Chromatic interventions in urban space paving: what are the possibilities?

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Colours impact urban aesthetics, play a fundamental role in visual identity, influence individuals' relationships with spaces, and transform the way environments are used. Well-designed colourful spaces contribute to the positive user experience, visually attracting and facilitating the interpretation and appropriation of the city by its inhabitants. Thus, colour interventions can be understood as an urban design tool that supports orientation and wayfinding strategies, while conserving, revitalising, beautifying, and activating urban areas, contributing to the local identity. Although, in general, the colour image of the city is often associated with buildings, urban chromatics also involves other elements such as furniture, vegetation, and paving. The latter has currently become one of the urban components that stand out in this context. It is well known that the use of colour in paving is very diversified, but, despite the existence of many chromatic projects, the lack of systematic studies does not allow a deeper understanding of this urban renewal strategy. This research analysed 115 urban projects to categorise the different ways in which colour is used. The interventions were classified by the function of colour, such as aesthetic or utilitarian, and by the infrastructure involved, such as areas for vehicular or pedestrian traffic. The performed analysis revealed that colours can be used expressively and strategically to transform urban spaces, prioritising pedestrians and creating spaces for social interaction of the community.

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Introduction

Since most people's daily lives take place in urban areas, it becomes evident that the quality of public spaces and urban structures, such as streets, squares, and paving, directly affects the comfort and well-being of the population. Well-designed and humanised environments, as established by urban planner Jan Gehl [1], attract and invite people to take ownership of the city, promoting a sense of belonging. In this context, it is correct to say that one of the main demands of contemporary society is the improvement of public spaces in cities. To address this demand, various aspects must be considered, including physical, cultural, and aesthetic characteristics. In this scenario, colours have emerged as a powerful tool to qualify spaces.

Colours can be used to distinguish urban functions, providing individuals with territorial control and a sense of unity and identity—factors that directly affect the quality of human life [2]. Pedestrian crossings, bike lanes, and signage signposts traffic signs are common elements of public space that use the colour to attract individuals' attention, convey information, and guide their movement, influencing the legibility and functionality of the city. These colourful elements contribute to the perception of urban space, affecting not only people's experiences in public spaces but also the local identity.

Colours having an aesthetic function are often used to promote local culture and symbolism. In this sense, the relationship between colours and urban identity is supported by various researchers, who highlight the importance of colour in building an emotional and cultural connection with the environment. Works by authors such as Lenclos [3] and Lancaster [4], among others, confirm the fundamental role that colour plays in the formation and reinforcement of a region's identity. Also, Cristina Boeri [5], within the concept of colour loci placemaking, emphasises the ability of colours to create new identities.

Colour plays both a perceptual and utilitarian role by having an effect on the way people perceive and use the city. This occurs on two main levels: informational and emotional. On the informational level, colour provides cues about the surroundings, communicating characteristics of the space to the user, directing their movement, and guiding their actions. On the emotional level, colour promotes different feelings such as safety, stability, and protection; it also can induce dramatic or tranquil effects [6]. Thus, in a visually pleasing environment, positive sensations and emotions are triggered in people, which can encourage exploration and the prolonged presence of users in these spaces.

In recent years, public paving has gained prominence as an element of the city with great potential for enhancement. In addition to serving as infrastructure, paving has historically been used as a decorative and informative element in various ways, bringing significant changes in the local aesthetics.

The Roman Mosaics, such as the Piazza del Campidoglio remodeled by Michelangelo in the 16th century, and Portuguese Cobblestone pavement, like the Padrão dos Descobrimentos from the 20th century, are examples of art linked to the polychromy of urban paving. They stand out for their beauty and demonstrate how paving can function as an aesthetic element of the city. In the 21st century, an example that follows the same logic is Plaza Penedès in Barcelona. A colourful carpet emerges in the floor design as a symbolic object that evokes spaces for gathering, welcoming, and social interaction, creating a large multicultural mosaic formed by the different communities that coexist in the neighbourhood (Figure 1).

Figure 1: Experimental procedural and setting.

The most contemporary trend in using paving as a tool to enhance urban spaces, however, is linked to painting of existing and established pavements in the city. Paints of various colours are applied to the

pavements, creating designs and decorative patterns (Figure 2). These projects transform public spaces by making changes to the road design to prioritise pedestrians. Narrowing the traffic lanes, extending the road curb, and installing refuge islands are some examples of actions taken. Other larger-scale initiatives transform vehicle-accessible spaces, such as parking lots and roads, into pedestrian environments, such as open plazas and pedestrian streets (Figure 2, right). Many of these projects were initially conceived as temporary; however, due to the many positive outcomes they became permanent.

Figure 2: A coloured pedestrian crossing (left) and a square where there was previously a vehicular road (right). Images from Pinterest.

When accessing image search websites, such as Google Images and Pinterest, it is evident that the ways in which colour is used in city paving are very diverse, and there is an infinite number of projects in this context. However, despite the wide range of chromatic actions on public pavements, the lack of systematic studies on the topic contributes to the limited understanding of this global phenomenon.

Thus, the following question arises: in what ways can colours be used in city paving to enhance urban space? To answer this question, it is necessary to create a typological categorisation for chromatic projects. In addition to serving as a guide for future initiatives involving colour in paving, the classification of the collected information will allow for a better understanding of the diversity of interventions and the objectives behind this trend.

Methodology

In order to understand the chromatic interventions made in urban paving, and to identify the possibilities of using colour in these actions, different initiatives were analysed based on urban design guides and manuals.

The research was developed in two stages, both carried out through observation of the images and capture of the information available online. In the first stage, manuals, guides, and websites about chromatic urban actions were consulted and analysed, aiming to identify projects implemented in paving. The selected sources were: the Designing Streets for Kids manual (i); the Asphalt Art Guide (ii) and its respective website; the Asphalt Art Initiative (iii); the guide Piazze Aperte: Un programma per lo spazio pubblico di Milano (iv); the website Street Plans (v); and the book Urbanismo Ciudadano en América Latina (vi). In order to include a greater variety of projects, different images from the Pinterest website were also analysed due a wide range of projects shared on this platform.

Based on the information gathered in the first stage, 115 projects were selected for analysis. The selection criteria were: 1) the projects should focus on the use of colour in public paving; 2) the "amount"

of colour used in the intervention should be expressive, meaning only projects with a significant use of colour were selected; and 3) the projects should have sufficient information to enable analysis. In cases of remaining doubts, such as regarding the location of the intervention, other sources were consulted, including the Google Maps location website.

The analysed samples presented a wide variety of significant information, which was organised into data sheets to facilitate the reading of the projects and, consequently, the identification of patterns of their implementation. The developed data sheets cover five themes (see Figure 3).

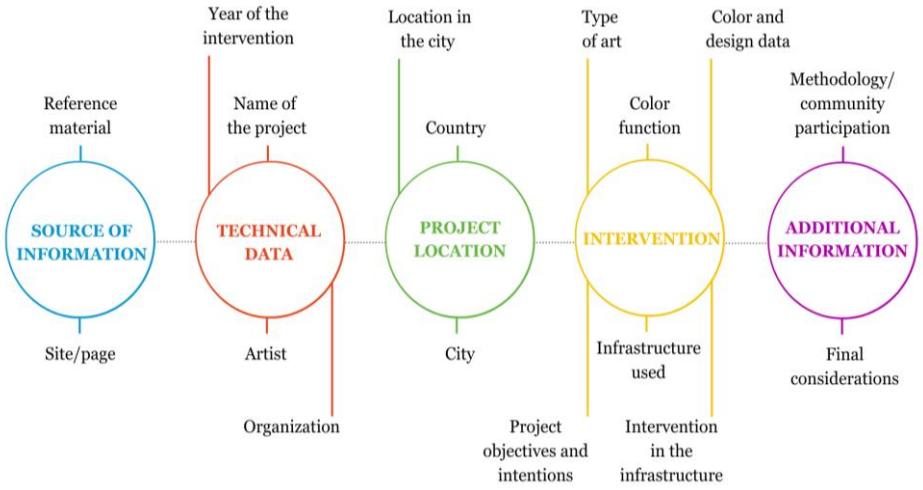

Figure 3: Topics covered in the data sheets.

A total of seventeen items were addressed. Among these, six stand out for focusing on the theme of colour or discussing the intervention itself: (i) colour function, (ii) infrastructure used, (iii) location in the city, (iv) project objectives and intentions, (v) intervention in the infrastructure, and (vi) colour and design data.

Results and discussion

In the initial contact with the projects, the first difference observed among the samples was related to the type of art present in the interventions. Some actions featured designs spread across the paving, alternating the paving material with paint, while others left no space for the pavement to show, since everything was painted. However, in the various research sources, there was only one way to name the designs in the projects: mural – or mural art.

Noting that there are significant differences between certain artistic compositions and that "mural" is too general term, it became necessary to propose another term to differentiate the actions. Based on this, there are two types of art: mural art and sparse art.

The difference between the two lies in the way the designs are created on the pavement. In the case of loose designs free drawings, not necessarily physically connected, "scattered sprayed" across the pavement, the intervention was classified as *sparse art* (Figure 4, left). This term was created and adopted to identify this type of art and was chosen precisely because of the way the designs are conceived.

Alternatively, *murals* are presented in a more concentrated and compact composition, where the designs are interconnected, and the intervention area is clearly defined. In this case, the design is created as if the pavement were a blank canvas, where everything is painted (Figure 4, right).

It is important to note that there are projects where it is not possible to determine which type of art predominates—sparse or mural—or where both options are found simultaneously, as the artistic proposals are not mutually exclusive. In these cases, the art is considered to be mixed.

In addition to classification of the art as sparse or mural, it is possible to extend the analysis to the chromatic compositions of the projects in order to identify which contrasts and harmonies were applied in the interventions.

Figure 4: Examples of sparse art (left) and mural art (right). Images from Pinterest.

The classification of projects by function and infrastructure

Analysing the artistic and chromatic aspects of the chosen projects, it becomes clear that the main differences between the interventions, on a general project scale, are related to the function performed by colour and the infrastructure used in the intervention, thus suggesting two ways to classify the actions involving colour in paving. In both cases, colours can be found in the urban space as sparse art, mural art, or mixed art.

1. Categorisation of projects by the function of colour

Two main functions for the use of colour in paving intervention projects can be identified as follows: aesthetic function and the function of space redesign. The latter is related to the perceptual and utilitarian function of colour.

In the analysed samples, it was possible to verify that, in many cases, the objective of the chromatic actions is to encourage the use of urban spaces through the embellishment of the area. There is a search for visually pleasant and attractive spaces that inspire the community to appropriate the location; colour, in these cases, is primarily understood as a tool for the visual qualification of the space, thus having an aesthetic function. Although there is no subclassification for this type of function, the chromatic analysis of each project is crucial to understand this typology. These analyses unfold into an evaluation of the physical aspects (chromatic attributes, including types of contrasts and harmonies) and an analysis of the symbolism and associations provoked.

In addition to the aesthetic function, colour can also play a utilitarian function of space redesign. In this case, two types of chromatic intervention in paving emerge: road redesign and urban redesign (Figure 5).

Both interventions prioritise pedestrians and cyclists over vehicles. Road redesign includes projects with objectives and actions related to traffic calming, where colour is used as a tool to modify the design of the city's road structure. Examples include actions with colours that alter the position of curbs and sidewalks, reinforce or add pedestrian crossings, and create refuge islands. In this case, colour is found in areas of vehicular traffic.

Figure 5: Examples of classification by the function of space redesign: road redesign (left) and urban redesign (right). Images from Pinterest.

Urban redesign has a different objective and aims to transform—redesign—urban spaces through new uses. In this case, colour is used to create new pedestrian areas in the city. Thus, environments previously used for one purpose are adopted for another one. The most common example of this action is outdoor parking lots converted into pedestrian plazas through pavement painting. In this type of projects, colour is used to mark areas inaccessible to motor vehicles.

In the analysed projects, there are cases where the intervention includes both road redesign and urban redesign; an example is when vehicular streets are transformed into pedestrian spaces, such as promenades and squares. In these situations, colour in the paving not only changes the type of use of the environment (urban redesign), which becomes dedicated to pedestrian activities, but also modifies the road structure of the city (road redesign), by "excluding" a vehicular lane from the road system and creating a space accessible only to pedestrians and cyclists.

2. Categorisation of projects by the infrastructure involved

In addition to classification by function, another way to categorise colour interventions in paving is based on the type of infrastructure involved in the project. According to the *Asphalt Art Guide* [7], there are two possible options: art in the roadway and art in pedestrian space (Figure 6). Based on this classification, it was possible to propose subcategories identified by the location and type of art applied.

Figure 6: Art in the roadway (left) and art in pedestrian space (right). Images from Pinterest.

Regarding art in the roadway—projects developed in paved areas that are active and accessible to motor vehicles—both sparse and mural art can be found in locations such as:

- Intersection: designs occupy the convergence area of roads at an intersection and are generally large in size;

- Pedestrian crossing: designs can either replace the traditional white stripes of the crossing or be painted alongside them;
- Paving: designs extend along the length of the roadway.

On the other hand, art in pedestrian space includes intervention projects carried out in areas inaccessible to motor vehicles, such as sidewalks, curb extensions, and pedestrian surfaces. The proposed subcategories for this type of intervention vary according to the location of the action. Thus, it is possible to have mural or sparse art in:

- Curb extension: designs are applied to the roadway to increase sidewalk space. The artworks, mostly murals, thus extend the limits of the curb;
- Sidewalk: colour interventions are carried out on pedestrian traffic areas, such as sidewalks, streets, and parking lots transformed into squares/plazas;
- Refuge island: positioned, generally, at the division between two lanes of traffic, the refuge island is a space reserved for pedestrians to facilitate crossing wide roads. Refuge islands developed through colour interventions are mainly murals painted on the roadway, marking the area designated for pedestrians and restricting vehicle access;
- Recreational area: in this case, murals are created in spaces like playgrounds and sports courts.

The two ways of classification, based on function and based on infrastructure, are not mutually exclusive but rather represent different ways of categorising colour projects in paving. Additionally, all classifications can include both sparse art and mural art. Therefore, it is possible to identify, for example, an aesthetic function of art in the roadway intervention that can be either a mural or sparse art on the pavement.

Complementary results

In addition to the general classification of the projects, other aspects were also observed: location in the city, in terms of the immediate surroundings and existing problems in the area; project objectives and intentions; intervention in the infrastructure; and colour and design data.

The point *location in the city* aims to understand the relationship of the project with its surrounding environment, identifying the area of intervention with respect to the elements around it, providing information about the type of surroundings, local characteristics, and nearby services.

Based on the studied projects, it was possible to identify some of the most common locations for this type of urban intervention.

Location in the city	
- Intersection;	- High pedestrian traffic area;
- Parking lot;	- Residential area;
- Corner;	- Unsafe area;
- Area near schools/childcare centres/universities;	- Underutilised space;
- Connection area between neighbourhoods;	- Near parks;
- Low-income neighbourhood;	- Near hospitals;
- Area of historical or symbolic importance;	- Square;
- Area of cultural significance;	- Playground;
- High vehicular traffic area;	- Sports court.

Table 1: Location in the city.

In addition, different intentions behind the colour interventions in paving were noted. Although they do not constitute a way of classifying chromatic actions, they are important pieces of information as they indicate the project objectives of the initiatives, which consequently determine how each project is developed. In general, it is observed that increasing pedestrian safety and local attractiveness are the most common reasons behind these actions. Other intentions found include prioritising pedestrians and cyclists, improving connectivity with other parts of the city, enhancing local accessibility, and creating fun spaces for children.

Regarding the *intervention in the infrastructure* topic, which indicates the specific intervention carried out, the most common actions identified are:

Intervention in the location	
- Extension of the existing curb; - Addition of a pedestrian crossing; - Action on the existing pedestrian crossing; - Action on the existing roadway; - Action on the existing sidewalk/plaza; - Addition of a refuge island; - Action on the existing refuge island;	- Addition of a bike lane; - Action on the existing bike lane; - Transformation of the existing roadway into a sidewalk/plaza; - Transformation of the existing parking lot into a plaza; - Action on a playground; - Action on public equipment.

Table 2: Intervention in the infrastructure.

The fourth and final aspect of great relevance in the projects concerns colour and design data. This section connects with the studies developed by Efimov [8] on urban polychromy and complements the categorisation under the aesthetic function by detailing the colour patterns and design used in the intervention.

Thus, the following characteristics are highlighted: (i) the colour palettes; (ii) the most expressive colour compositions, such as relationships of contrasts and harmonies; (iii) the theme of the design – fauna, flora, abstract, human figure, geometric shapes; (iv) whether there is a symbolism determining the adopted design, such as inspirations drawn from cultural and local characteristics.

Examples of analyses

1. Gulfton Safe Streets, Houston, USA

Figure 7: Intervention in Gulfton Safe Streets. Image sourced from Bloomberg Philanthropies' Asphalt Art Initiative.

(a) Location in the city:

- Intersection;
- the space serves as the entrance to the local community;
- difficulty of movement for pedestrians and cyclists;
- high number of accidents;
- close to hospitals;
- unsafe area;
- area of high vehicular traffic;
- area of cultural importance.

(b) Project objectives and intentions:

Considering the region's reality, the proposed intervention aimed to increase the visibility of pedestrian spaces, such as marking the pedestrian crossings and delineating a bike lane, in order to ensure the safety of pedestrians and cyclists. The initiative also sought to promote vitality in the public space, being a "visual" intervention through the colours adopted in the action, which strengthens the region's identity [9].

(c) Intervention in the infrastructure:

The project carried out is categorised as an aesthetic intervention and a road redesign, with art in the roadway and art in pedestrian space. The interventions made are identified below (Figure 8):

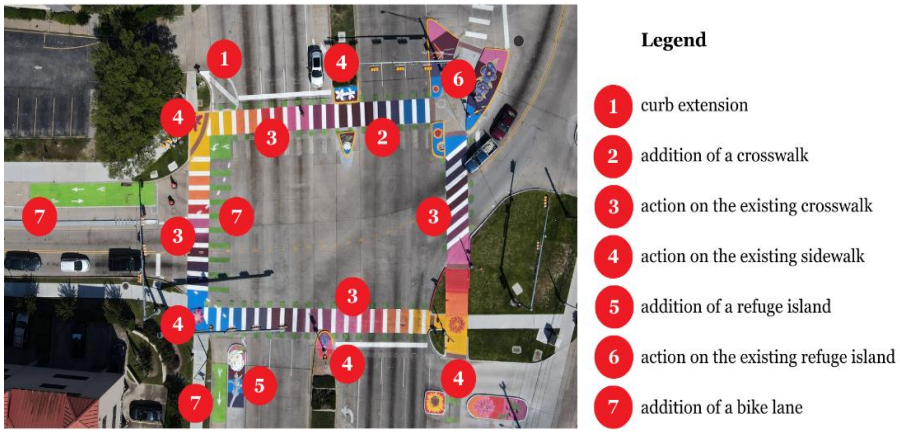

Figure 8: Identification of the interventions carried out. Image from the Bloomberg Philanthropies' Asphalt Art Initiative (modified).

(d) Colour and design data:

In the project, seven main hues can be identified: yellow, blue, green, orange, red, pink, and purple in saturated tones.

Although, likely, the amount of each hue is similar to the others (except for the green of the bike lane), yellow and blue seem to stand out among the other colours, as they are present at the "corners" of the crossings, that is, in the area of the design with a larger portion of the same colour. The choice of saturated colours was intentional [9], as the project's creators aimed to enhance the visibility of the crossings to improve pedestrian safety.

Regarding the contrasts, following Itten's definition [10], the intervention includes the following features: hue contrast (seven different hues) and temperature contrast (yellow, orange, and red versus green, blue, purple, and pink). As for the harmonies, the hues are opposites on the colour wheel, creating

a complementary harmony (yellow-purple, orange-blue, red-green). Since three pairs of complementary hues are used, it is also possible to identify a hexadic harmonic composition (Figure 9).

The design of the project is simple, with the use of stripes on the crosswalks and floral elements in the artwork on the sidewalks and refuge islands (see Figure 7). Furthermore, it is noticeable that the white stripes amidst the colourful mural create a sense of rhythm and continuity in the artwork.

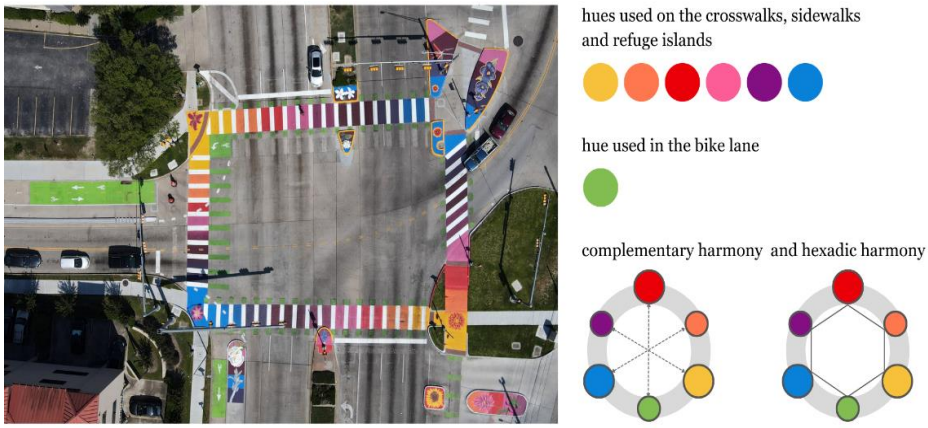

Figure 9: Chromatic analysis of the intervention. Image from the Bloomberg Philanthropies' Asphalt Art Initiative (modified).

2. Playground Barigui, Curitiba, Brazil

Figure 10: Playground Barigui. Image from ArchDaily Brasil.

(a) Location in the city:

- located in one of the main parks in Curitiba, Barigui Park;
- playground;
- close to an event venue;
- close to a parking lot;
- underutilised space.

(b) Project objectives and intentions:

The project aimed to attract young people to the space by promoting games, encouraging to leave the home TVs and computers, and stimulating the appropriation and social interaction in public spaces [11]. Additionally, the intervention aimed to strengthen the sense of community and connection to green

spaces, as well as positively impact the physical and mental well-being of children. Another key goal is stimulating playfulness through a multicoloured and visually attractive space.

(c) Intervention in the infrastructure:

The completed project can be classified as an aesthetic intervention, with mural-type art in the pedestrian space within a recreational area.

(d) Colour and design data:

In the project, two hues can be identified: orange - saturated - and blue, which is expanded into three shades (Figure 11).

Figure 11: Chromatic analysis of the intervention. Image from ArchDaily Brasil (modified)).

It can be noted that orange is used only in the circles of the design, while blue extends throughout the rest of the intervention. The shades of blue vary in lightness and saturation, while orange is presented in a single, saturated and vibrant tone.

The proportion between the two hues—blue and orange—seems to follow the logic of the contrast of extension [10], as orange is present in a smaller proportion than blue, creating a more balanced combination. In addition to this contrast, a contrast of temperature can be observed (orange versus blue). As for the harmonies, the hues are opposite on the colour wheel, forming a complementary harmony (Figure 11).

The design features geometric shapes and overlapping curved lines that, combined with the colours, guide users within the space, demarcating areas for sitting and circulation. "The dark blue of the floor directs the 'flow' of children, the light blue defines the 'breathing' and resting areas, and the orange highlights the points where the main playground equipment is located" [11].

Conclusions

Based on the analysis performed, it can be concluded that chromatic interventions in urban paving have immense potential for revitalisation of public spaces, both through their aesthetic function and their practical utility in redesigning of cities. The strategic use of colour on streets, squares, and other urban elements not only improves the visual perception of spaces but also has a direct impact on functionality and urban mobility. By creating a more attractive and accessible city, colours play a crucial

role in transforming previously lifeless environments into dynamic, inviting places that the population can adopt and enjoy.

Furthermore, by classifying the projects according to their functions and infrastructure, it becomes evident that in many cases, colour is used not only as a decorative element but also as a tool for spatial reorganisation and improvement of the urban experience. The presence of interventions such as colourful pedestrian crossings, road redesign, and the transformation of underutilised spaces into pedestrian areas reflects the growing awareness of the importance of urban planning that prioritises the well-being of the population and promotes smart cities.

The integration of colour into urban design reflects a commitment to create more human-centred, safe, and accessible spaces, contributing to the development of cities with a higher quality of life. The combination of mural art and sparse art, with their different approaches to application, promotes both functionality and artistic expression in cities. The various categories and typologies proposed to classify these actions can serve as a guide for future projects, encouraging a more conscious and planned approach to the implementation of colour in urban spaces.

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