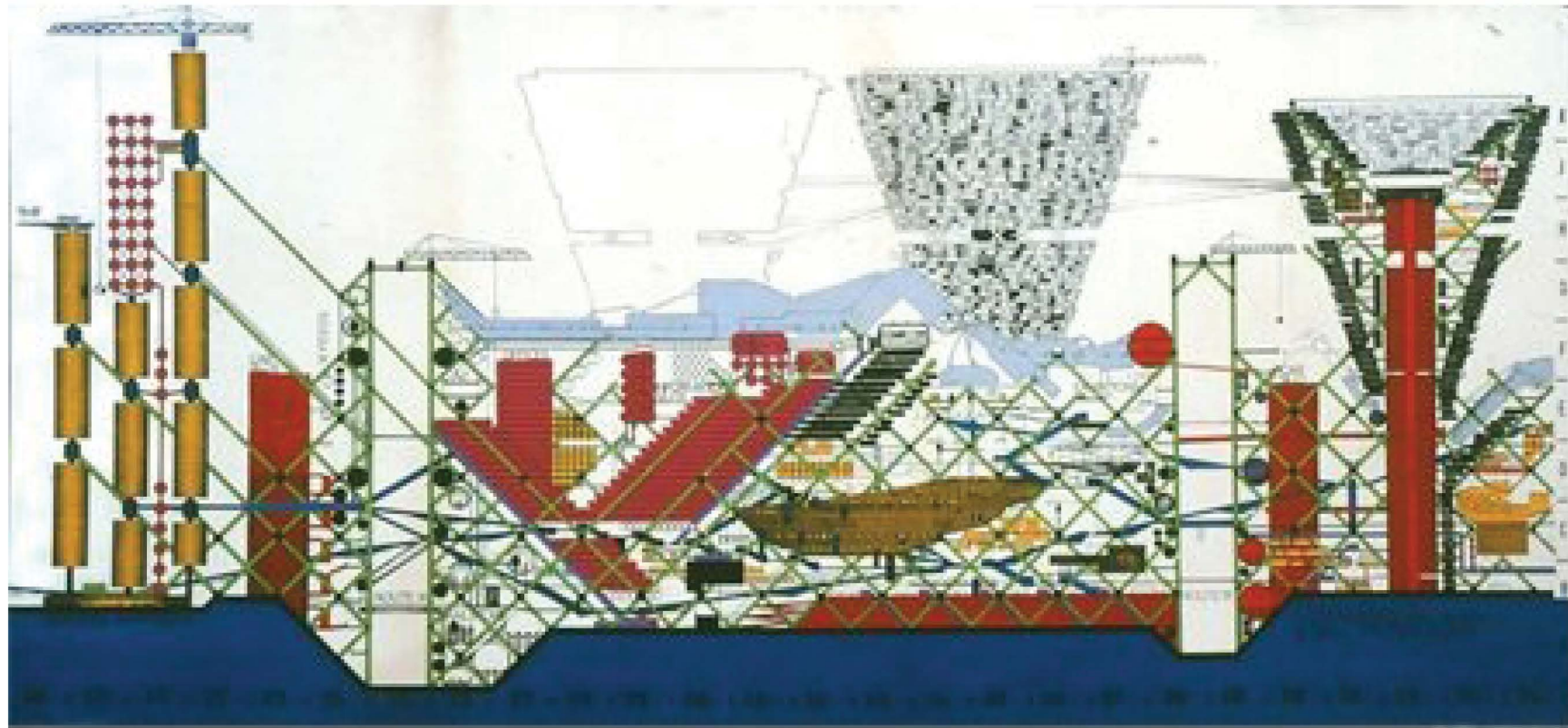
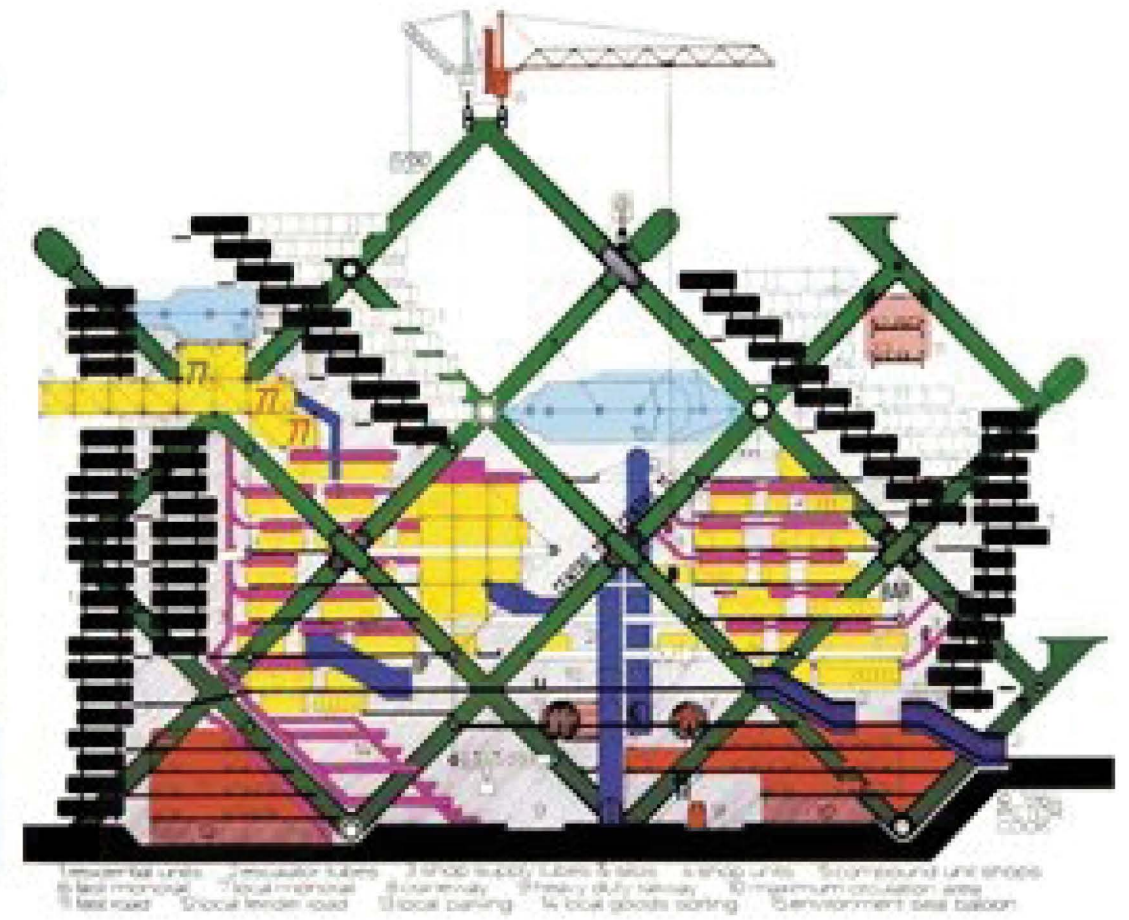


Fig.29 : Architectural diagram of Plug-In City by Peter Cook



Plug-In City (1963-66) by Peter Cook

Plug-In City demonstrated an avant garde concept of flexibility to home dwelling. Peter Cook illustrated the thought of users being able to expand or shrink their home according to their suitability. Capsule like structures that can easily be replaced by them when required.

3.5 Reflection

Looking into past works of Cedric Price and Peter Cook (Archigram), the similarities that is seen in such works are examples of avant garde architecture that has challenged the discourse of contemporary design. All the mentioned projects demonstrates the possibilities of animating structures that could shape shift according to user intentions, nomadic structures, thus, making architecture more of a situation than construction.

When collecting ideas from these precedents, I understood the limitations of these projects. All three projects were left conceptual because the technology needed to build were not available in that time. Even if the technology may now exist, the cost of constructing these projects are still too costly. However, the concepts of these projects did illuminate design ideas, which greatly contributed to architectural practice even today. A prime example is Center Pompidou in Paris, designed by Renzo Piano and Richard Rogers.

As a result, the research project intents on attempting to solve the obstacle that these projects faced, which is the limitation to the cost of constructing them. I believe with the help of mixed reality, dematerializing the architecture could be a fitting experiment to solve and continue exploring these concepts that was implemented by the former architects.

As mentioned in Chapter 2.9 (New Public Doamin with Spatial Experience Ladder) and 3.0 (Reflection), a case study is required for the design experiment of the thesis. The following hypothesis is based in order to correctly grasp the need of a case study:

‘How can we create a network society using mixed reality that focus on the immigrant group of a hosting nation? Emphasizing the subject group’s cultural identity and exploring new forms of social cohesion between two cultures.’

Elaborating the hypothesis, the idea of creating a network society is taken from Instant City by Peter Cook. The project talks about how it transforms a small town into a metropolis. Meaning the project itself needs to have a community as the subject and giving the opportunity to experience the lifestyle of another community, which is from the metropolis. Chapter 2.8 (In Search of New Public Domain) mentions that *having a successful public domain requires a spatial arrangement where multiple groups could dominate and exchange their activities among them [16]. Followed by the inter-relationship of places and non-places produced by the consumers and the variety of cultural influence that can inhabit within a proximity, would create a network society - forming a new metropolitan by connecting the urban, rural and suburban environments that is seemingly structureless accumulation of functions [16].*



CHAPTER 4

DEGREE PROJECT

4.1 Case Study

Following the hypothesis, a case study is set between Sweden as the host society and its second largest minority group, Iraq. The role is to survey Iraqi diaspora individuals and their perspectives of living in Sweden. The goal is to investigate elements that can contribute to the hypothesis.

Starting with a background, as of 1st of January 2021, Sweden is home to 147,000 Iraqis. Almost 30,000 people of Iraqis in Sweden today have migrated as a consequence of the Iraq war of 2003 to 2010. Most are Sunni Arabs and Assyrian Christians, Christian Iraqis. They are also the largest Asian communities in the country. Initially, Iraqis migrated to Södertälje, a city in Södermanland and Stockholm County. During that time, due to the large influx of Iraqi refugees, the city of Södertälje was called the 'Little Baghdad'. The city compliments itself for owning two Assyrian football teams, one of them having all players from Iraqi descendant. Gradually, most refugees have moved to suitable cities in Sweden and close to half the people moved to Sweden's third largest city, Malmö. People from 183 different countries live in Malmö. In 2021, there were 11,675



Fig.30 : Flags of Sweden and Iraq

Iraqis living in Malmö - 43% have a foreign background, with those with origins in Iraq making up the largest single group [17]. Almost all of the Iraqi citizens live in Rosengård - area located in the eastern parts of Malmö, located four kilometers away from the city center [17].

Even though it has been many years since the migration of Iraqi refugees into Sweden, the minority group still face slight social stratification and unfairness. Recent research paper by Önver A. Cetrez, Valerie DeMarinis, Maria Sundvall, Manuel Fernandez-Gonzalez, Luibov Borisova and David Teteöman on 'A Public Mental Health Study among Iraqi Refugees in Sweden; Social Determinants, Resilience, Gender, and Cultural Context', addresses the awareness of reduced resilience among individuals due to the lack of attention [18]. As defined by the article, resilience in someone are the characteristics that help flourish when adapting or comprehending to new context [18]. The article also notes that individual resilience is a particular resource that helps thrive in a culturally defined group and community context [18].

In order to gain social resilience, one should follow a society's value system and the system also acknowledge the individual under the integration process by providing space for the realization

and interaction among both cultures [18]. This could result to acculturation - having new attitude and behavior among the individuals in the encounter between two cultural groups and help coping with social and psychological conflicts like cultural clash norms, renegotiating gender roles and relationships etc [18].

The article concludes that the minority group does not show vulnerability to mental health, including P.T.S.D. However, study shows their vulnerability in some aspects like individual and long-term psychological resilience [18]. Among many, factors relevant to this research are *social networks outside the family are weak* and there is *inadequate awareness of managing post-migration needs of the refugee's for better acculturation process* [18].

To my understanding, acculturation is most effective when an individual is able to express their characteristic in a society which constricts them into anonymity [16]. For it to occur, one should gain social resilience, following that society's value system and the system should also acknowledge the individual under the integration process by providing space for the realization and interaction among both cultures [18]. To understand this and investigate the factors that can help an individual gain social resilience, a number of interviews were conducted.

4.2 Case Study Interviews

The following questions are set for this thesis. The questions are set upon the Iraqi Swedish citizens living in Sweden. So far five interviews were conducted on people of different ages ranging from 20 to 60 years. The role of the question are set to explore the cultural integrity of the Iraqi-Swedish citizens living in the Swedish social context. Followed by gathering insights on their cultural traditions followed in their home country.

Among all the interviews gathered, three of them are presented to this thesis. The three participants have migrated to Sweden in early 2000s, during the Iraq war first broke out. First participant migrated at a very young age, so he is well adopted to the Swedish culture more than of Iraq due to geographical context. The next two participants are an old couple (man and wife) who migrated together to Sweden. All three participants initially lived in Malmö, but the young participant is currently living in Lund for higher education and the couple has moved to Flen in Södermanland County.

Here are the questions presented for the interview:

1. Do you visit Iraq? Where do visit in Iraq?
2. Could you list 5 things you like about Iraqi cities?
3. If you could build a part of Iraq, what would you like to build?
4. What is your favorite part of the Iraqi culture?
5. What is your favorite Iraqi cultural event?
6. Do these events celebrate in Sweden?
7. How do you feel about social dynamics between Iraqi and Swedish people?
8. Do you feel there is a lack of social understanding with Swedish people?
9. Are you able to express yourself to a Swedish and an Iraqi person equally?
10. Like Iraqi-Swedish football players, what other activity do you think Iraqi people would excel in?
11. Name things you think people of Swedish would love about the Iraqi culture?
12. How do you wish to contribute to the Iraqi community living in Sweden?

First interview presented is **Abdulla Salman Ramez (A.S.R.)**. He is born 1998 in Baghdad. Lived in Zayouna and after 6 months of his birth moved to Libya. He moved to Sweden in 2003.

1. Do you visit Iraq? Where do visit in Iraq?

A.S.R.: *I visited Iraq 3 times so far and all of them were 3 to 6 months long trips. I am planning to visit Iraq soon in December.*

2. Could you list 5 things you like about Iraqi cities?

A.S.R.: *(1) Erbil Citadel, it was called the ancient round city; (2) Sulaymaniyah, for it's nature; (3) the natural retreats around the Kurdish borders filled with mountains; (4) Kirkuk city; and (5) Mosul old city. I also like the city life itself like the cafes as they are very family oriented and old architecture that is preserved. An example of it is the Al Rashid street.*

3. If you could build a part of Iraq, what would you like to build?

A.S.R.: *Every city! I wish to rebuild the history of Babylon. All because it is the pride of Iraq and it's culture. The strong history of culture, architecture and knowledge.*

4. What is your favorite part of the Iraqi culture?

A.S.R.: *Iraq has hyper diversity for the independent tribes and their influences. There is tribal clashes among them and have caused social and political imbalances. However, regardless of the differences of tribes, people still keeps the unity and help each other.*

5. What is your favorite Iraqi cultural event?

A.S.R.: *We have weddings and I love how we go crazy with the celebrations. Military day that is celebrated in Iraq, celebrating the pride of how the nation's military has strives throughout history. It is a one day event and people celebrate it outdoors on that day.*

6. Do these events celebrate in Sweden?

A.S.R.: *None happen in Sweden. I would like to have the festivities like Ashura. I love to have a food competing celebration in Iraq as Sweden loves Iraqi food. I would love to have that happen as it is full of energy and eating different food made by different groups or families.*

7. How do you feel about social dynamics between Iraqi and Swedish people?

A.S.R.: *I have lived my whole life living in Sweden and having Swedish friends. These friends are so old*

Case Study Interviews

that I do not how long we been friends. However, when I moved to Lund, I noticed how is takes more time and effort to make friends with the locals. It takes time to be close to them, I sensed them to be more laid back.

8. Do you feel there is a lack of social understanding with Swedish people?

A.S.R.: The social dynamics with Iraqi people are being instantly close and we tend to be touchy, but this kind of dynamics cannot be established with Swedish people and it takes time to form close bonds sometimes.

9. Are you able to express yourself to a Swedish and an Iraqi person equally?

A.S.R.: Friending with Iraqi people are easier and you can instantly have deep conversations. With Swedish people I sometimes face a bit of complexity but I love their patience and respect towards others.

10. Like Iraqi-Swedish football players, what other activity do you think Iraqi people would excel in?

A.S.R.: Taekwando would be fun to have as I see it currently trending in Iraq.

11. Name things you think people of Sweden would love about the Iraqi culture?

A.S.R.: Food is proudly loved here in Sweden. I believe this is the core strength to the social coherence among Iraqi and Swedish people.

12. How do you wish to contribute to the Iraqi community living in Sweden?

A.S.R.: Communally help and support my Iraqi Swedish community.

Second interview presented is **Nazik Alkualal (N.A.)**. Born 1958 in Najaf, Iraq and lived majority of her life in Zayouna, Baghdad. She holds a PhD degree in Genetics from Iraq. She moved to Sweden in 2003.

1. Do you visit Iraq? Where do visit in Iraq?

N.A.: I visit Iraq every two years, or so, and whenever I visit Iraq it's mainly Baghdad and Najaf.

2. Could you list 5 things you like about Iraqi cities?

N.A.: (1) The old city parts are the most interesting ones because of the local bazaars; (2) The Leisure areas, for instance in Mansoura, there are a lot of family activities or activities for younger people. The energy is vibrant and fun; (3) Almost all Iraq cities have either the Euphrates or Tigris flowing through them, therefore, there are a lot of activities you could do there, and I like the riverbanks; (4) The cemeteries, especially in Najaf the World's largest, where we visit our family members who lay there; and (5) The universities because I am very into academics.

3. If you could build a part of Iraq, what would you like to build?

N.A.: I would like to build the Al Rashid Street. I have many memories from there.

4. What is your favorite part of the Iraqi culture?

N.A.: It's the social customs. How people interact with you, invite you to their homes and the friendliness that lies behind those social customs.

5. What is your favorite Iraqi cultural event?

N.A.: Ashura in Karbala. Iraqi culture is mainly Islamic culture and Ashura portrays it very well especially for the Shia population.

6. Do these events celebrate in Sweden?

N.A.: There should be some Shia gathering for this in Sweden when it comes to Ashura. I haven't seen one where I live though.

7. How do you feel about social dynamics between Iraqi and Swedish people?

N.A.: Iraqis are way more talkative, extremely social, and very touchy people. The body language is very strong, whilst the Swedish people have almost none of that. Iraqis express themselves much more than Swedes. But I really like the social dynamic the Swedes have because it's based a lot on being calm and respecting people's privacy.

Case Study Interviews

8. Do you feel there is a lack of social understanding with Swedish people?

N.A.: *Of course. Nobody can relate to what we have been through in our history. Especially not the Swedes.*

9. Are you able to express yourself to a Swedish and an Iraqi person equally?

N.A.: *Equally, yes. Behavior wise? No. With Iraqis, you can jump into very deep conversations early on in your relationship.*

10. Like Iraqi-Swedish football players, what other activity do you think Iraqi people would excel in?

N.A.: *Iraqis have been very prominent in Swedish politics, academics, and media. This is very known here, and I think they excel quite well in those markets.*

11. Name things you think people of Swedish would love about the Iraqi culture?

N.A.: *This is a known fact between Swedes, they love our food. Also, our music is very popular here along with art.*

12. How do you wish to contribute to the Iraqi community living in Sweden?

N.A.: *Through academics.*

Third interview presented is *Muhannad Salman Ramez (M.S.A.)*. Born 1955 in Egypt, raised in Damascus and moved to Baghdad by end of 1960s. He was going through academical medical training, but later turned to Military Officer at the Golden Panzar Division. Lived majority of his life in Zayouna, Baghdad. Spent many years at different locations due to military operations. He moved to Sweden in 2003.

1. Do you visit Iraq? Where do visit in Iraq?

M.S.A.: *I have not visited Iraq since 1998. Planning on to visit in one or two years.*

2. Could you list 5 things you like about Iraqi cities?

M.S.A.: *(1) I like the historical areas and would answer as Nazik in the first one. The old city parts are vibrant, and contain a lot of history which I am interested of; (2) The educational areas, universities and intellectual gatherings that sometimes even occur on the river banks*

3. If you could build a part of Iraq, what would you like to build?

M.S.A.: *I would like to build the old city of Basra as it was the Venice of the East. I spent a lot of time there especially during my military service.*

4. What is your favorite part of the Iraqi culture?

M.S.A.: *The academic part of our culture. People put out stands in some parts of the streets but mainly by the riverbanks and they show off their poetry, or tell a tale which they have written.*

5. What is your favorite Iraqi cultural event?

M.S.A.: *I like the weddings, and Iraqi gatherings in general. They are cultural. However, Iraqi culture is based a lot on Islamic events, and I really prefer Islamic events. Nazik's answer was such.*

6. Do these events celebrate in Sweden?

M.S.A.: *Yes, the Islamic events are celebrated here but other Iraqi culture is very limited, especially where we live.*

7. How do you feel about social dynamics between Iraqi and Swedish people?

M.S.A.: *It's very easy for both of these groups to communicate with each other but I guess the Iraqis are better at spontaneous social situations than Swedes.*

8. Do you feel there is a lack of social understanding with Swedish people?

M.S.A.: Absolutely. Our social dynamics have been forged through thousands of years, and I do not think that Swedes can comprehend that.

9. Are you able to express yourself to a Swedish and an Iraqi person equally?

M.S.A.: In my experience, yes.

10. Like Iraqi-Swedish football players, what other activity do you think Iraqi people would excel in?

M.S.A.: I would say Iraqis would excel in any type of activity if they put in the time. Doesn't matter where you are from. However, Iraqis integrating in Sweden finds it easy to excel at many areas and activities.

11. Name things you think people of Swedish would love about the Iraqi culture?

M.S.A.: Swedes and Iraqis have actually been communicating since 1000 years ago. Vikings traveled to Baghdad frequently for trade, and many Swedes love this cultural interference. Many museums in Sweden have Iraqi gold or goods which the Vikings brought back. Therefore, I know that many Swedes engage in this cultural interference because it is very random and cool!

12. How do you wish to contribute to the Iraqi community living in Sweden?

M.S.A.: Academics.

4.3 Reflection

Interviewing all the participants has greatly contributed to my design ideas for the thesis. That is how the questions were devised personally for me, as I am fairly new to the culture and architecture of Iraq because of the war has nearly wiped out the country's existing history.

I also gathered a lot of interesting facts about the country like the history of Vikings traveling to Baghdad, hyper diversity among different tribes in the country, how there are academic cafes specially arranged for people to have intellectual conversations and Mutanabbi street where they only sell books of all kinds. From all the Iraqi participants, I noticed how much they value knowledge and how driven they are by curiosity. I had a lot of fun explaining them about my thesis and they were very keen to share their opinion on how I can express their culture in my project. This shows how rich in culture Iraq itself is and not dependent on the religious aspects.

Even though I am presenting three interviews to my thesis, I would like to mention some of the facts that I think is worth noting from other interviews. Firstly I noticed how other participants were hesitant with the social coherence that could be achieved in Sweden as they say Iraq has a barbaric history and some of the celebrations will be very difficult to portray here in Sweden. As majority of the country's religious following is Shia, their history is full of war stories. Secondly, the call for prayer is not appreciated in Sweden and almost all of the participants has mentioned about how much wish to have that in Sweden.

I believe there are some ways to enhance the social coherence among the two groups and that could be portrayed by small architectural arrangements, which would help harbor cultural gathering and celebrations, shared among the two groups. As there are some shared establishments among the two groups like food and music, I am optimistic that further social coherence can be achieved if we explore more about the cultural trends of the Iraqi people and present them to Sweden.

4.4 Design Intention

Taking notes from the case study, the research has evolved to investigate new forms of social resilience to help the Iraqi minorities. Hence, the degree project intends to augment part of a city in Iraq onto the site in Malmö using mixed reality. This is to help find more cultural mixing among the two nations that could enhance the existing social culture among Iraqi and Swedish people.

The design elements will cater to the level of immersion according to the spatial experience ladder. Some parts are augmented and some are virtual putting together a type of network society with mixed reality.

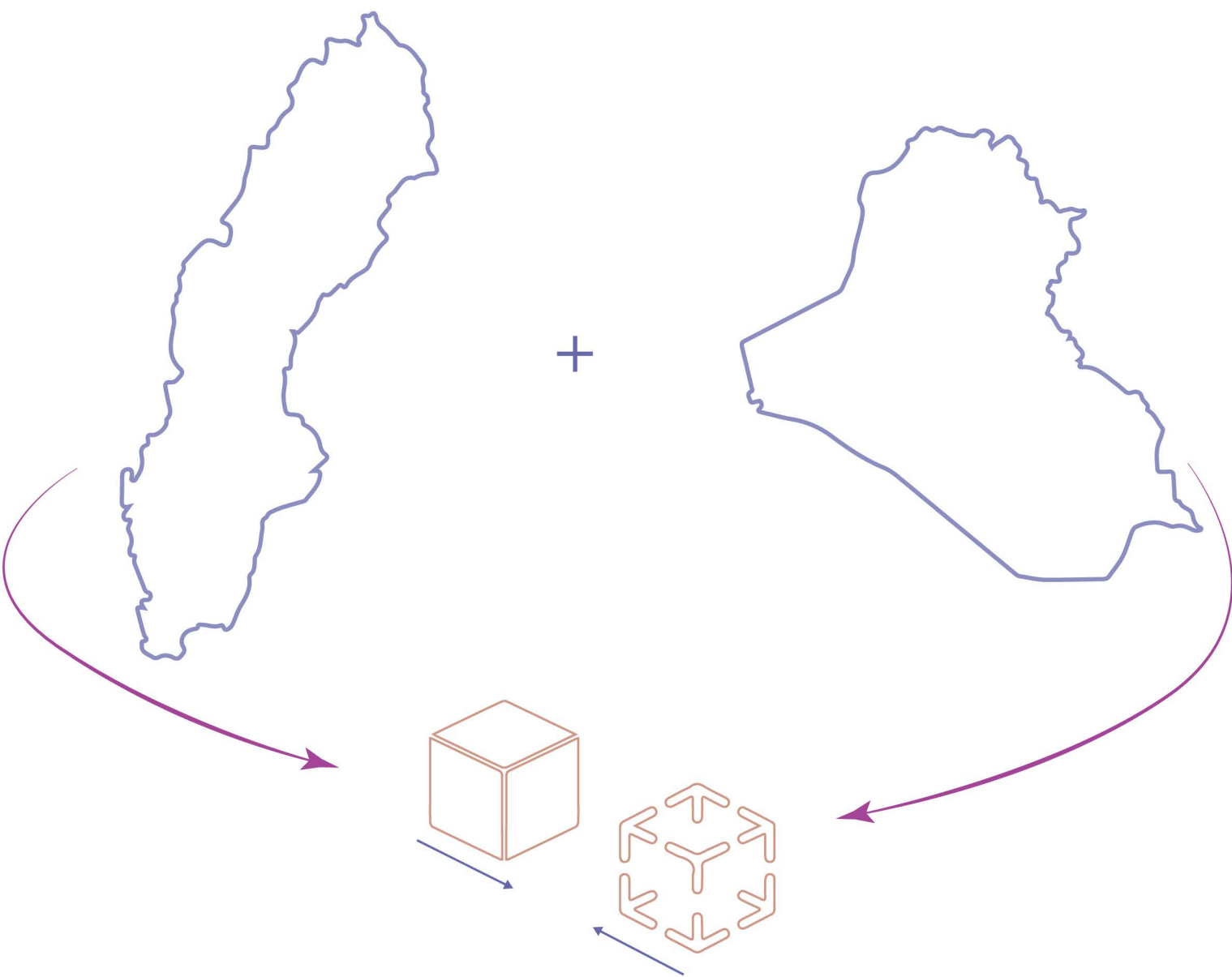


Fig.31 : Illustration of Augmenting part of a neighbourhood in Iraq onto Malmö, Sweden

4.5 Site Selection

The site selected for the thesis is Gustav Adolfs torg located in Malmö. This site is 770 meters away from Malmö central station. Gustav Adolfs torg is one of the popular squares in Malmö. The square seems to act as a meeting point for the locals. The site is favorable as it holds many features of a public space upon which the design could be implemented.

Rosengård was considered to be selected since it is where most of the Iraqi citizens live in Malmö. Rather Rosengård is used as reference to investigate the cultural norms followed by the Iraqi citizens living there.

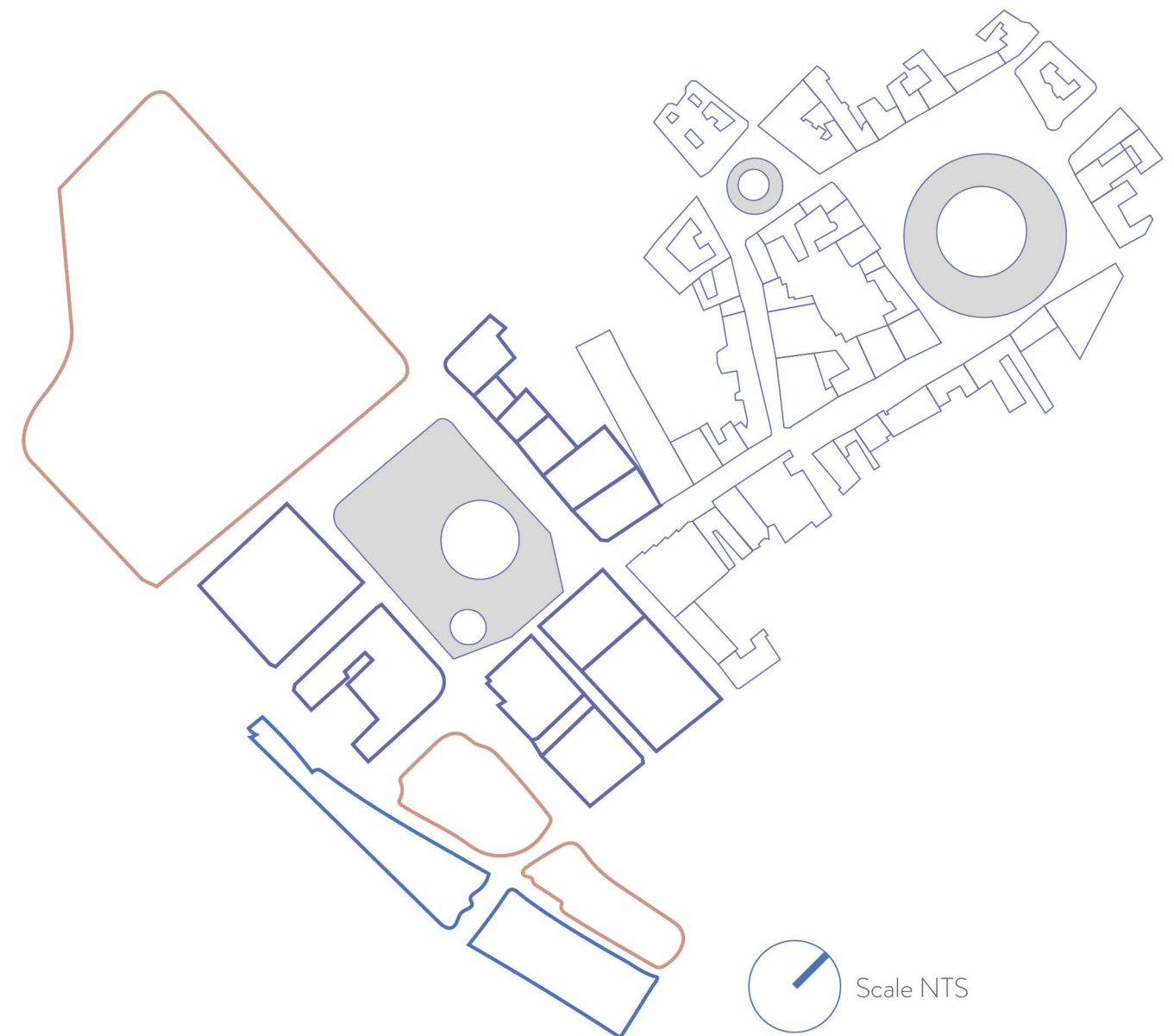


Fig.32 : Macro Site Plan of Adolf Gustav torg, Malmö

Site Selection



Fig.33 : Google Earth images of Gustav Adolf torg, Malmö

4.6 Site Study

The square is surrounded by restaurants and pubs, along with food carts and temporary stalls. Most of the roads that lead to the square consists of variety of restaurants, hence the fitting reason to be used as a meeting point by the locals. Traffic flow is moderate, depends on the time of the day. The square is designed one half with landscape, so that the locals can relax and enjoy in the green space, and the other half in concrete, where most of the temporary stalls are set up and other sorts of activities.

The site has a good balance of green and open spaces. Since the number of interaction is moderate, designing in this space is fitting to incorporate mixed reality to explore ways to increase the level of interaction. People of different culture seem to interact at the square and does not show any domination among ethnic groups.

To my observation, there is zero activity on red days. Rather only see delivery men waiting at the restaurants for order pickups and deliveries. Number of pedestrians is very low and there did not seem to be any group meet up etc.



Fig.34 : Site Images taken on a Red Day

Site Study

On a typical day, the stalls set up every morning at around 8. Pedestrian traffic is relatively less compared to other times of the day in the square. The bus stop located to the North-West of the square has the most number of people waiting for their corresponding bus. Number of vehicles are more from 8.00 till 10.00 in the morning as people are commuting to work.

During noon, the square gets slightly crowded, mostly crowded around the restaurants for lunch. There are some people sitting on the bench in the landscape. They are mostly seen to be sitting with their lunch and enjoying the outdoor. Number of vehicles are less, only the buses are seen constantly at the bus stop.

The square gets crowded in the afternoon from 16.30 onwards. At that time, people are seen to be commuting back home from work. It has been observed that the square turns into a meeting point by many. Restaurants and bars around the area get crowded and so do the temporary stalls. Police cars are seen to be parked around the square. I have seen policemen patrolling the roads surrounding the square.



Fig.35 : Site Images taken in the Morning

Fig.36 : (L) Site Images taken at Noon
(R) Site Images taken in the Afternoon

Site Study



From 17.00 onwards, the square and all the connecting streets are crowded. Restaurants and pubs are filled with visitors and long queues outside. There are no street performance on the square or any part of the area. People around that time seem to be people coming back from work and even families with their children. There seem to be more pedestrian traffic than vehicle.

After 22.00, which is around night time, the square is empty and relatively little to no people are seen. The square is bright enough at night, even if there are no visitors. Similarly, there are little to no vehicle visible at the site.

Fig.37 : (L) Site Images taken in the Evening
(R) Site Images taken at Night

Site Study

The site is in good condition. There are several points of interaction at the site. As mentioned before, the square is one half covered by landscape and people are not seen to gather in that area. As mentioned before, there are rows of restaurants and bars on the North side of the square, and there is one restaurant placed in the square. There are more bars and restaurants situated on the south side of the site, beside the water body. People are seen to be relax and spend time near the water. There are multiple water features installed in the square.

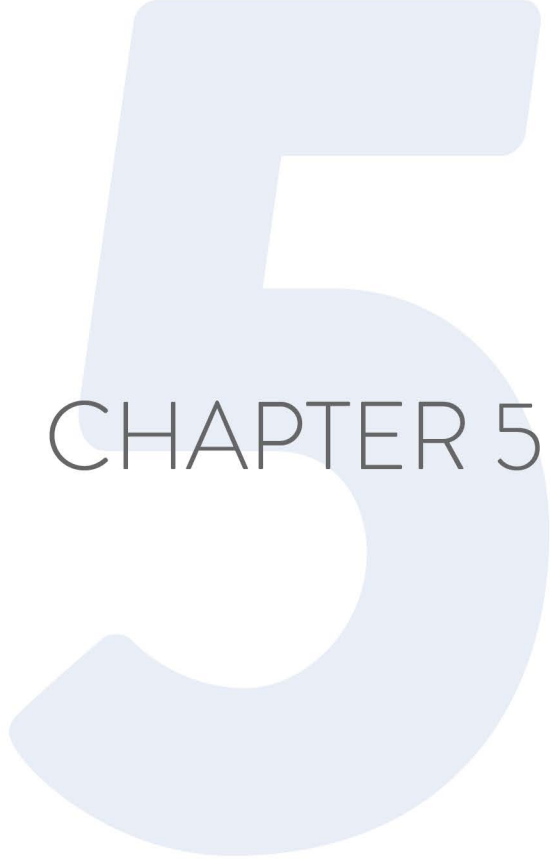
Vehicle flow is minimal there are two roads placed parallel to the square. Cars are seen to be parked on the open space of the square.

The small park situated on the West side of the site has minimal pedestrian traffic. People mostly seen to relax. There is another restaurant placed near to the park there and there seem to moderate gathering of pedestrians.

- Landscape
- Pedestrian gathering points
- Temporary stalls
- Parked vehicles
- Pedestrian flow
- Vehicle flow
- Section line



Fig.38 : Micro Site Plan of Adolf Gustav torg, Malmö



CHAPTER 5

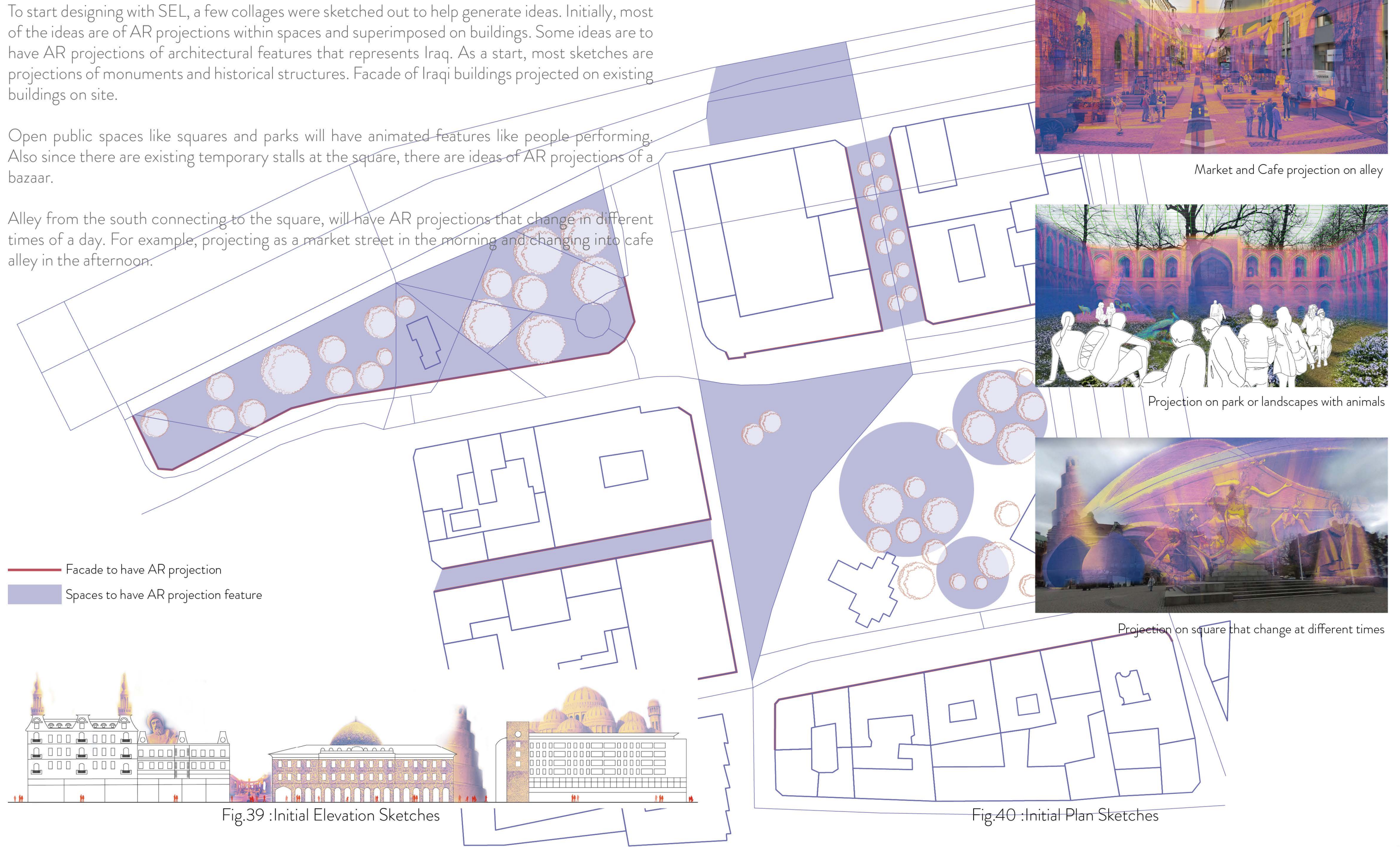
INITIAL DESIGNS

5.1 Initial Sketches

To start designing with SEL, a few collages were sketched out to help generate ideas. Initially, most of the ideas are of AR projections within spaces and superimposed on buildings. Some ideas are to have AR projections of architectural features that represents Iraq. As a start, most sketches are projections of monuments and historical structures. Facade of Iraqi buildings projected on existing buildings on site.

Open public spaces like squares and parks will have animated features like people performing. Also since there are existing temporary stalls at the square, there are ideas of AR projections of a bazaar.

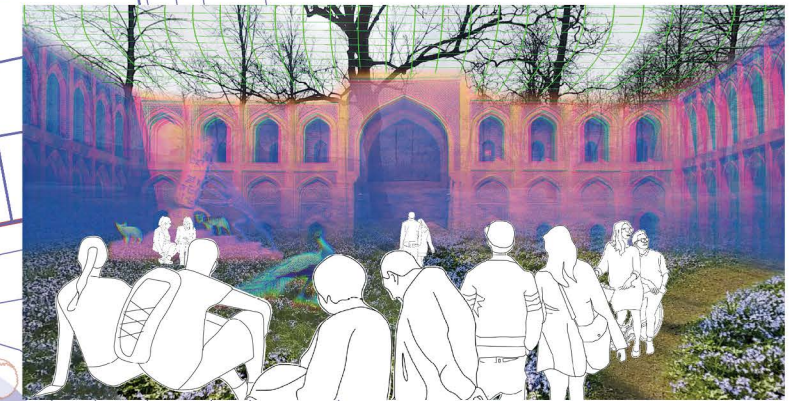
Alley from the south connecting to the square, will have AR projections that change in different times of a day. For example, projecting as a market street in the morning and changing into cafe alley in the afternoon.



— Facade to have AR projection
 ■ Spaces to have AR projection feature



Market and Cafe projection on alley



Projection on park or landscapes with animals



Projection on square that change at different times

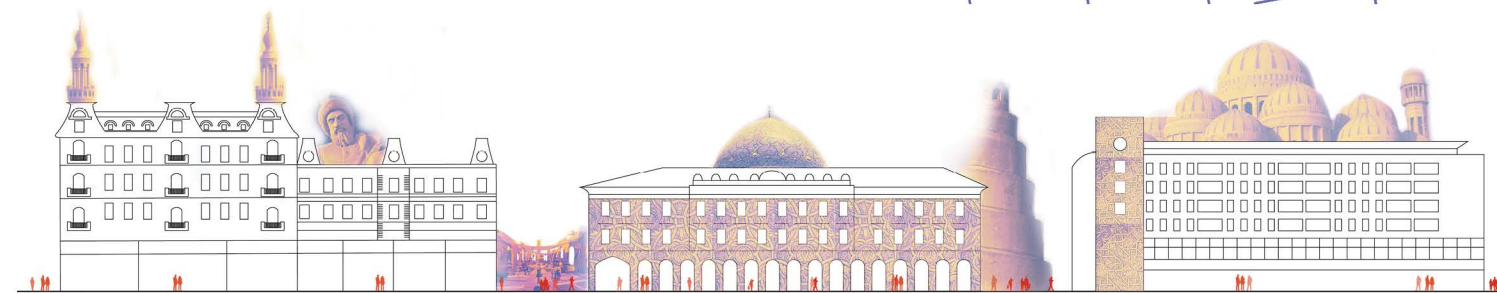


Fig.39 :Initial Elevation Sketches

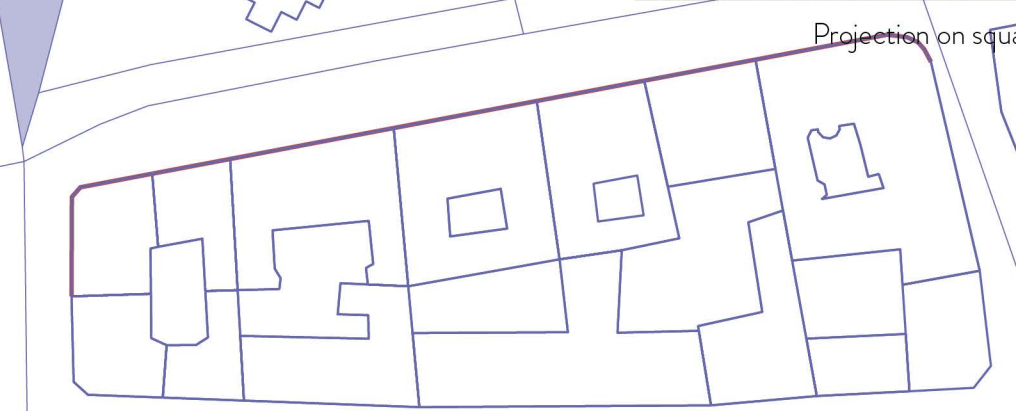
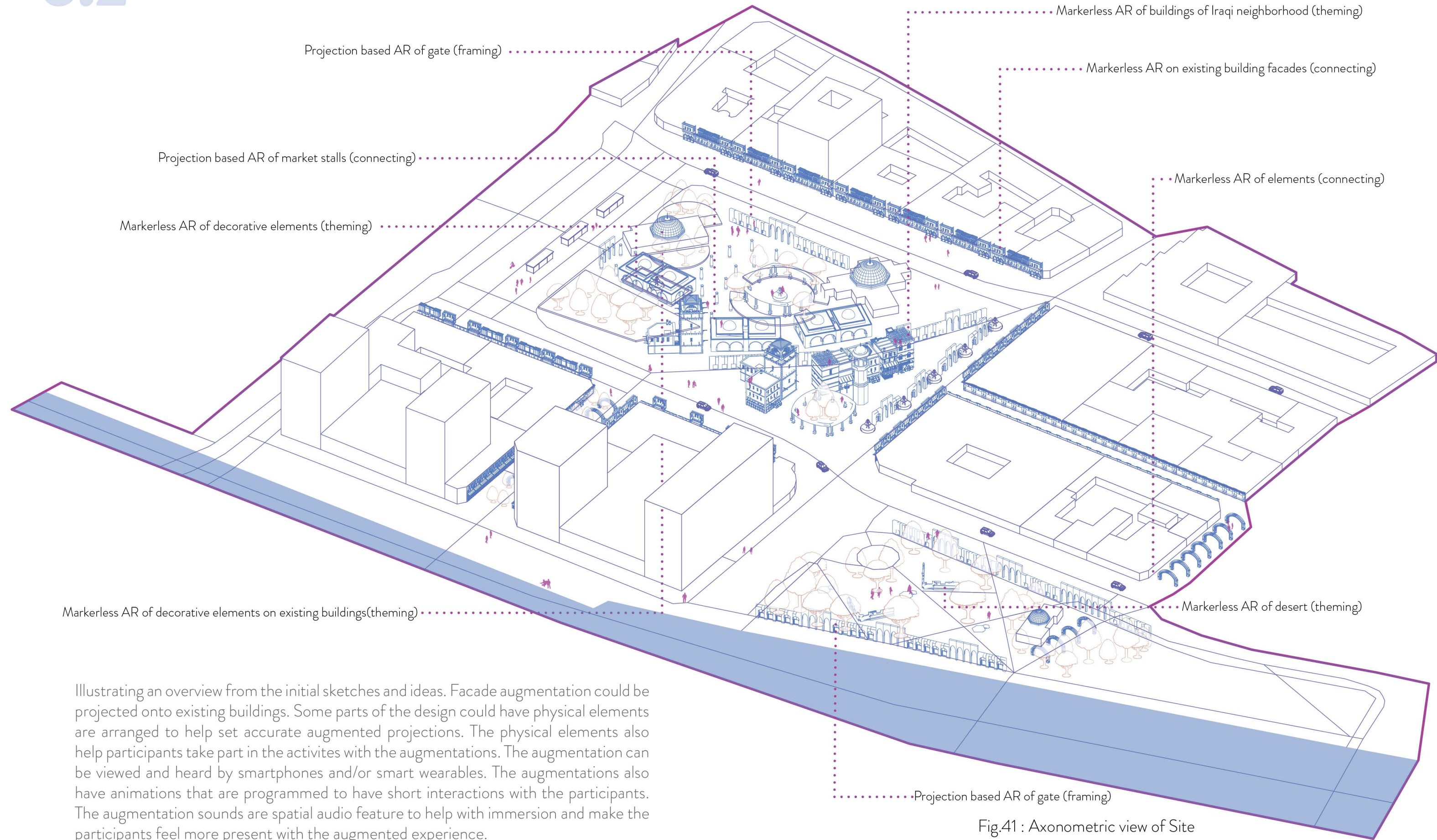


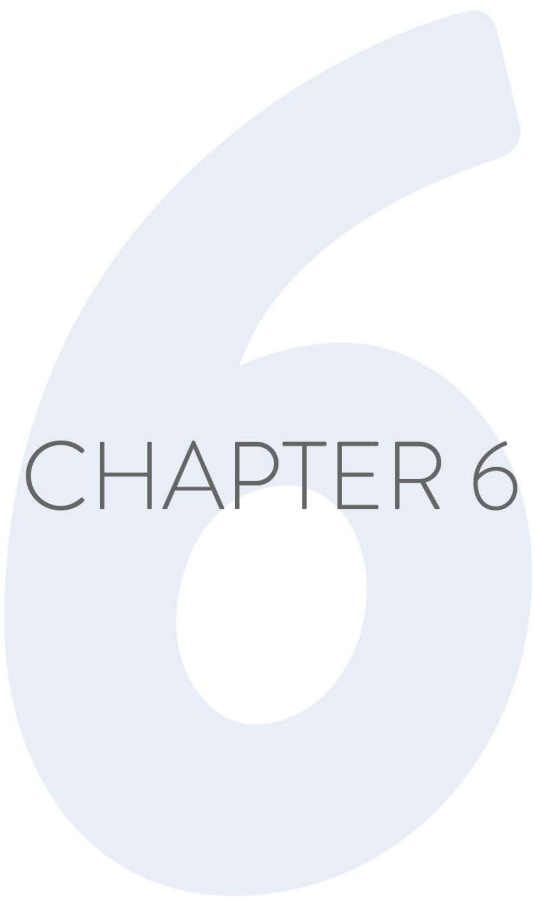
Fig.40 :Initial Plan Sketches

5.2 Initial Development



Illustrating an overview from the initial sketches and ideas. Facade augmentation could be projected onto existing buildings. Some parts of the design could have physical elements are arranged to help set accurate augmented projections. The physical elements also help participants take part in the activities with the augmentations. The augmentation can be viewed and heard by smartphones and/or smart wearables. The augmentations also have animations that are programmed to have short interactions with the participants. The augmentation sounds are spatial audio feature to help with immersion and make the participants feel more present with the augmented experience.

Fig.41 : Axonometric view of Site



CHAPTER 6

DESIGN DEVELOPMENT

6.1 Design Development - Elements

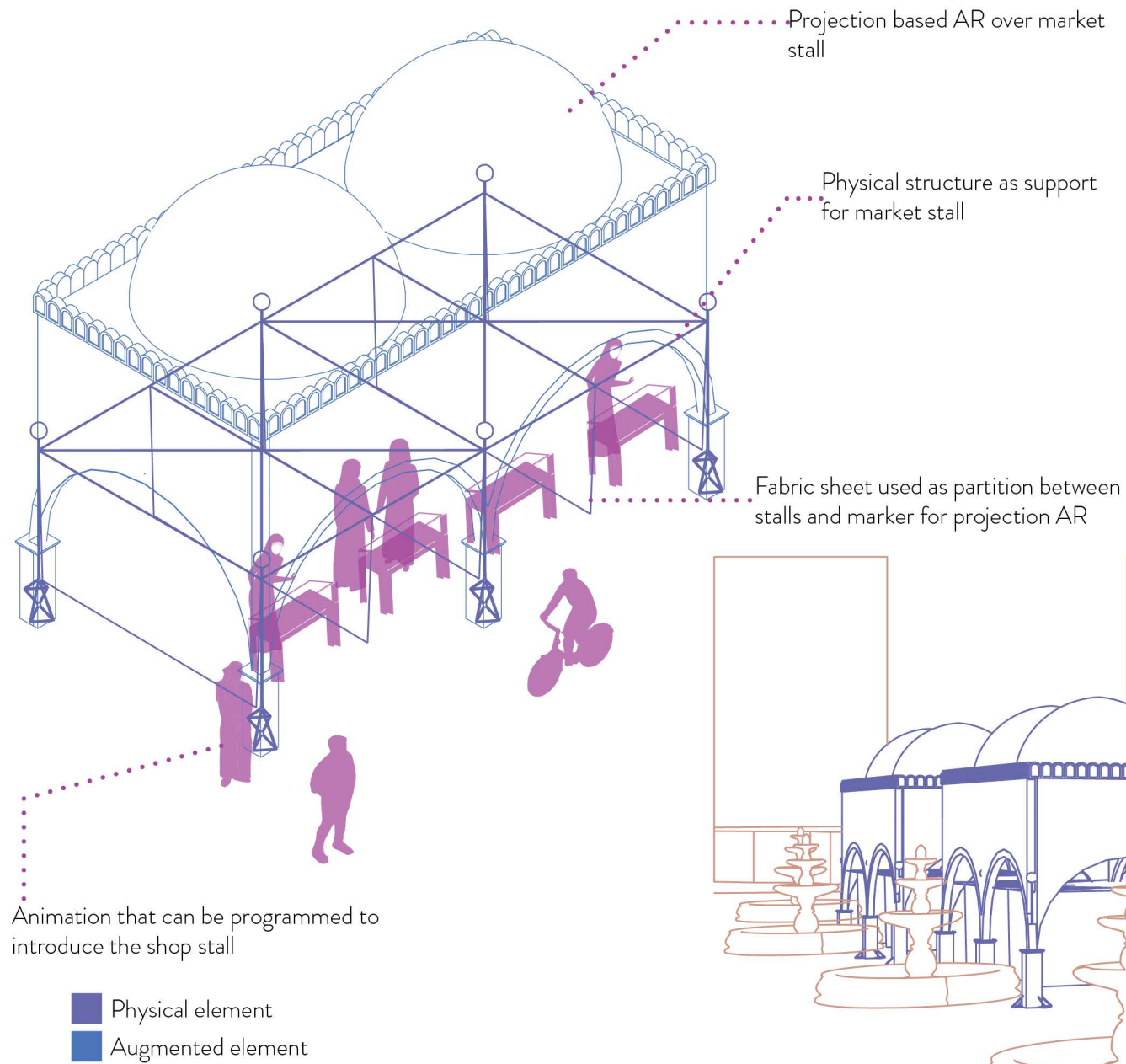


Fig.42 : Axonometric view of Market Stall

Once the stalls are set, the augmented projection can be enabled. The projections are to imitate a typical stall in Iraq. The projections are static. The augmentation can be modified or customized according to the shop keeper. The stalls are arranged to accommodate people set their own shops.

The square is seen to have some temporary market stalls during the daytime. These stalls have their own decorations and set up independently and unorganized.

So in order to accommodate for the existing stalls or even help newer ones to set up, one side of the square is proposed to have stall arrangements for the existing and new shops to set. There are physical elements that can be used to set the stalls. The physical parts together consist of metal poles with markers that help with accurate augmented projection. Small led lights are set on the head of the poles for night time augmentations.

These stalls are to accommodate people who do not have their own tent to set up. The poles are connected by thin lightweight metal rods. The stalls are roughly 4,5 x 2,1m in dimension. Simple fabric sheets are used as partitions for the stalls.

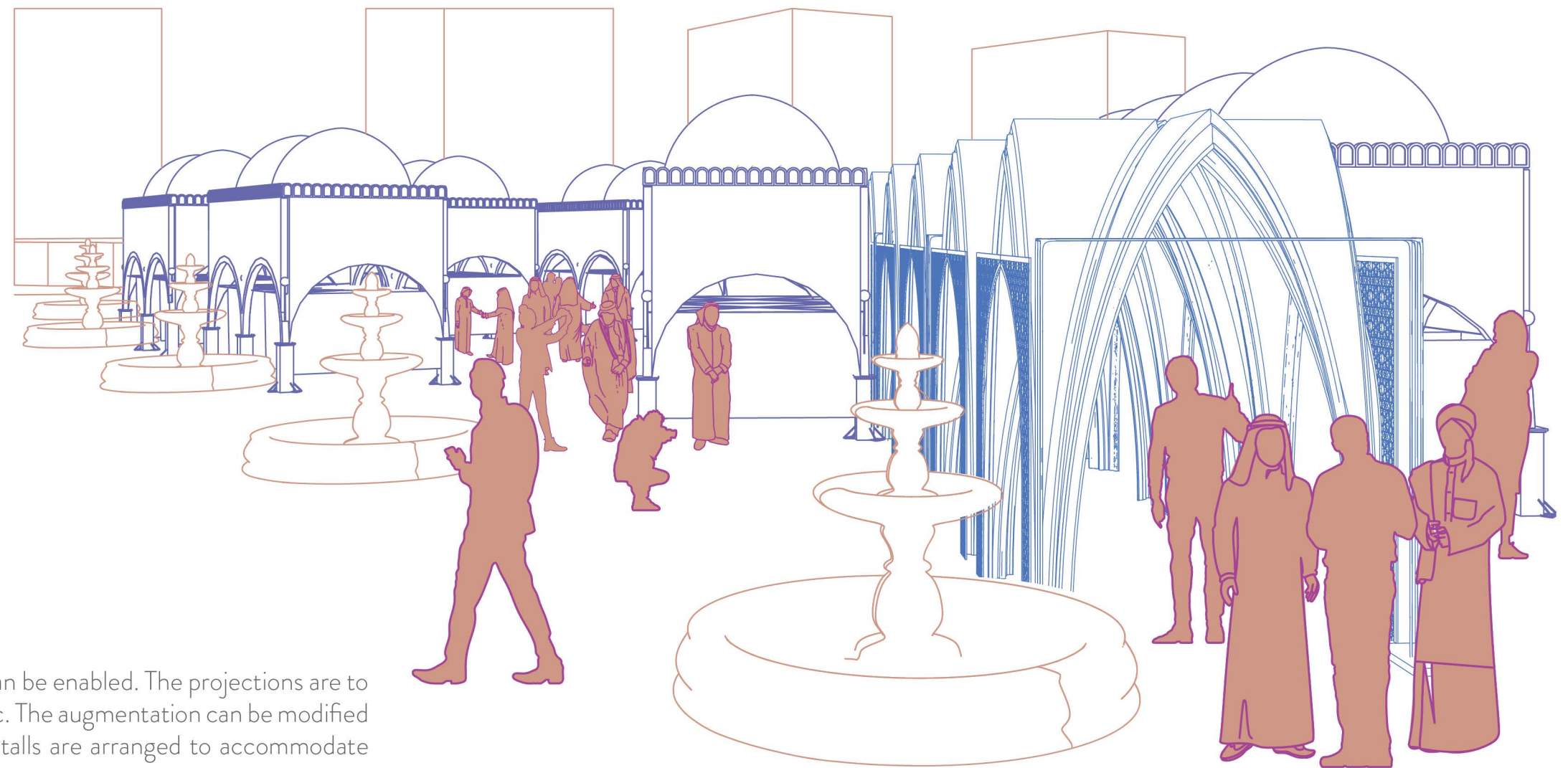


Fig.43 : Perspective view of Market

Design Development - Elements

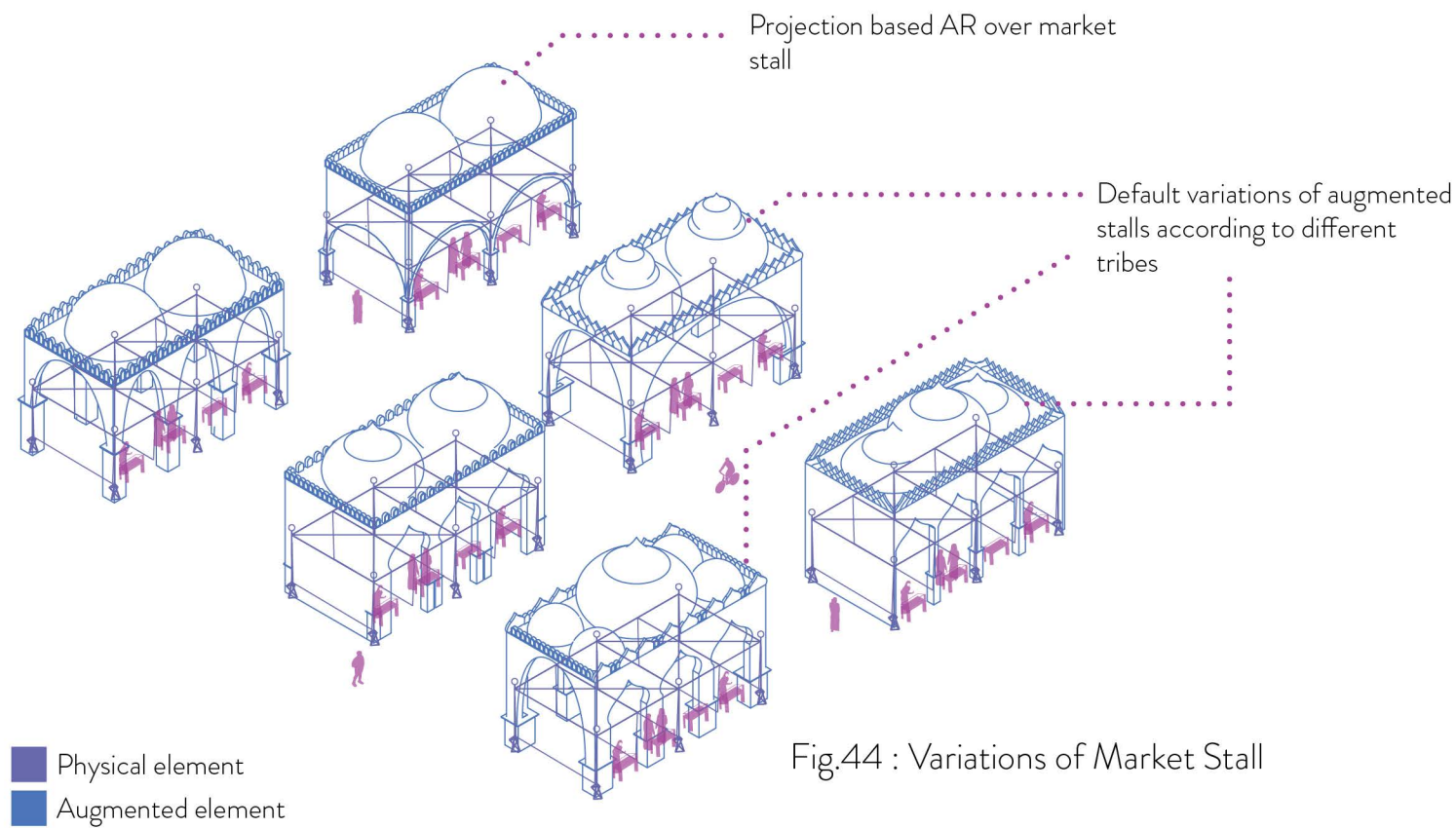


Fig.44 : Variations of Market Stall

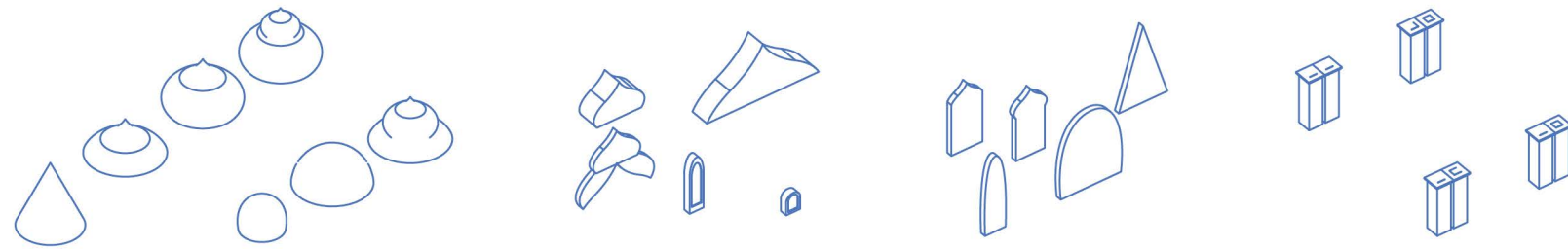


Fig.45 : Customizing elements of Market Stall

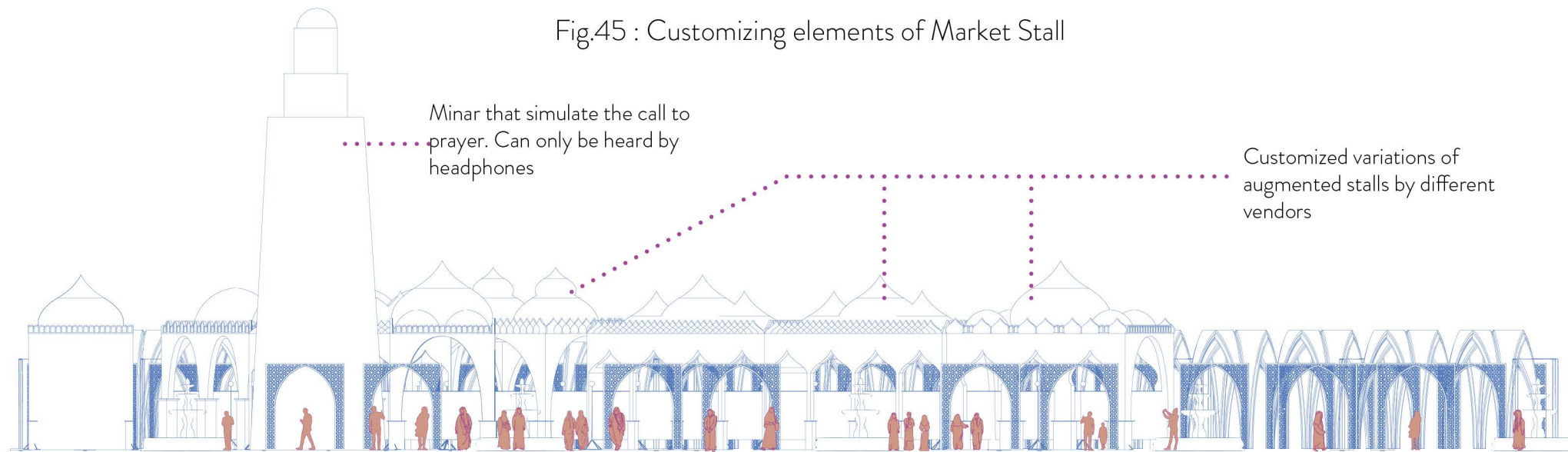
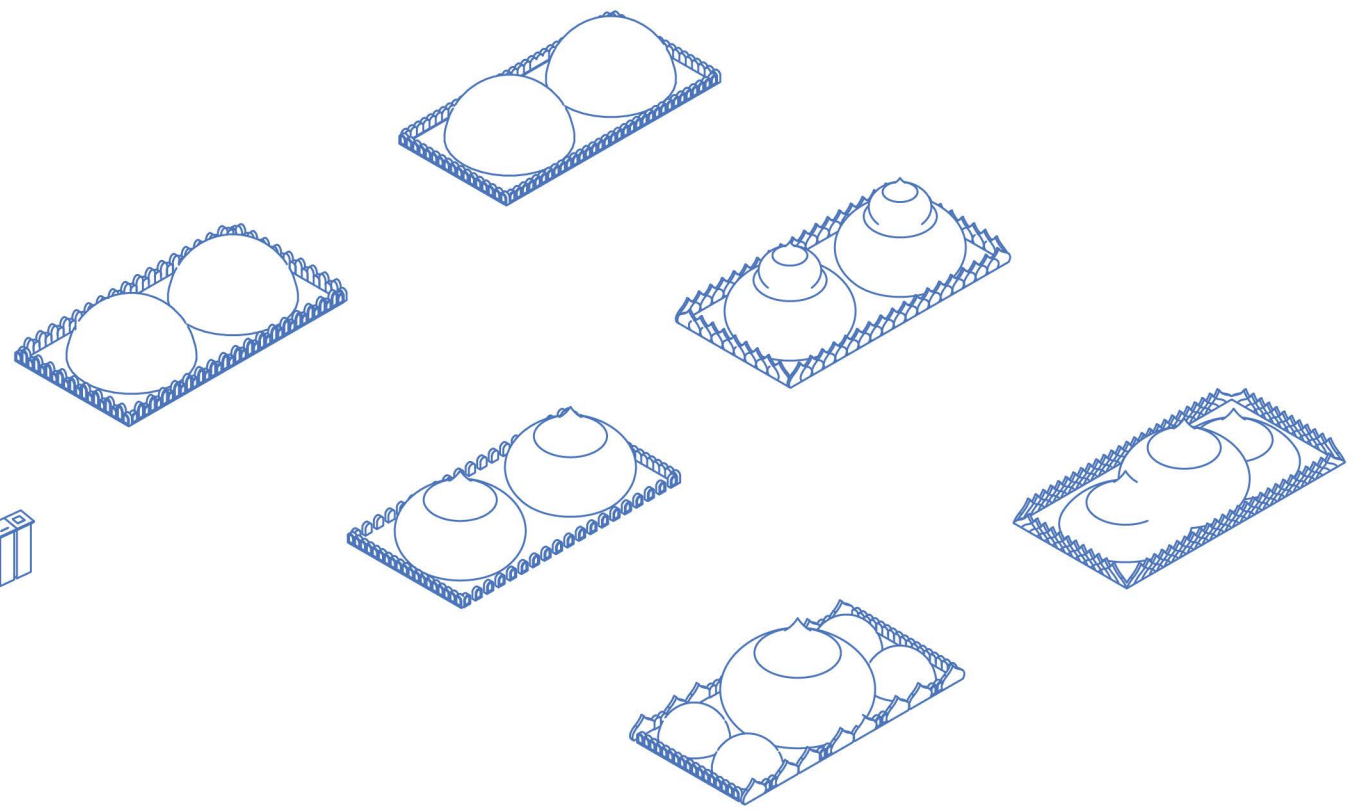


Fig.46 : Elevation view of Market

Mentioned earlier from the interviews, Iraq has over 100 different tribes. These tribes have their own expression of culture and some have different style of architecture. To be able to express themselves, there are variations of market stalls that suits the merchants tribe or interest. Each variation comes with an animation of a person of the corresponding tribe to share brief story about the tribes.

Also, the stalls can be modified by the merchant. There are customizable elements that can be augmented and best suit the persons shop. The customized shops also come with animation of a person that can programmed to tell welcoming sentences. The sentences could be typed via phone.



The market place has a Minar augmented at the center of the designated space. The Minar is one of the key elements to any market place with Islamic influences. The Minar simulate the call to prayer and can only be heard by headphones. This is added to the design as it is mentioned by most of the interviewed participants.

Design Development - Elements

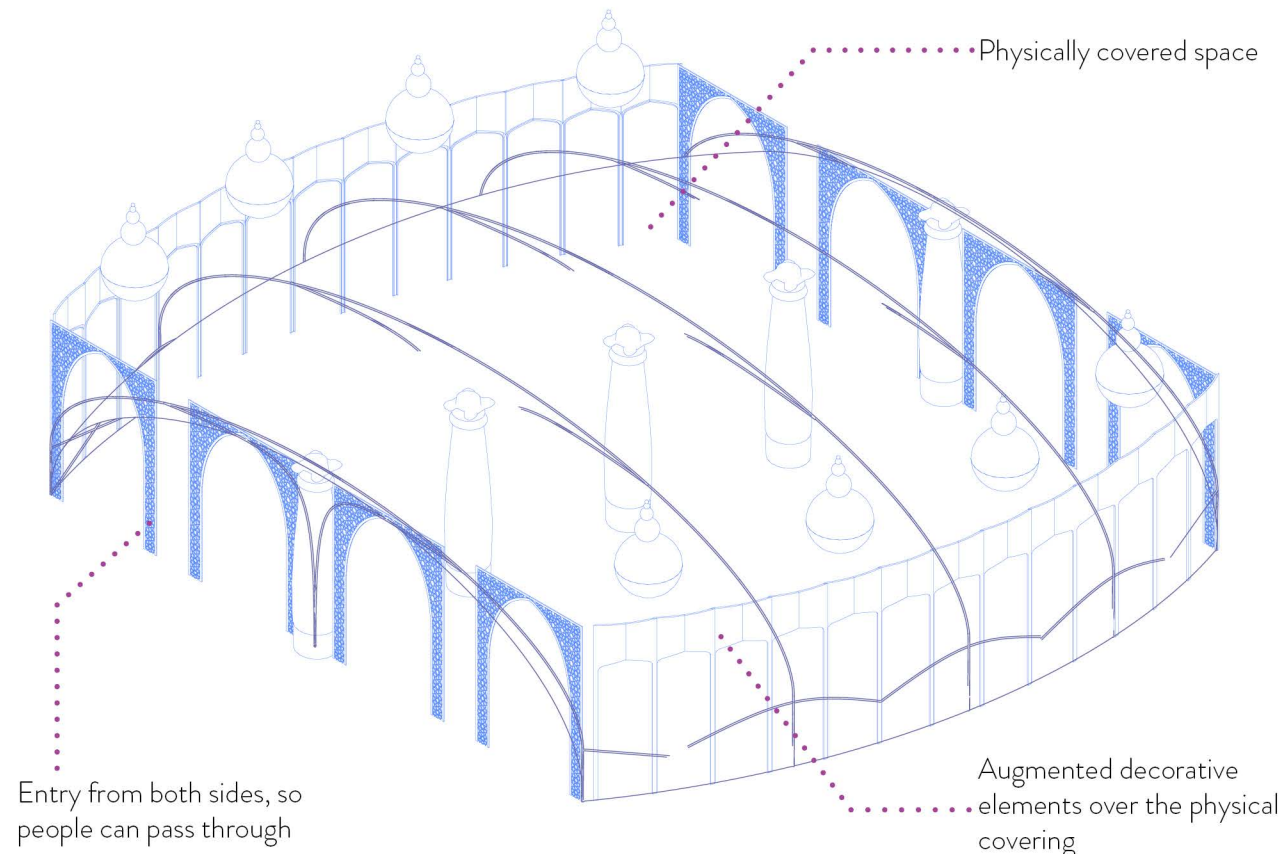


Fig.47 : Variations of Market Stall

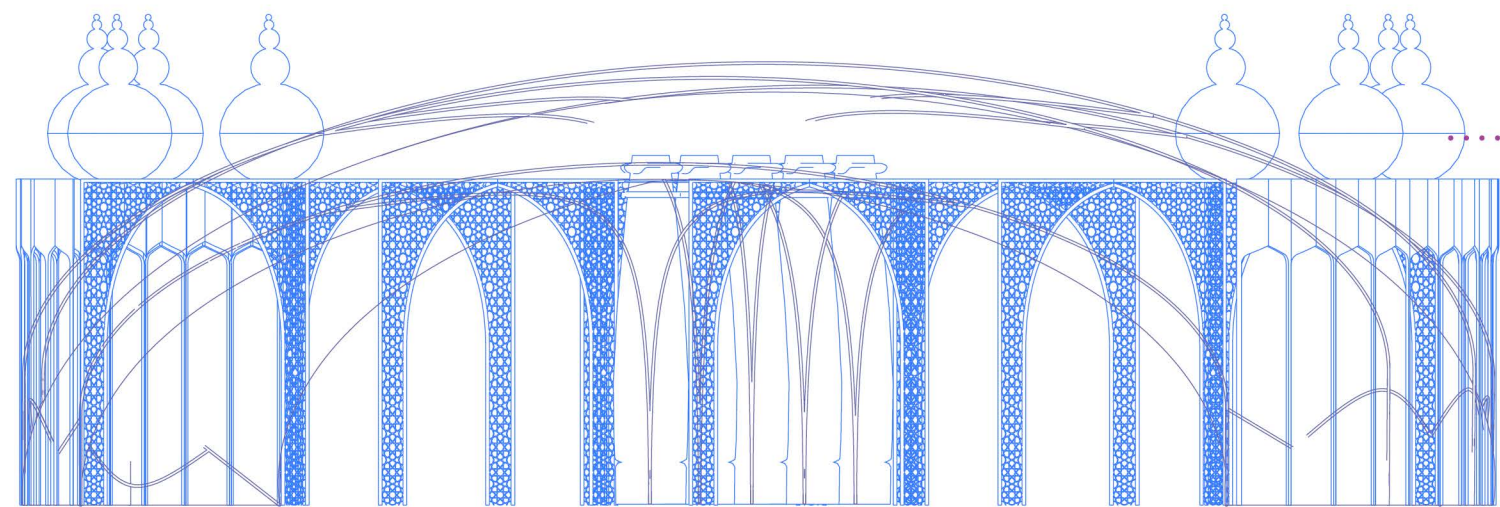


Fig.49 : Elevation view of Market

A hall space that is dedicated to cultural celebrations of the Iraqi people. This space has the feature of photogrammetry. So this space is shared with another space in Iraq where the same celebration is taking place at the same time. There are corresponding cameras that can capture the live feed from here and project back to the site in Iraq, vice versa.

This would create an opportunity for the Iraqi people to express their cultural celebration in a dedicated space. Also the real time live feed feature could also allow them to express more comfortably. This would also be a unique opportunity for the Swedish born Iraqi to learn about their culture in a more fun way.

This would also allow the locals to learn and participate in the activities with the minor.

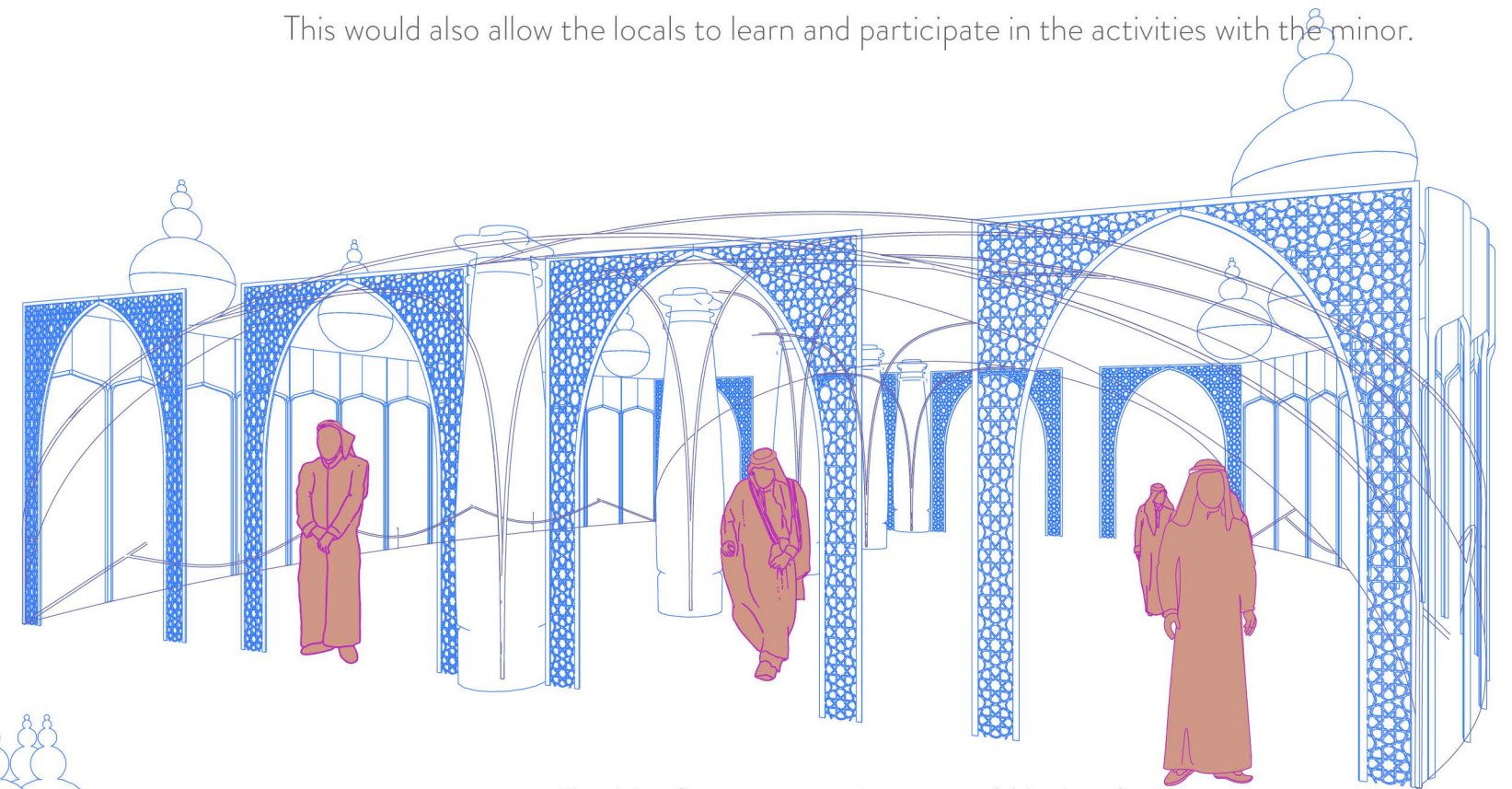


Fig.48 : Customizing elements of Market Stall

The augmented decorative elements can be changed and are programmed to change by the corresponding activity that takes place. Iraqi culture has many religious celebrations like Ashura, Eid etc. Football is a loved sport among both Iraqi and Swedish people, during the interview, Iraqi people love watching football matches on the street with friends. This hall space can be used as such and the photogrammetry camera can be converted into projectors to watch live games.

Design Development - Elements

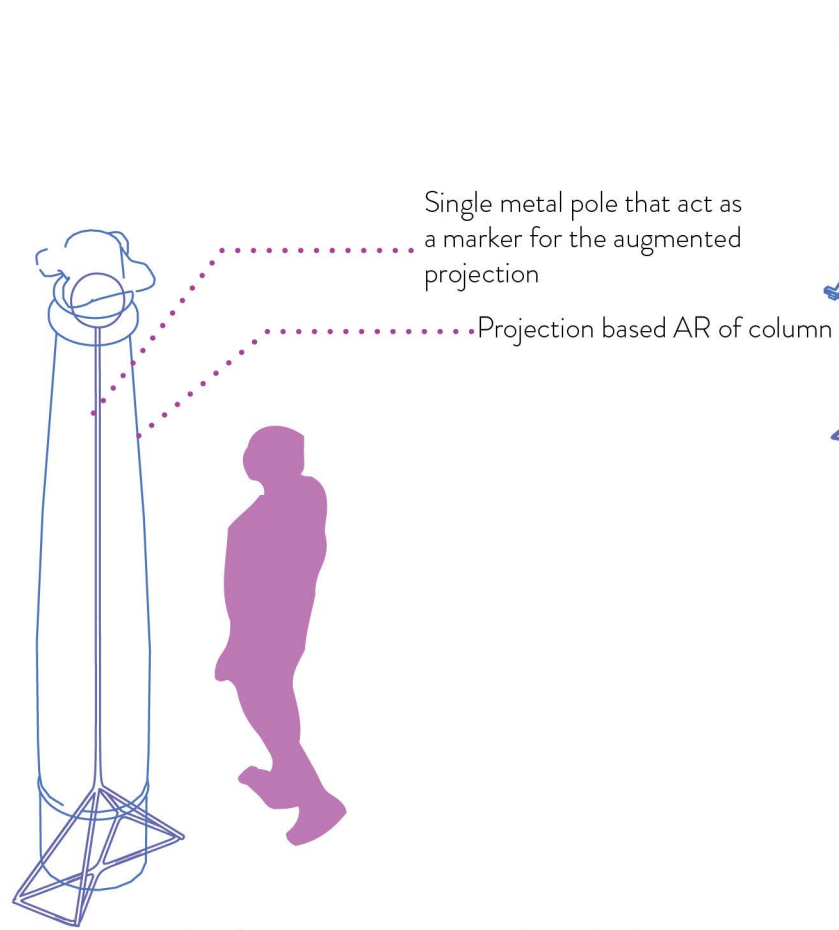
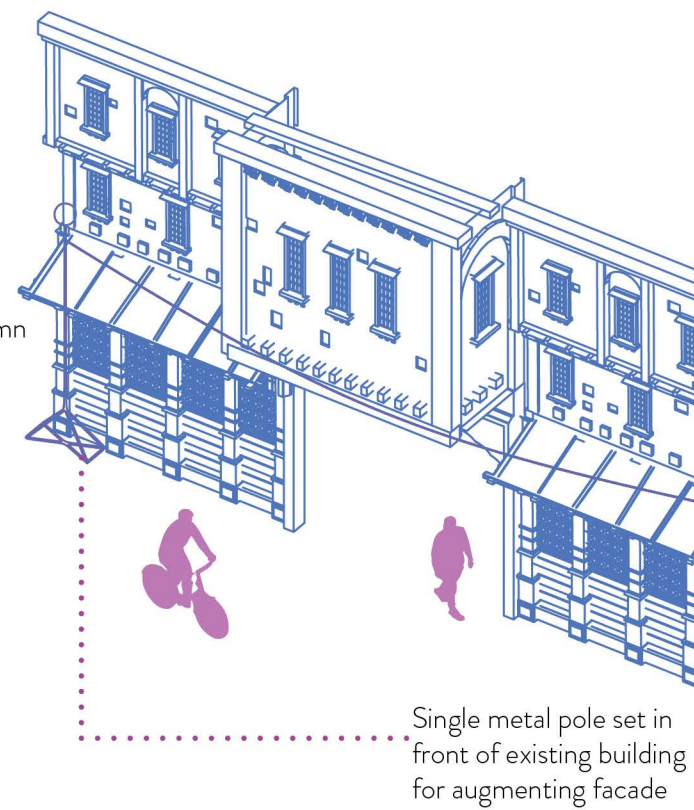


Fig.50 : Axonometric view of single Pole projecting Column



Metal poles which are 3m in height, used as markers to help set the augmentation accurately. The projections are static. There are animated projections of different kind to enhance the augmented experience. The poles can function independently or collectively when linked by wires. Different kinds of augmentations can be projected, depending on the role. The head of the poles can emit light for night time augmentation.

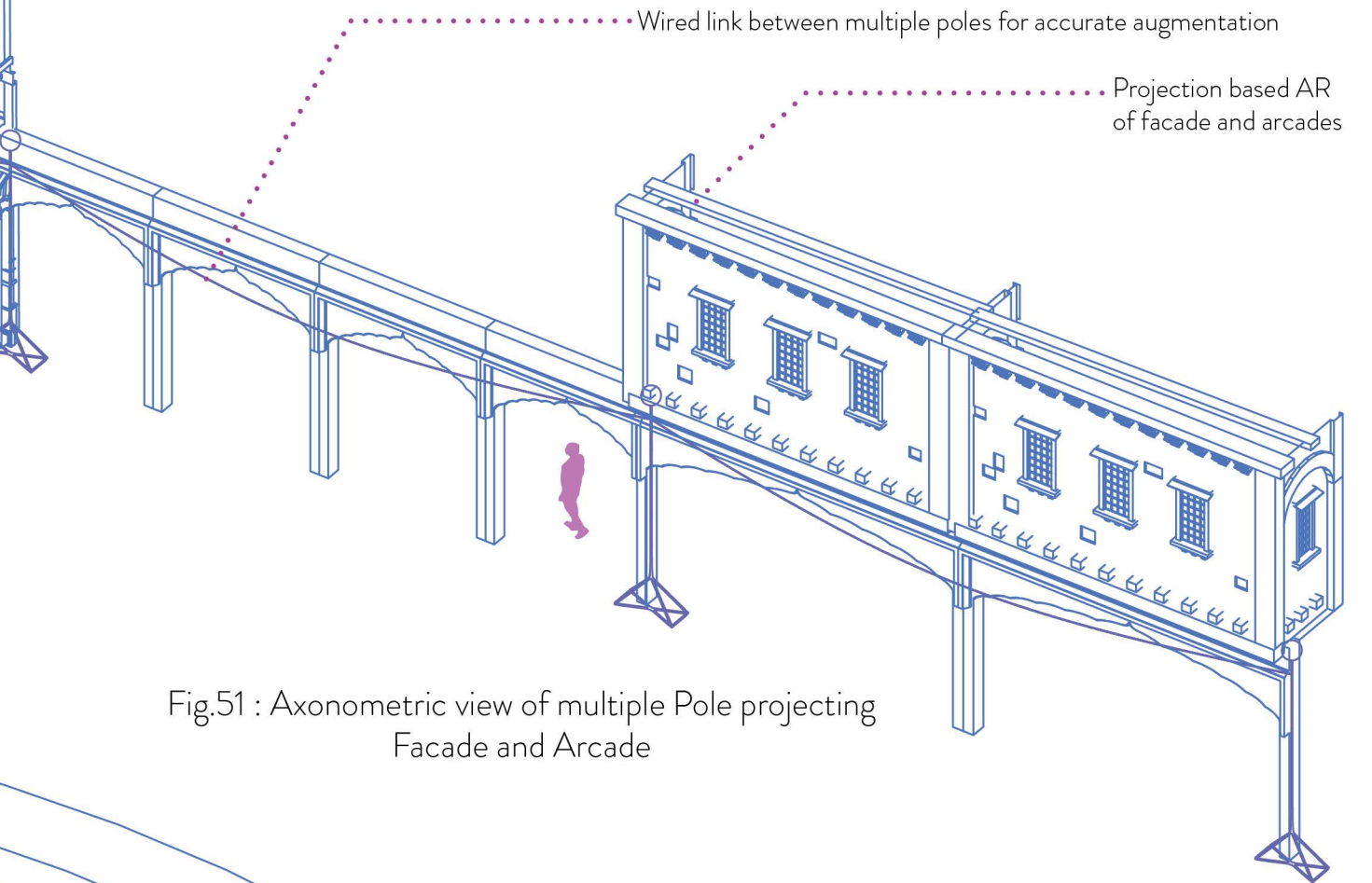


Fig.51 : Axonometric view of multiple Pole projecting Facade and Arcade

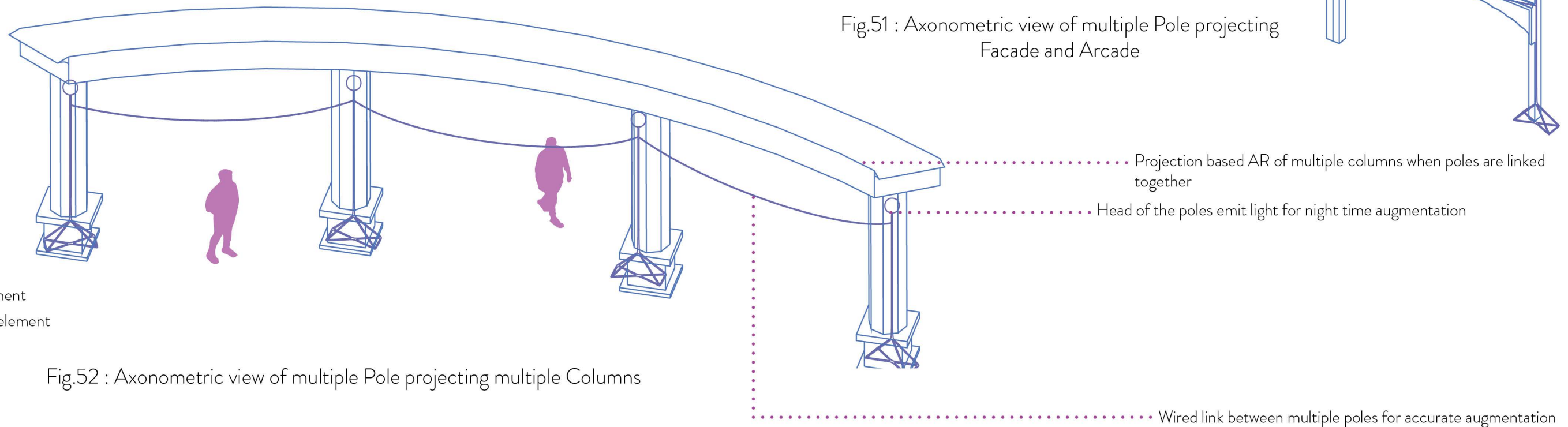


Fig.52 : Axonometric view of multiple Pole projecting multiple Columns

- Physical element
- Augmented element

Design Development - Elements

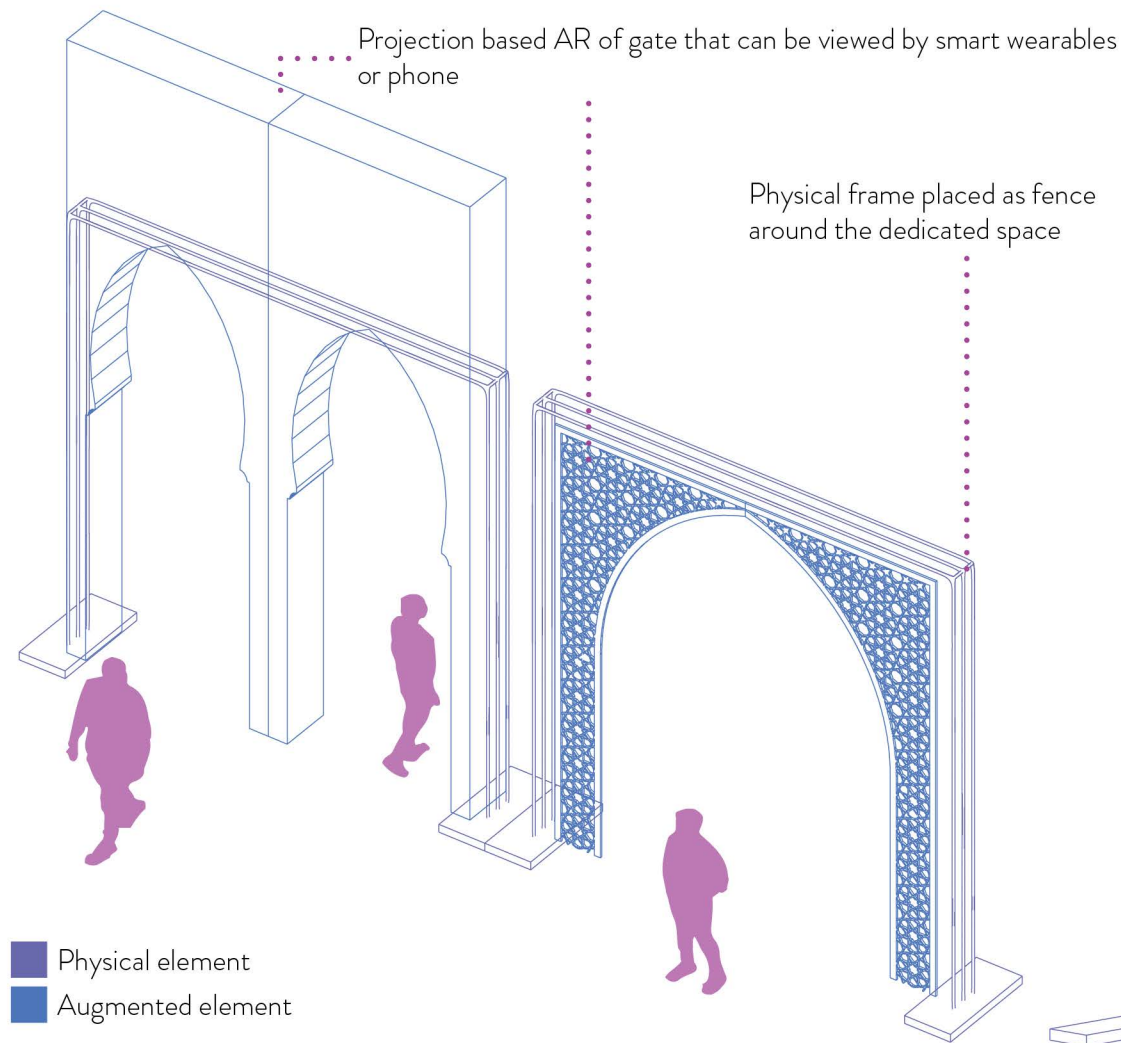


Fig.53 : Axonometric view of Gate

Metal truss frames are set around certain places of the site. These frames will have markers that will enable to project augmented models of gates. The frames are of same design but are programmed to project different gates where needed.

The metal frames can also be set in series or linear arrangement, like the example below, over an existing pathway to create augmented arches over it. The frames act as markers for accurate augmented projection.

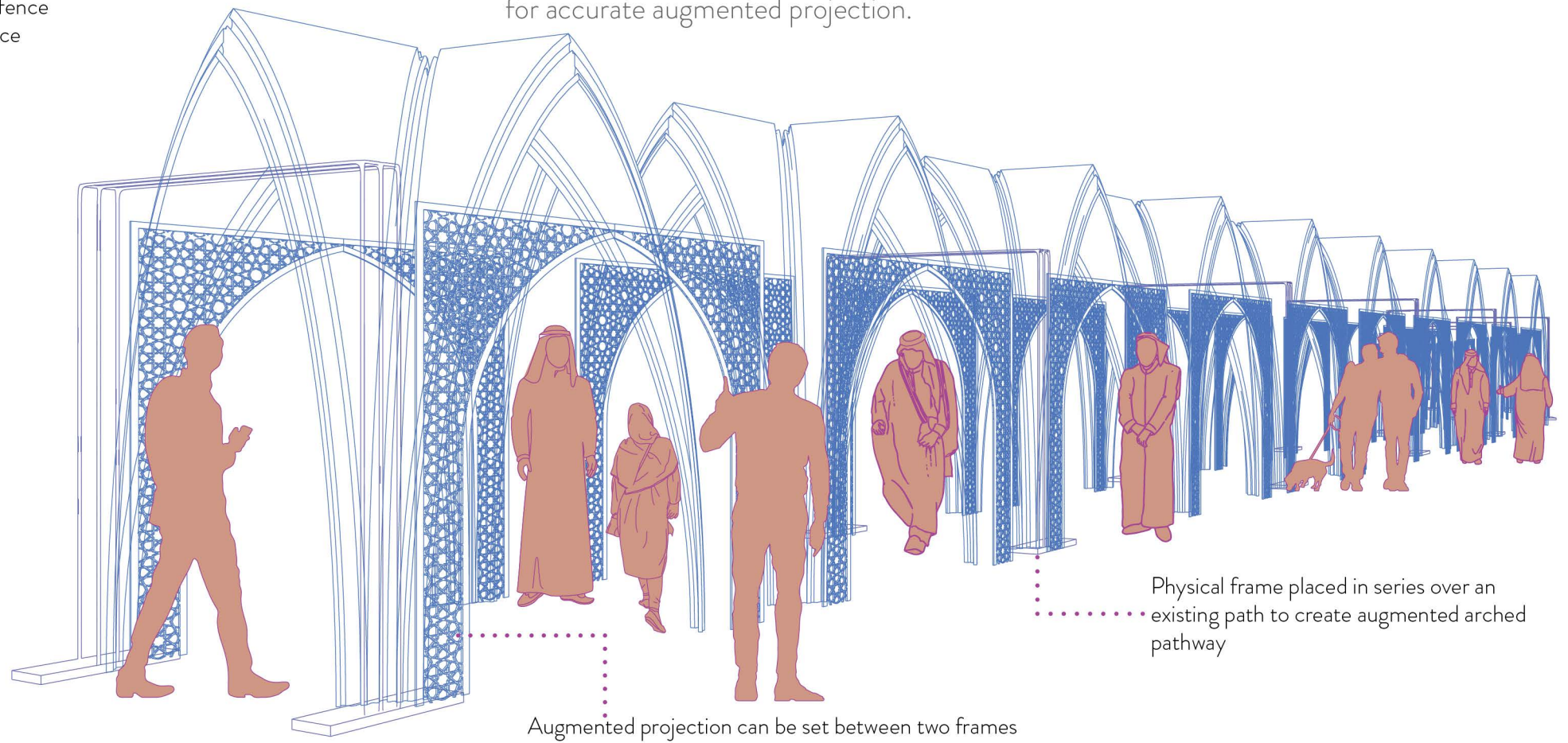


Fig.54 : Perspective view of Gates set in series (arches augmentation)

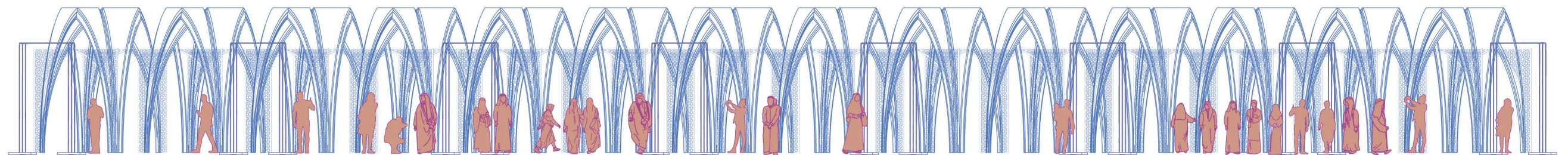


Fig.55 : Elevation view of Gates set in series (arches augmentation)

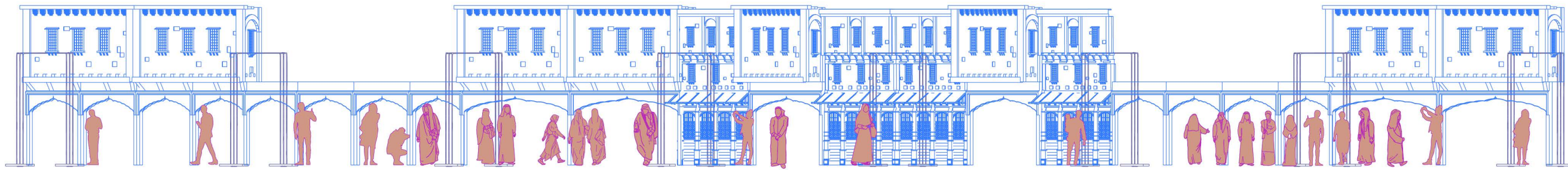


Fig.56 : Elevation view of Gates set in series (street alley augmentation)

These metal frames are set on the walking paths on the square. The paths are noted during site observation. This will allow the participants to maintain immersion when moving from one space to another. The path also act as a framing to each designated spaces, meaning it act as boundaries to the spaces.

The changes in the augmentation is to maintain the theme of the immersion which is dictated by the connecting spaces.

Physical frame placed in series over an existing path to create augmented arched pathway

Augmented projection that can be programmed to chnaged manually or to change automatically over time



Fig.57 : Perspective view of Gates set in series (street alley augmentation)

Design Development - Element

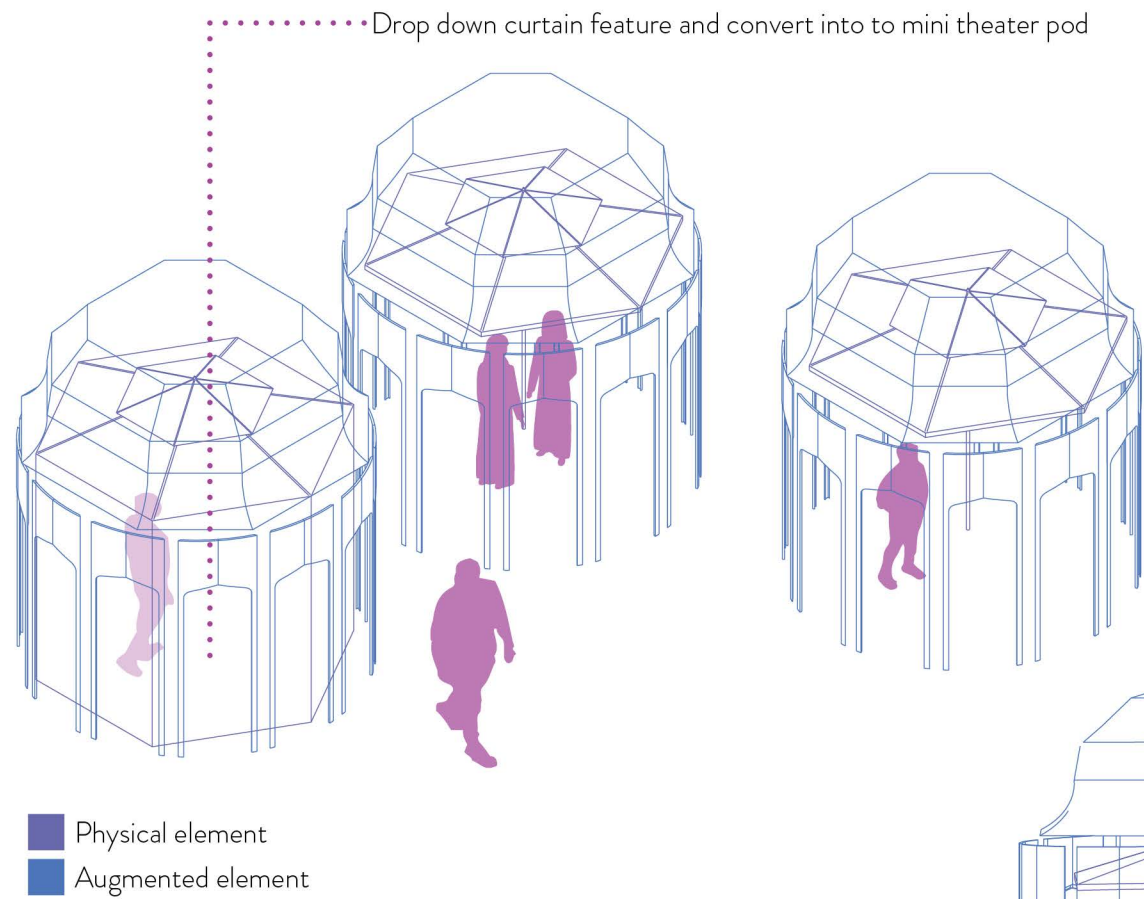


Fig.58 : Axonometric view of Small Pods

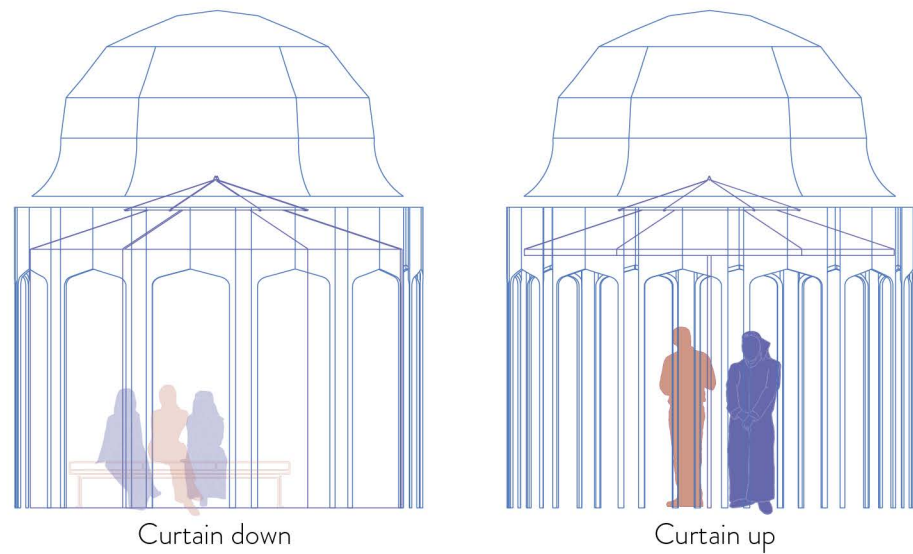


Fig.60 : Elevation view of Small Pods

During site observation, there were multiple spaces where people usually sit. Those spaces have small umbrellas added as covered shading and also setting up augmentations around them to look like small booths with Iraqi ornamentals. These booths has and can be used for multiple purposes, like sitting, relaxing. Participants can also be accompanied by animations with whom can have short conversations.

The umbrellas are made of micro-led fabric and has curtain feature that can dropped down to cover completely and turn into a mini theater and watch short video about the Iraq and it's culture.

These umbrellas can be moved around within the boundary of the site, giving the participants the freedom to entertain at their desired spot.

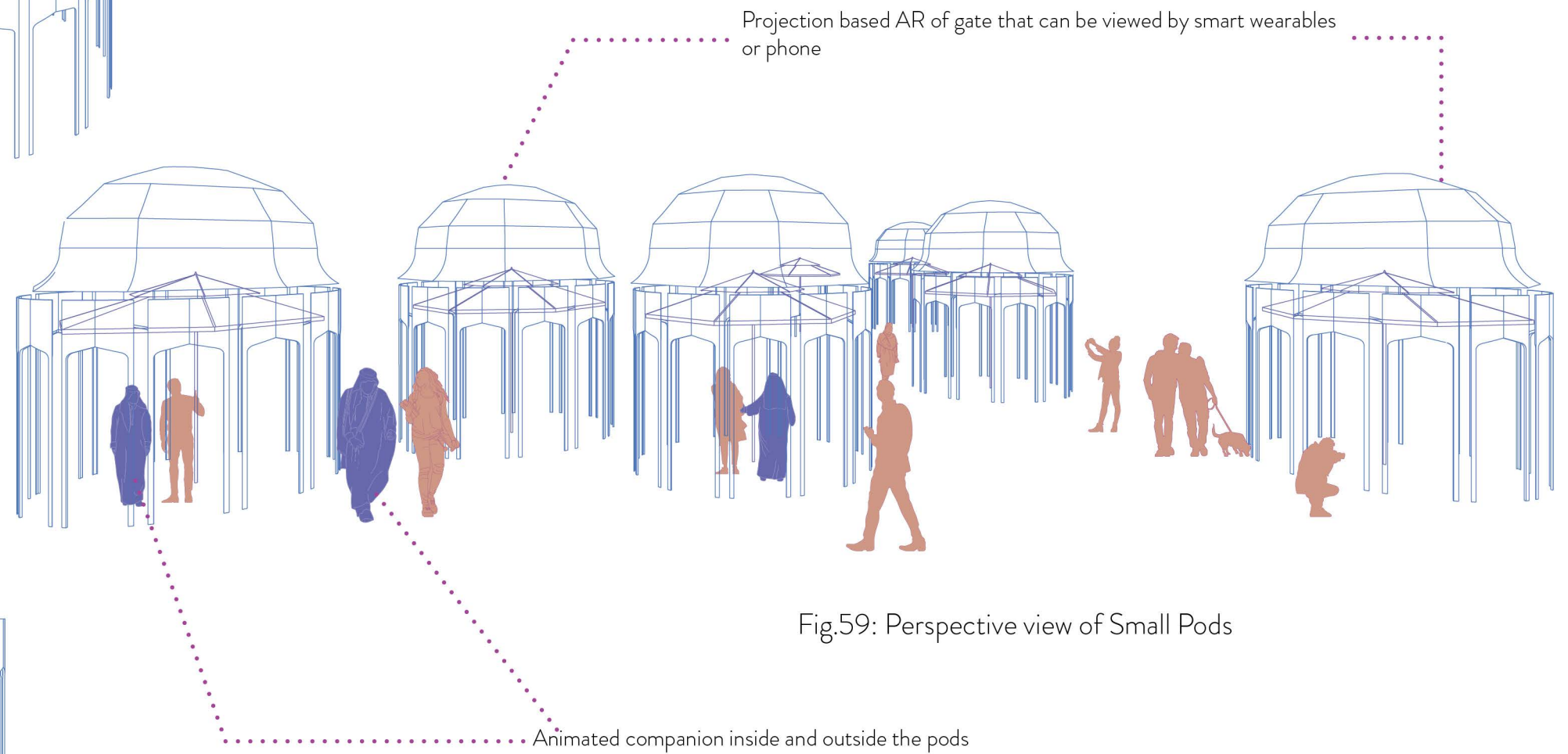


Fig.59: Perspective view of Small Pods

Design Development - Elements

Inflatable tunnels are set on the vehicle roads at the site. The tunnel has micro-led installed inside that project realistic visuals of Iraq, so vehicles crossing through will experience driving in streets of Iraq. The tunnel also act as a marker for augmented projection of arches set over it. This helps the tunnel blend with the other arrangements.

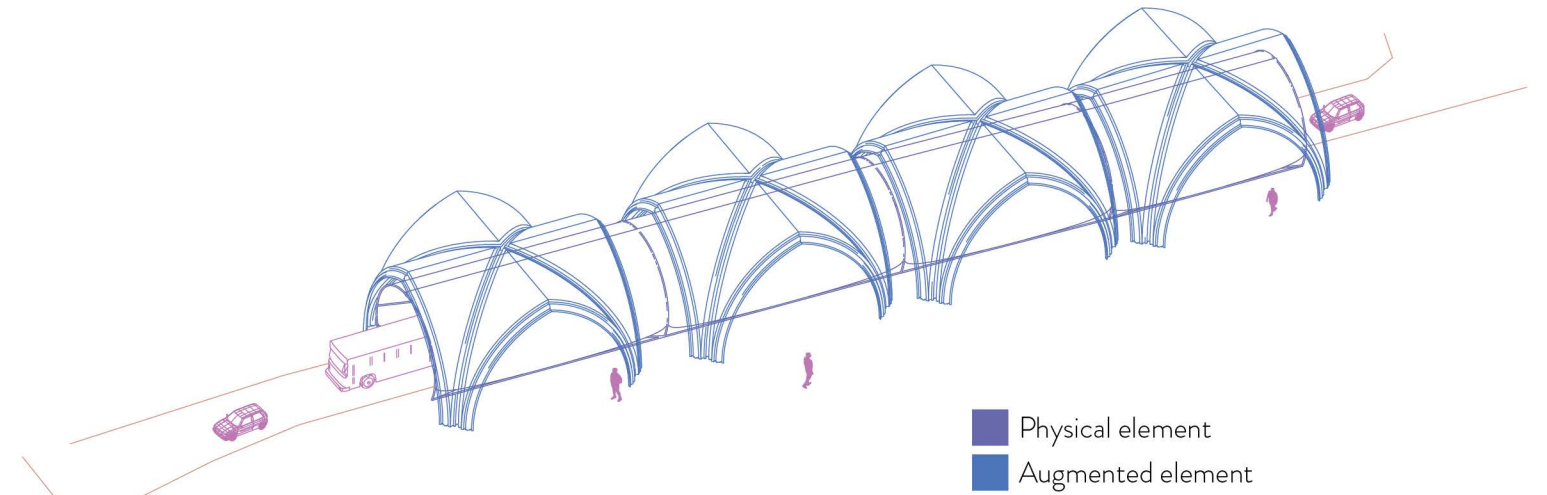


Fig.61 : Axonometric view of Tunnel

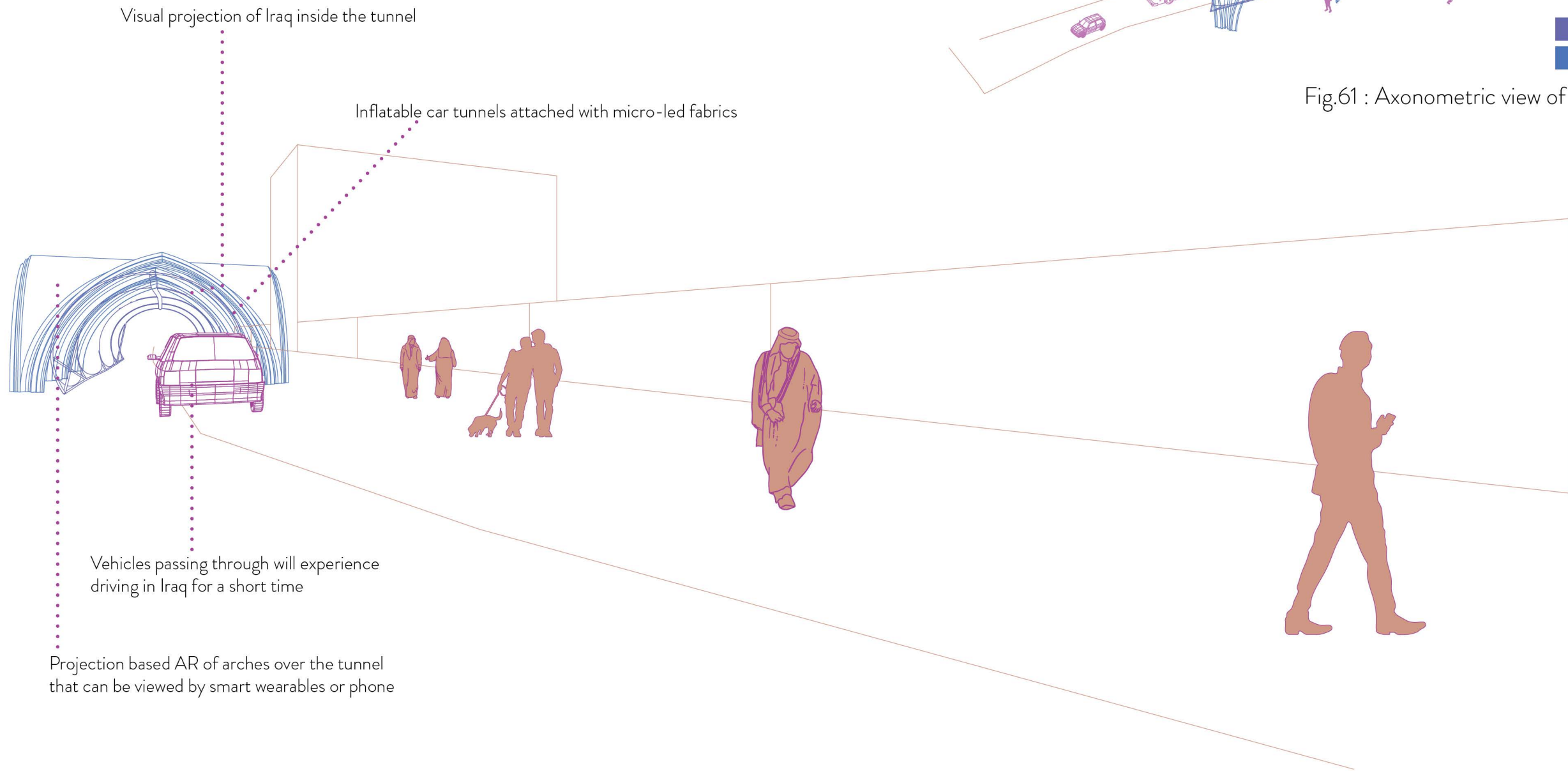


Fig.62 : Perspective view of Tunnel

6.2 Design Development - Strategy

Two streets that lead to the square are used as connectors to attract visitors. One of the streets has set of trees planted on the middle. Covered arches as static elements is AR projected over the trees and the animations of Iraqi people. Existing lamp posts are used as markers to help set the augmentation accurately. Animated people are part of enhancing the experience of AR that change at different times of the day.

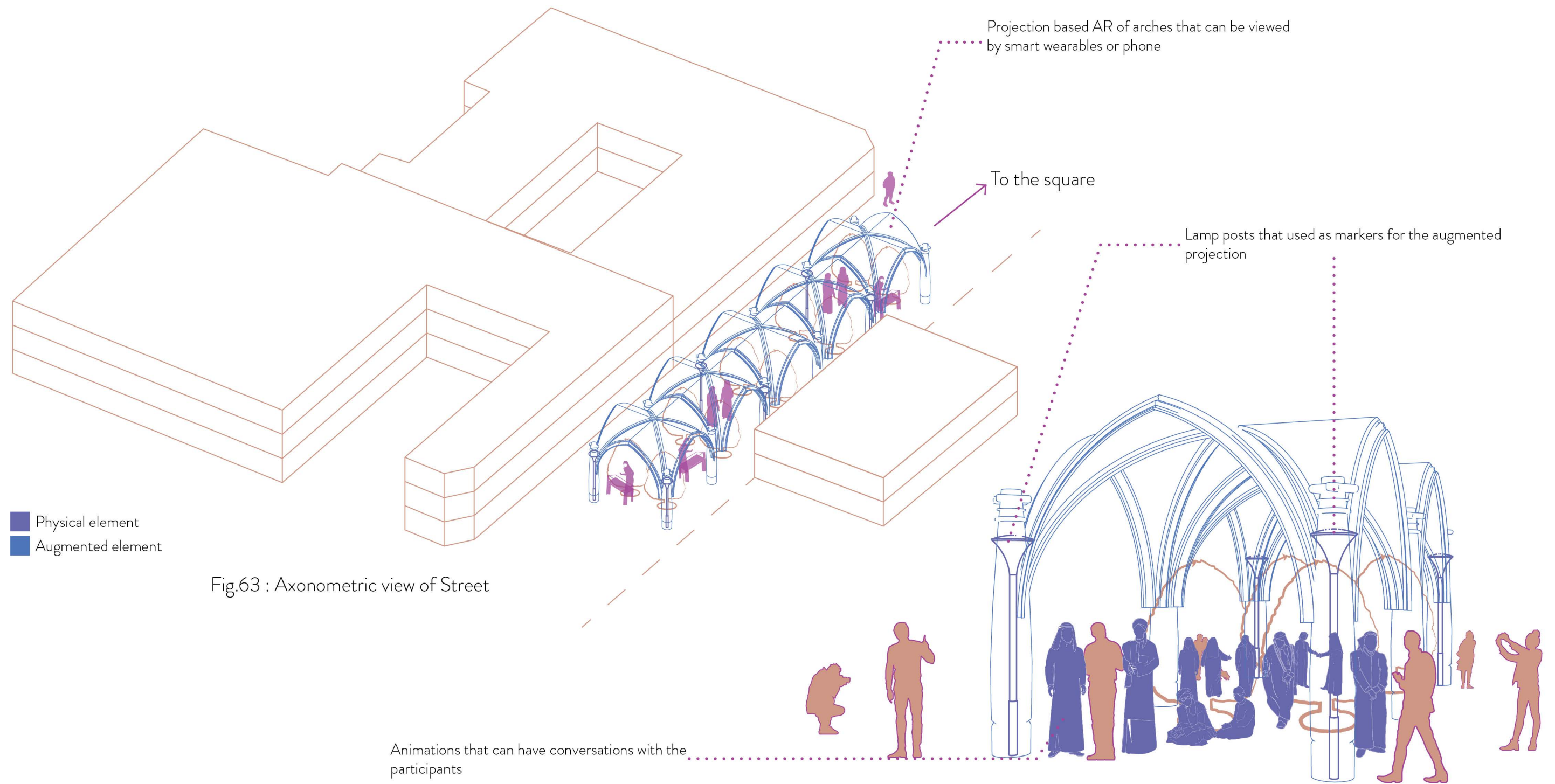


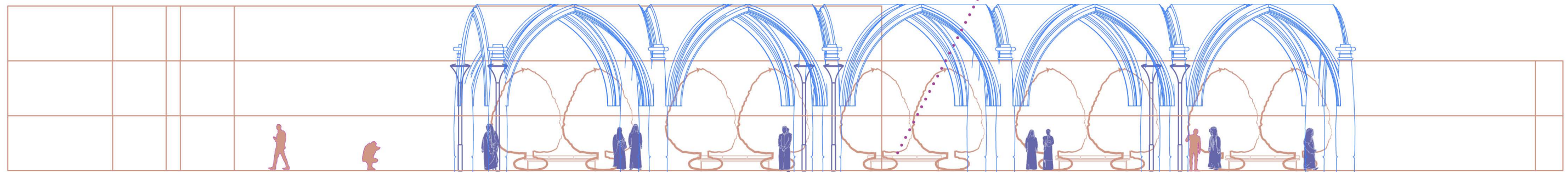
Fig.63 : Axonometric view of Street

Fig.64 : Perspective view of Street

Design Development - Strategy

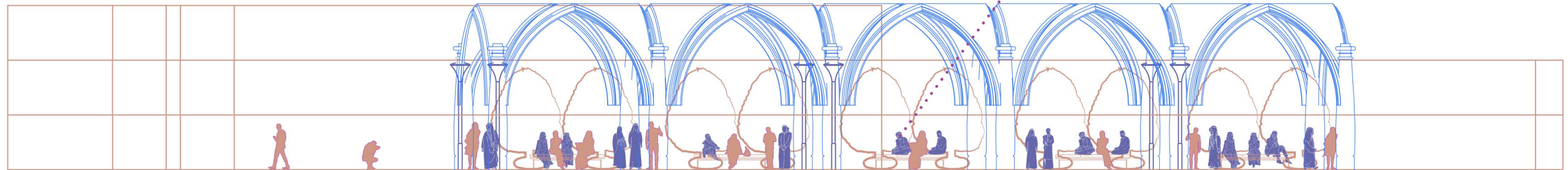
As the augmentation change throughout the day, the morning scene is set to a market street where animated people buying and selling. In the afternoon, the scene changes to cafe street in Iraq with people sitting and having tea/coffee and the visitors can interact with the animations and have conversations. At night, the scene change to only the arches and only animations of fire on the columns. At night, the scene change to only the arches and only animations of fire torch set on the columns, illuminating right above the lamp posts.

■ Physical element
■ Augmented element



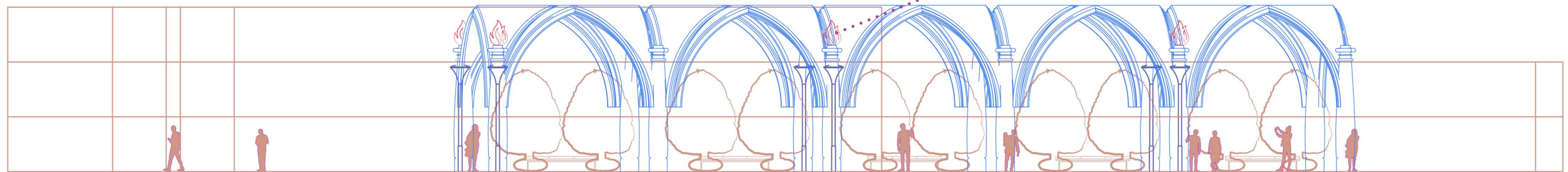
Augmented arches with animated people to demonstrate a market street in Iraq. Can be viewed by smart wearables or phone.

Fig.65 : Elevation view of Street (Street Market)



Augmented arches with animated people to demonstrate a cafe street in Iraq. Can be viewed by smart wearables or phone.

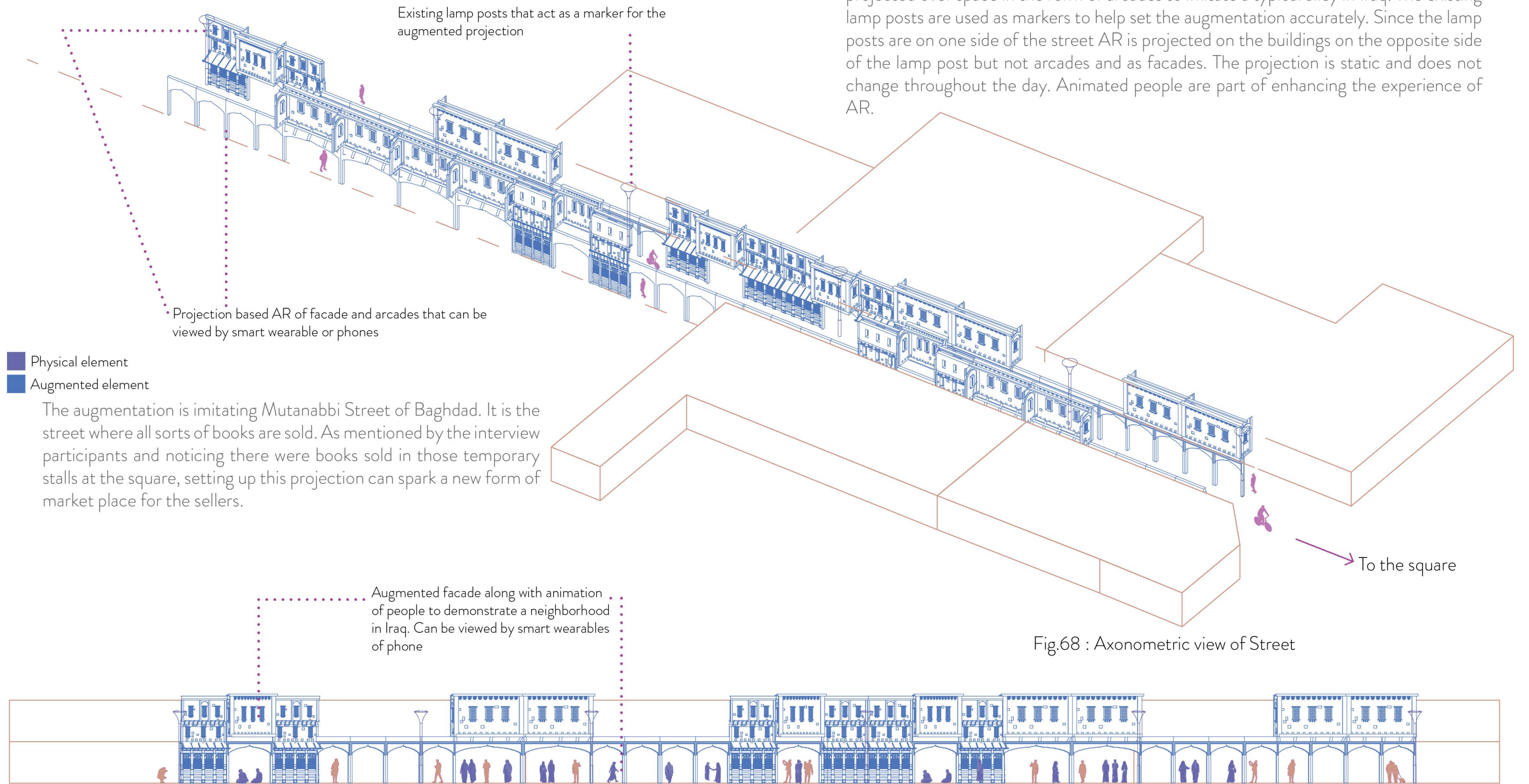
Fig.66 : Elevation view of Street (Cafe Street)



Augmented arches with animated fire torches on top of the columns. Can be viewed by smart wearables or phone.

Fig.67 : Elevation view of Street (Park Street)

Design Development - Strategy



Existing lamp posts that act as a marker for the augmented projection

Projection based AR of facade and arcades that can be viewed by smart wearable or phones

- Physical element
- Augmented element

The augmentation is imitating Mutanabbi Street of Baghdad. It is the street where all sorts of books are sold. As mentioned by the interview participants and noticing there were books sold in those temporary stalls at the square, setting up this projection can spark a new form of market place for the sellers.

Augmented facade along with animation of people to demonstrate a neighborhood in Iraq. Can be viewed by smart wearables of phone

→ To the square

Fig.68 : Axonometric view of Street

Fig.69 : Elevation view of Street

Design Development - Strategy

The street leads to the square. Right before the end of the street are five fountains that are part of the existing square. Like the street lamps, these existing fountains are also used as markers to help set the augmentation accurately. So the fountains are used as a welcoming gate to the square where the market stalls are set up. This is arranged in order to maintain the augmentation and immersion and to connect the different spaces and activities together.

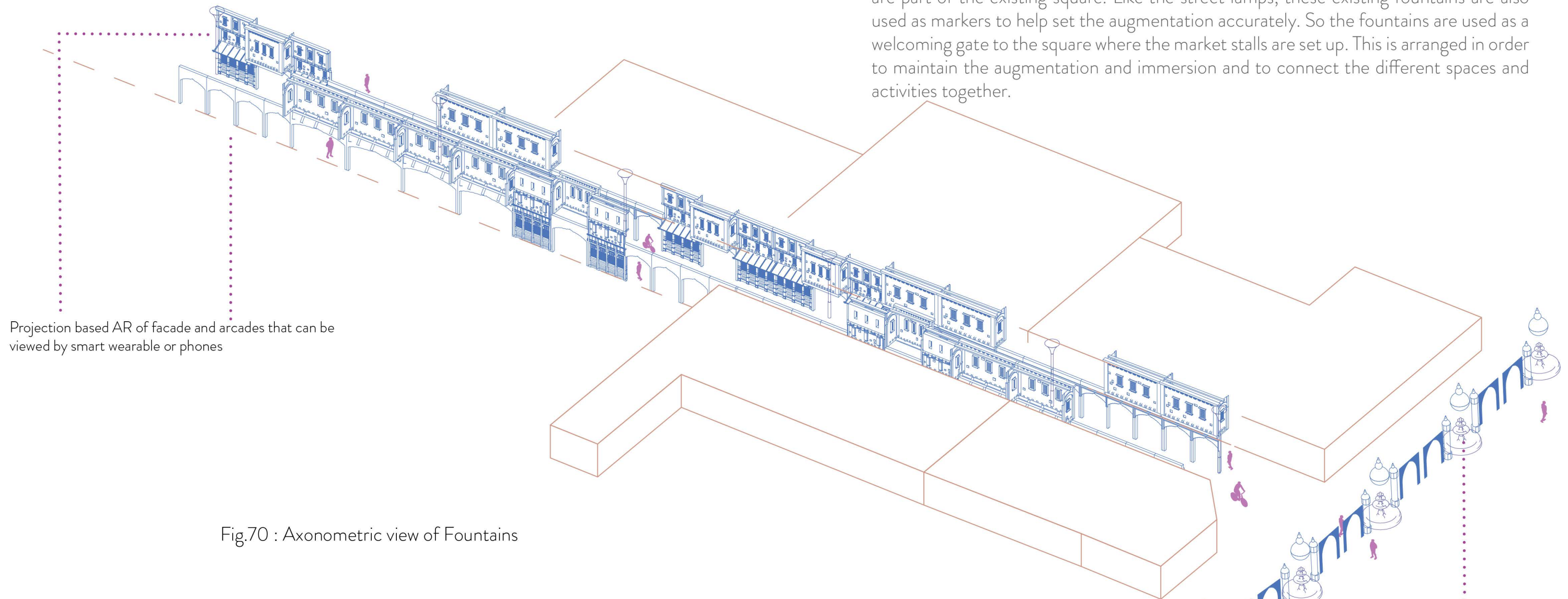


Fig.70 : Axonometric view of Fountains

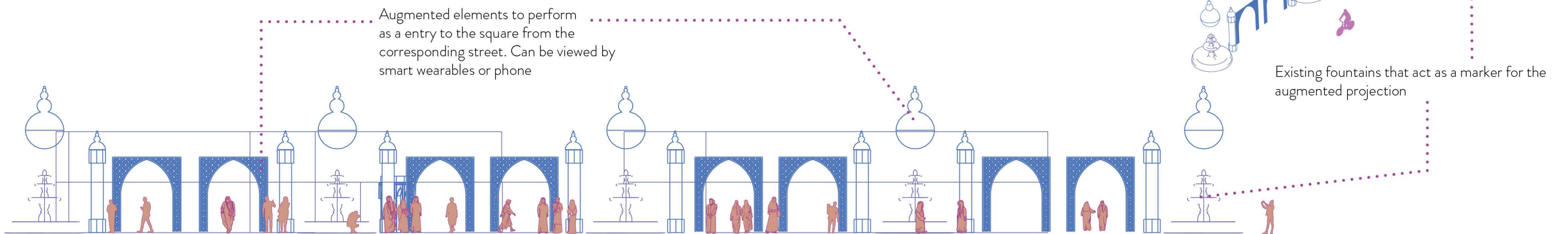


Fig.71 : Elevation view of Fountains

- Physical element
- Augmented element

Design Development - Strategy

Roundabout dedicated to food competition, a form of celebration that can be enjoyed by both groups

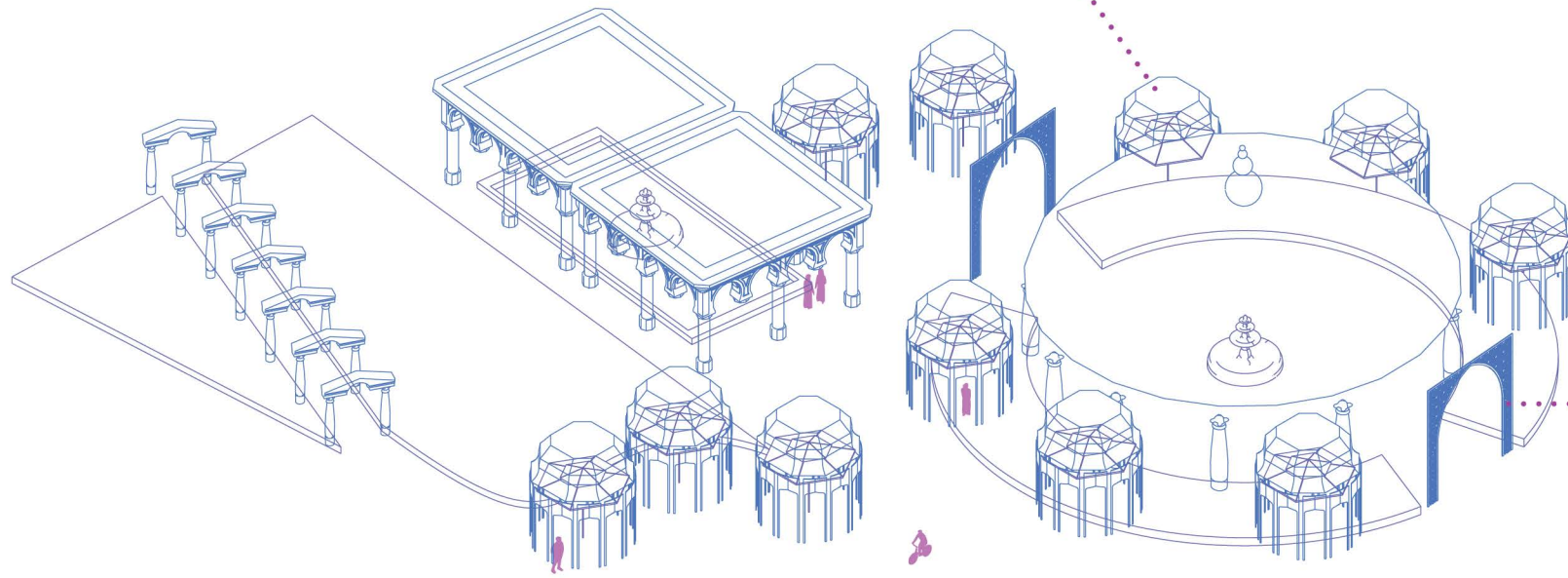


Fig.72 : Axonometric view of Square Space

During observation, the square has multiple sitting spaces used by people at different times of the day. Setting up augmentation around these spaces make people enjoy and relax together.

The augmentation projected are set by marking the existing elements in the space, like the lamp posts, the fountain, the elevated concrete bordering the space. The augmentations set are static with animations of people from Iraq programmed to have short conversations with the visitors.

Augmented elements set as ornamentation to the space. Can be viewed by smart wearables or phone.

- Physical element
- Augmented element

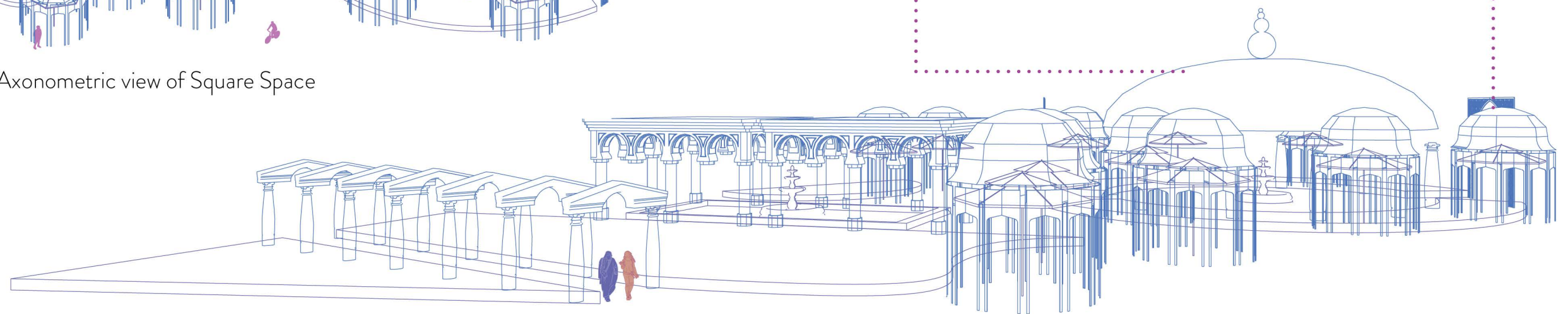


Fig.73 : Perspective view of Square Space

Elements at the square used as a marker for the augmented projection

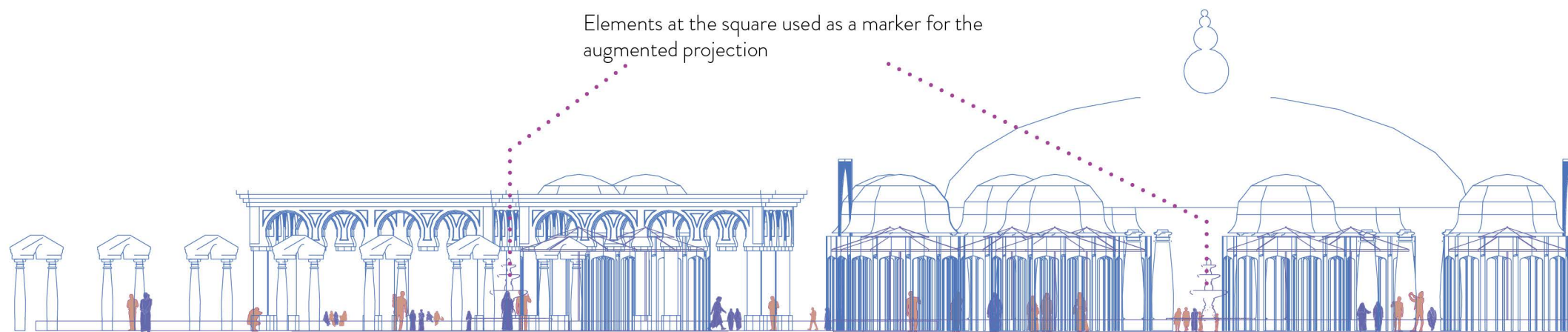


Fig.74 : Elevation view of Square Space

The roundabout space is dedicated to a food competition. It is a unique type of celebration that is held among the Iraqi tribes in their hometown. This was mentioned by one of the interviewing participants. Since Iraqi food is widely appreciated among the Swedish locals, having this celebration would be an interesting activity to share.

Design Development - Strategy

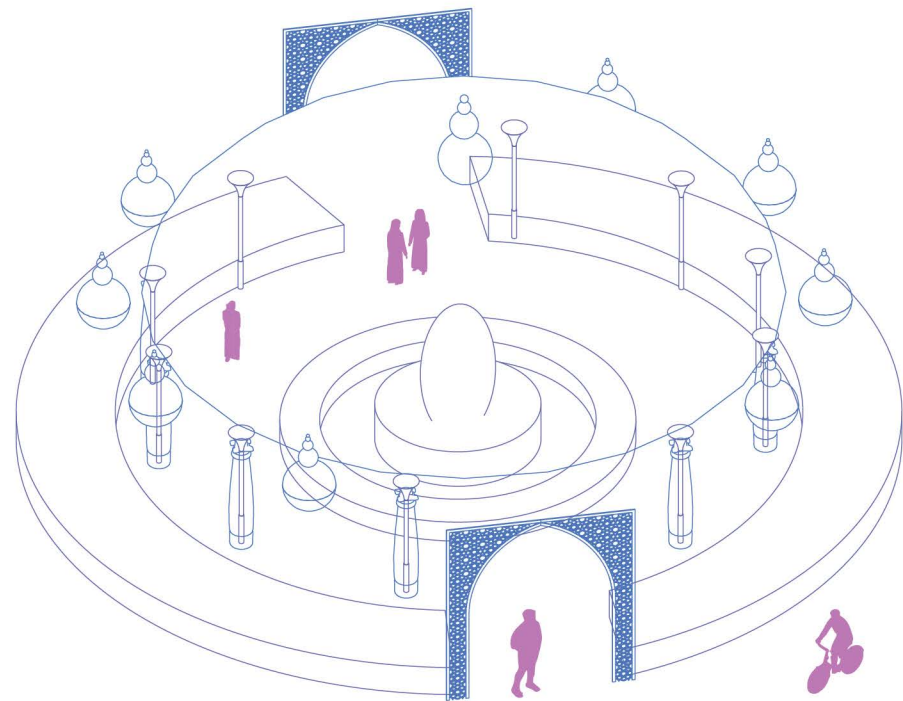


Fig.75 : Axonometric view of Park Space

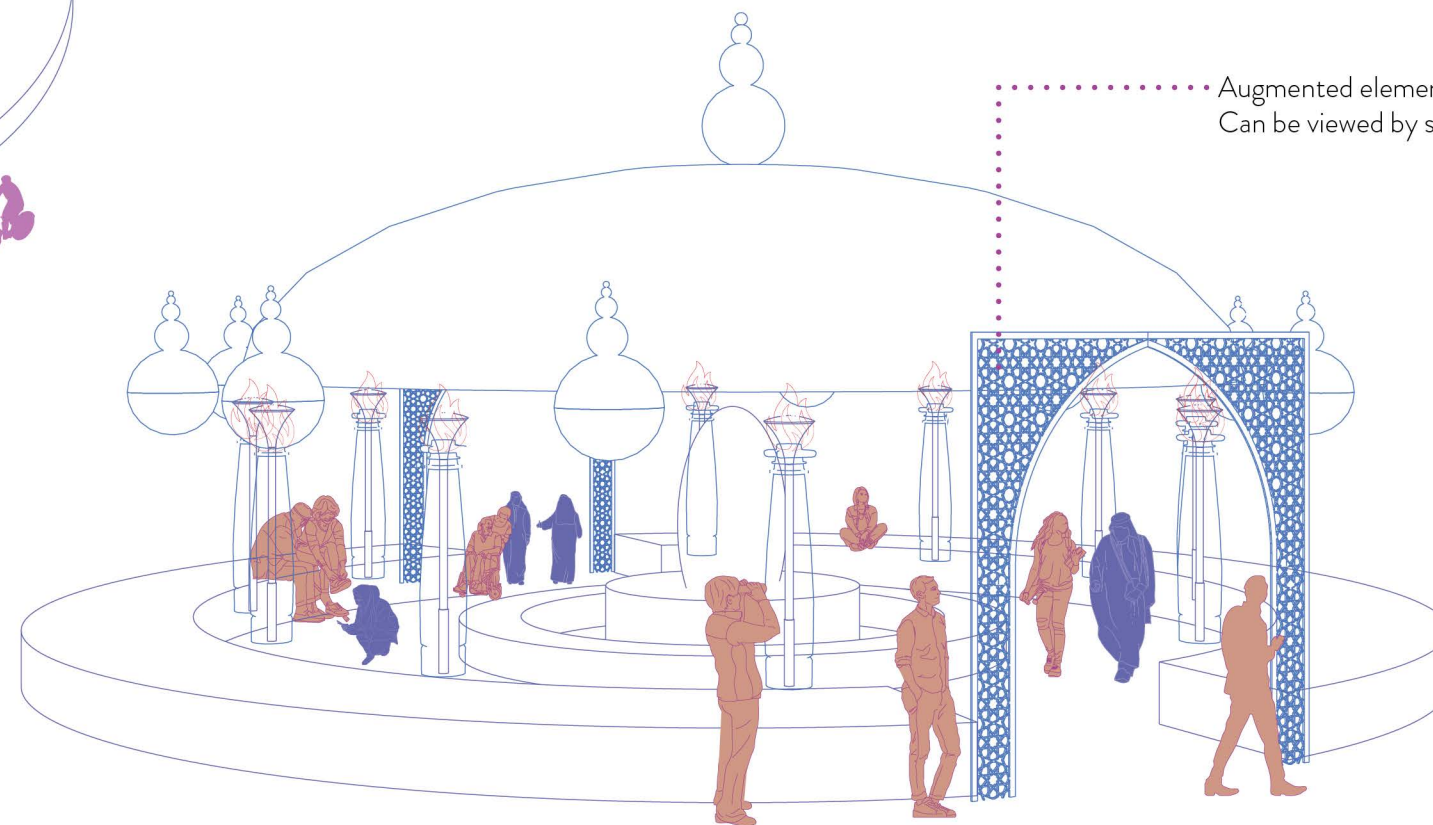


Fig.76 : Perspective view of Park Space

The spaces in the park have mostly static augmentation and not many activities. They are mostly assigned to perform as attracting people to the square. These spaces are also set if people wish to engage less.

Similar observation was made at the park beside the square. There are multiple spaces at the park designed with sitting arrangements. Using the elements in those spaces as markers, augmentations are set to expand further around the site. The illustration below shows one of the spaces to have augmented ornamentation of Iraqi architectural elements. These spaces also have animations programmed, similarly like the ones in the square.

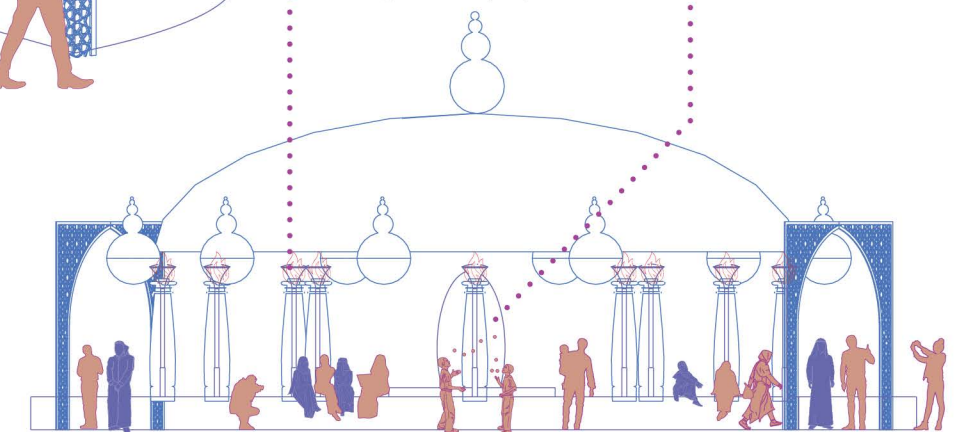


Fig.77 : Elevation view of Park Space

6.3 Final Design - Plan



Fig.78 : Site Plan view of Final Design

6.4 Final Design - Axonometric

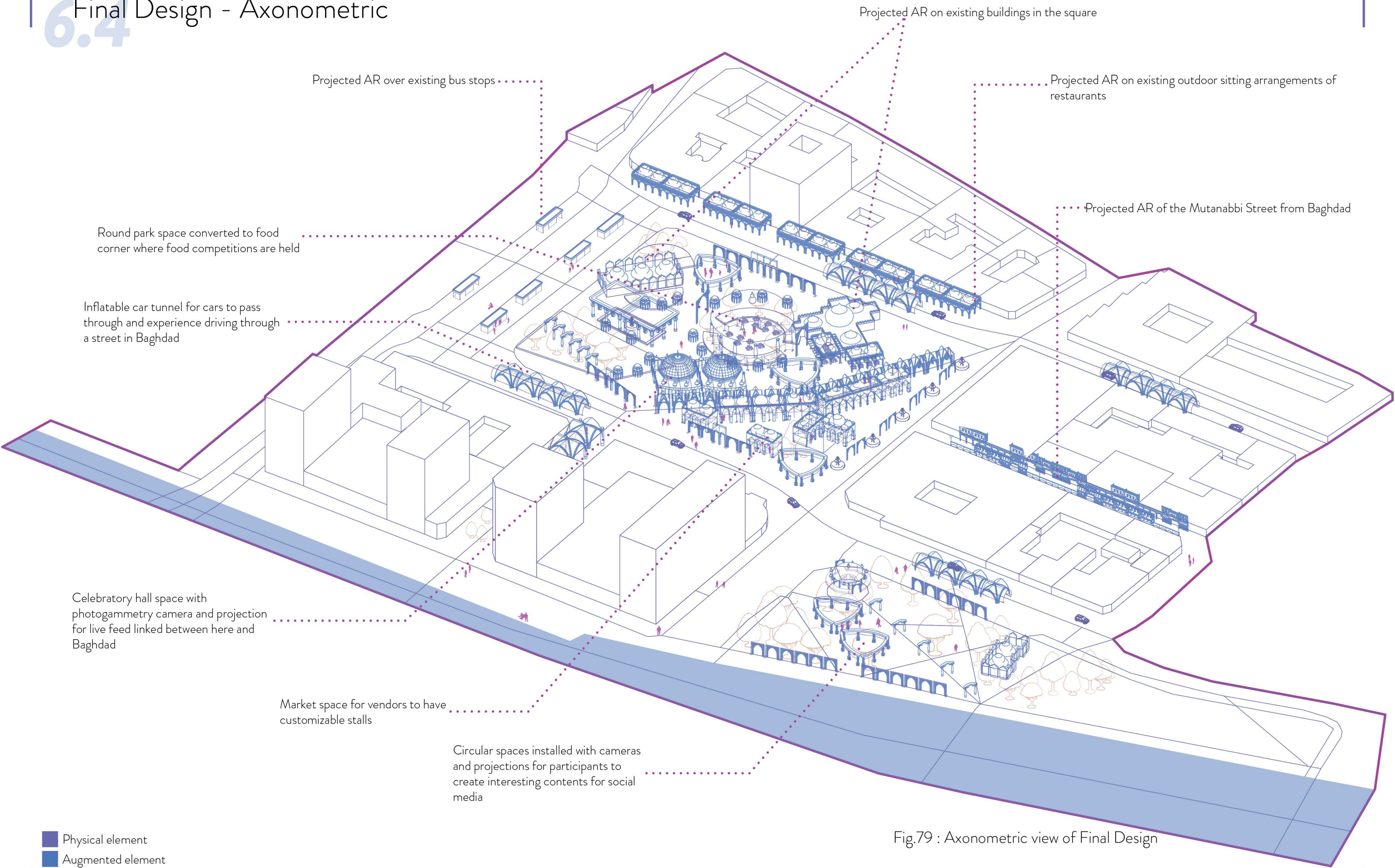


Fig.79 : Axonometric view of Final Design

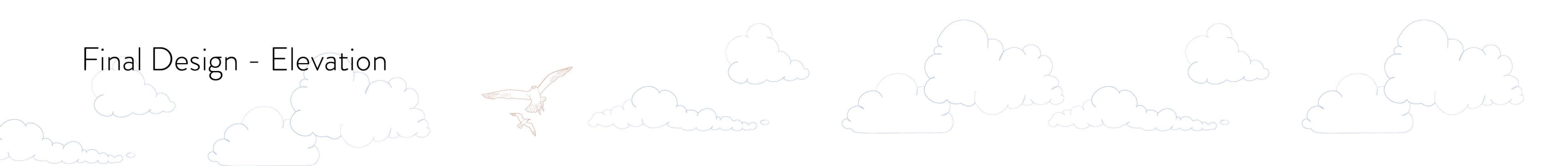
6.5 Final Design - Elevation

- Physical element
- Augmented element
- Animated People
- Present People

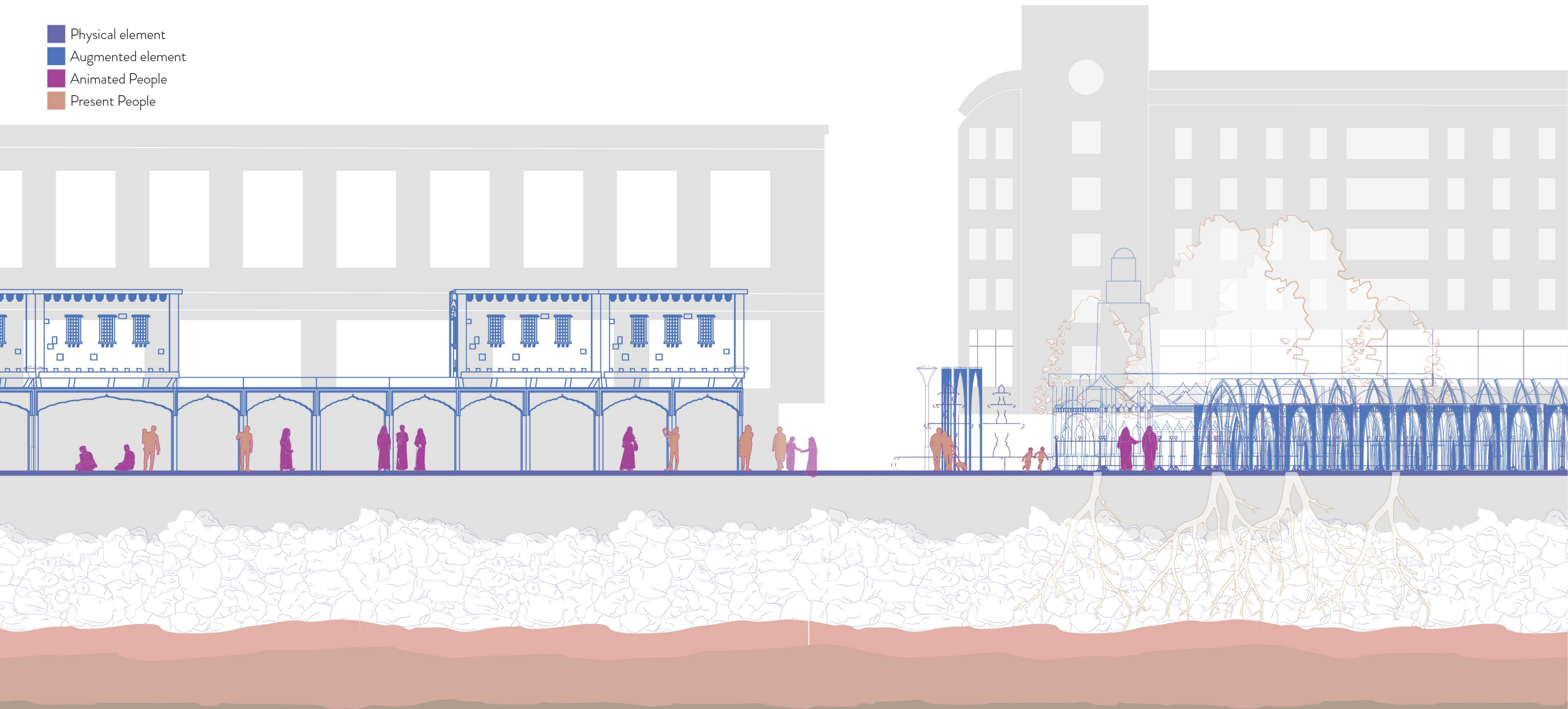
Fig.80 : Elevation view of Final Design in Scale of 1:200



Final Design - Elevation

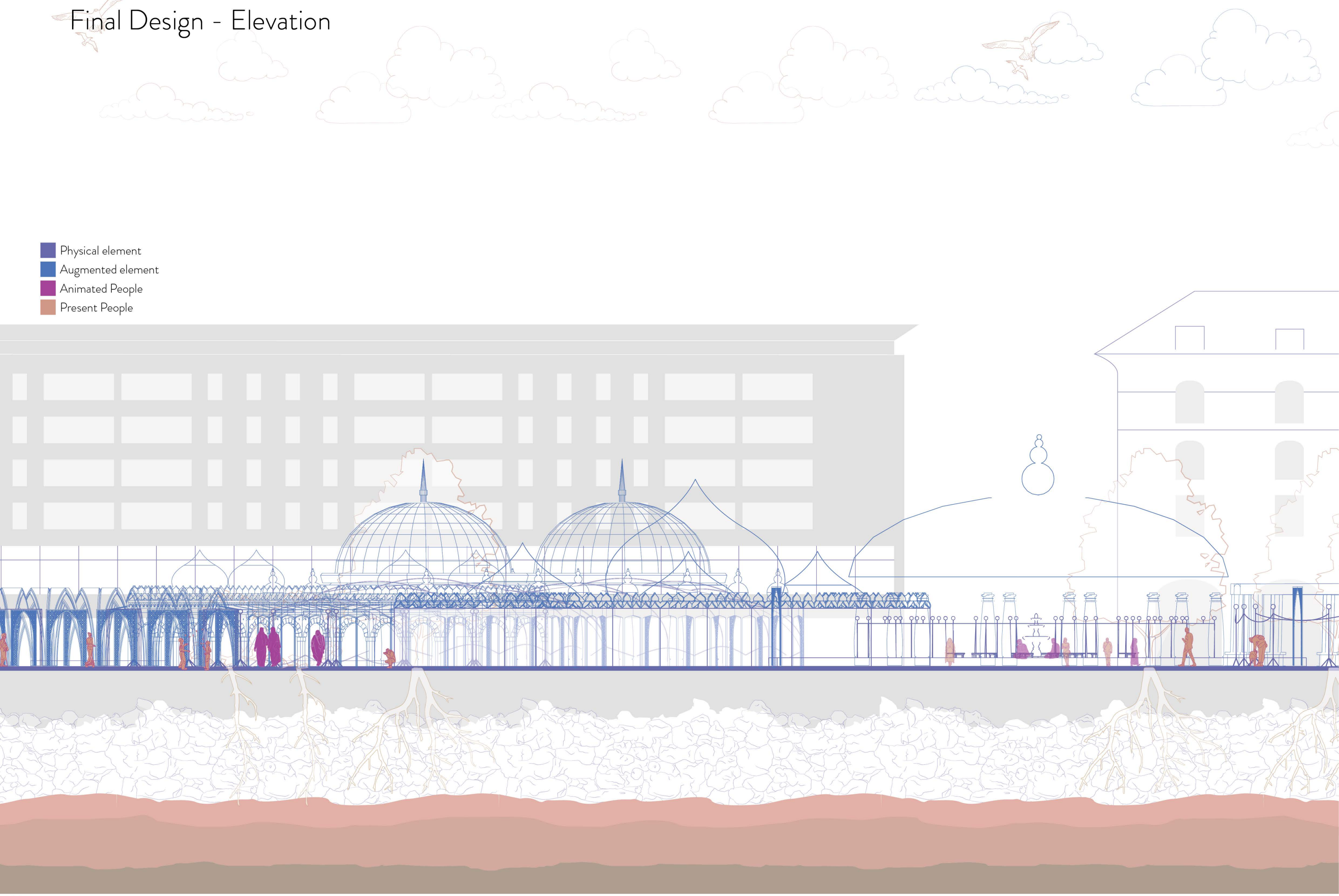


- Physical element
- Augmented element
- Animated People
- Present People



Final Design - Elevation

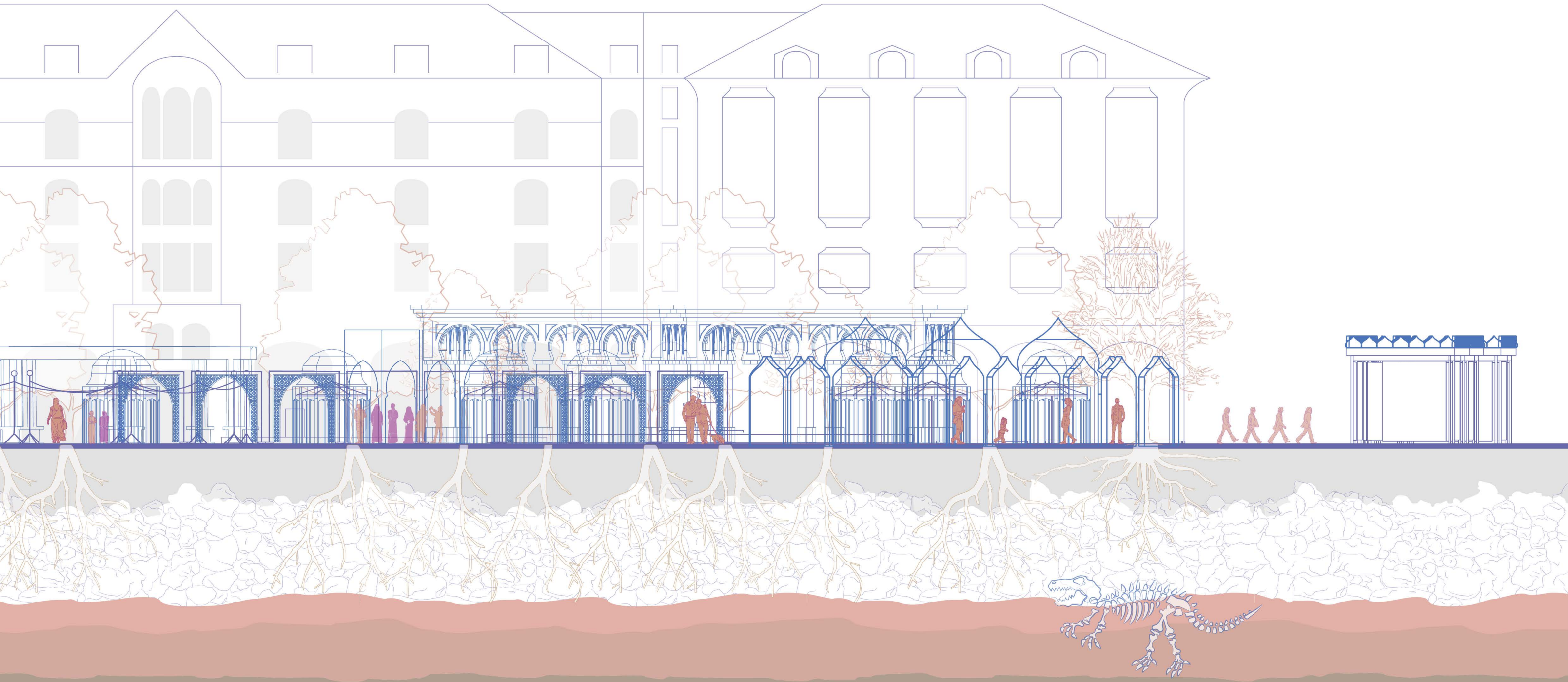
- Physical element
- Augmented element
- Animated People
- Present People



Final Design - Elevation



- Physical element
- Augmented element
- Animated People
- Present People



6.8 Reflection

The designs proposed in this thesis caters to what the targeted group (Iraqi-Swedish minorities) wish to express their culture. The interviews conducted gathered insights about their cultural norms in their hometown of Baghdad and historical influences of the country. Ranging from their celebrations, religious beliefs and their war stories. All these accumulating to the architectural influences of the country.

In order to make them feel present of their hometown, mixed reality is used to design spaces that allow them to participate in the events not as only a visitor but also let them choose how they wish to participate. Spaces are designed to replicate the situations from Baghdad and allow the participants to express themselves in the spaces dedicated for them. These spaces are not only for the minorities but also for people of other culture to participate in the way they believe they can contribute. For example, Mutanabbi Street is a street in Baghdad that is famous for the everyday street market and activities. The street is special for selling books of all kinds. Similarly, many Sunday markets in Sweden is seen to sell mostly books, hence imitating Mutanabbi Street is ideal for both Iraqi and Swedish participants. The market stalls are designed like Lego blocks so that people could design them the way they wish at any time. The elements provided are taken from the tribal influences of Iraq, giving the chance to the minorities to express among themselves individually too. This does not limit to having only Iraqi stalls but also for Swedish individuals who also like to participate. The celebratory hall space with photogrammetry camera and projectors can have live feeds. This gives the opportunity for the Iraqi people could feel the presence of celebrating in their hometown and with the people of Baghdad. This could also be a learning opportunity for the Iraqi born in Sweden and gaining knowledge more in depth about their culture. Some spaces are dedicated for social media content creators and make interesting contents using mixed reality provided at the site. Since food is the common shared interest among the Iraqi and Swedish people, dedicating a space for the Iraqi people to celebrate their food competition would be the best way to engage in activities that both group can participate.

Most interviewed participants mentioned that they wish to contribute to their society with academia, hence many of the spaces are accompanied by animations of Iraqi people which are programmed to also have academic conversations. This is aimed at not only Swedish people but also the young Iraqi-Swedish people who have neither born or visited Iraq. The idea is designed to educate these young people about their Iraqi roots and culture. Other small elements designed are the small details that contribute to the overall experience and letting the people to express themselves. Making new forms of memories and allow both groups to express and participate in different types of activities presented.

Giving the people to participate in the activities and sparking new forms of expressions could possibly create a social cohesion and could possibly reduce the social barriers among different groups. Since my thesis focus on the social resilience among Iraqi minority group, using mixed reality could be a possible approach to experiment and study.



PART 7

CONCLUSION

7.1 Conclusion

Following the theory of Spatial Experience Ladder (SEL), achieving *presence* would indicate that the participants are under a complete immersive experience. Using this and converting an existing public space into a domain for a target minority is what the thesis project aimed to explore. I believe this would also indicate the participants understanding the true role of a group expressing their identity in a public domain. Designing with the help of *mixed reality*, the designed project is aimed to examine how virtual elements can compliment the physical built environment. Creating new forms of situations over an existing platform.

The reason to use mixed reality as the tool of exploration is that it has the potential to be used as a design tool to communicate new ideas. It takes away the physical costs that require time and space. Mixed reality allows architects and designers to experiment their design in a synthetic way and allowing them explore across flat media with the help of spatial computing. The core intention of this thesis is to explore the thought of possibilities to include the general people into the design process when designing public spaces. This could let designers experiment in a broader scale and understand the changing needs of the public before making tangible design decisions.

In conclusion, mixed reality could change the existing design discourse with the possibilities of designing synthetic structures and experiment them in real situations, using the general public and let them participate in the design process. With the constant advancement of technology, mixed reality will continue to mature and give designers more opportunities to exploring design methods. Computational design could expand from flat media to immersive media, giving designers and concept artists experiment ideas in 1:1 scale. Physical spaces has reached the limit of exploration and virtual spaces are trending. Mixing these two realities into one can be a paradigm shift in the built environment.



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