

# INFLUENCE OF DESIGN ELEMENTS ON REACTION TO WINDOW VIEWS

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**Abstract.** This article focuses on the respondents' reactions to window views in dense urban environments. A representative sample of multistorey buildings in residential neighbourhoods in close-up window view was observed. To test the respondents' reactions to window views and the influence of various architectural features, the data was collected with an online questionnaire. The respondents were selecting a reaction to an individual window view, evaluated features and defined causes for their decisions. Results were analysed with descriptive statistics and Chi-Square test was used to analyse the relationship between the variables. The research indicates that window views in densely build urban environments that restrict the building from the context of the space received predominantly negative reactions, but due to various features and causes. As a general rule, the restricted window views increase importance of architectural details, increase importance of surface treatment of façades and decrease importance of the façade geometry. Specifically, the research indicates that the age of the respondents and the way they spend their day does not significantly influence their tolerance to unfavourable window views.

**Key words:** architecture, window view, façade, urban density, daylight

## 1. Introduction

The window is an element of the buildings' outer envelope with very important functions – it allows the transmission of daylight into the building and the interaction with the external environment, both of which have a strong impact on health and well-being of users.

The fact that a space without daylight may trigger unpleasant emotions, depression, insomnia and decreases attentiveness in people is well known (Yeom *et al.*, 2020). Conversely, well-daylighted space benefits psychological comfort and personal satisfaction (Yeom *et al.*, 2020; Veitch and Galasiu, 2012).

This article focuses on the windows' function of visual interaction with the exterior environment. Particular interest is on urban environments, where the quality of window views may be limited due to building density.

A review of previous studies shows that window views in working environments and features in the window views were mainly discussed. Some studies indicate that the features in the motive observed through the window evoke psychological reactions that match the characteristics of the observed motive itself (Van Esch *et al.*, 2019). Further, the motives that comprise various interesting features are considered rich in terms of content. Giraldo Vasquez *et al.* (2019) note that the positive perception of urban views is also influenced by the number of layers in the view – the more layers there are, the more pleasing the window view. The top layer allows a distant view and comprises the sky and horizon, the middle layer includes natural or built elements, the lower layer comprises the ground in the vicinity and also provides information about the distance and size of objects in the middle layer (Bell and Burt, 1995; SIST EN 17037:2019). An attractive window view usually comprises both foreground and horizon (Littlefair, 1996) and conveys important information about the time of day, location, weather, human activities, etc. The impressions can be further reinforced by the visual quality of urban space and sonic information (Deng *et al.*, 2020).

The quality of the visual information obtained with the help of window view depends on the features in the motive and variety of elements. Many researchers discuss the impact of window view on peoples' well-being and define the responses triggered by certain

motives. They note that not all motives are equally attractive when viewed through windows, and when studying the merits of motives, their characteristics or information should be taken into account (Aries *et al.*, 2010). For example, views of poor-quality urban environment, like rundown industrial or uninteresting commercial areas can increase negative feelings and decrease attentiveness (Ulrich, 1979). Similarly, patients who had a window view of a brick wall had a longer postoperative hospital stay, a higher number of minor postoperative complications and received a higher dose of analgesics compared to patients who observed nature through the window (Ulrich, 1984).

Further, greenery is also perceived as an aesthetic element that can improve the observer's response when looking through the window at the urban environment. Researchers find that views of nature perform similarly to actually being in nature (Ko *et al.*, 2020; Kaplan and Kaplan, 1989) and evoke positive mood (Yeom *et al.*, 2020; Veitch and Galasiu, 2012; Drobne *et al.*, 2022). For example, when distant views cannot be provided due to location constraints, satisfaction with window view is enhanced by introducing nature into the observed environment (Kent and Sciavon, 2020). In densely populated urban settings, integration of natural elements into the surrounding environment is suggested, as experience of natural elements positively affects the visual perception of space and improves the health and well-being of users (Elsadek *et al.* 2020). By comparing exposure to different environments, Laumann *et al.* (2001) found that the urban environment has a smaller restorative effect than the natural environment, and the view of the urban environment, such as pedestrian streets, a bus station and a

road with heavy traffic, caused higher heart rate in a group of observers than in the group that observed the natural environment (Laumann *et al.*, 2003).

Similarly, in the work environment, many studies suggest that visual contact with nature improves general life and work satisfaction (Ko *et al.*, 2020; Chang *et al.*, 2020; Kaplan, 1993, 2001; Kang and Kim, 2019). Further, Van Esch *et al.* (2019) find that the characteristics of the motive seen through the office window reproduce psychological and physical well-being. Especially important are the window views in urban environments. Office workers generally prefer a window view. Given the choice of an office with or without a window, most people will choose an office with a window view (Butler and Biner, 1989; Stone and Irvine, 1994). Similarly, in cafes seats near the window are occupied first and renting a hotel room with a view is more desired (Kim and Wineman, 2005). Even during the covid-19 epidemic, which limited life to apartments for many weeks and triggered a ramped-up work from home, in many places the window was the only contact with the outside environment and thus relieved stress and anxiety, anger, fear, boredom, irritability and sleep disturbances (Batoool *et al.*, 2021; Spano *et al.*, 2021; Soga *et al.*, 2021). Kaplan (2001) explains that short and repeating breaks that occur when a person looks out the window at nature also reduce mental fatigue caused by constant focused attention. Views of nature, on the other hand, do not require focused attention, but entail fascination, which triggers an involuntary attention that performs regeneratively (Tyrväinen *et al.*, 2014).

An important indicator of quality window view into the urban environment is also the visual aesthetics

of motive (Szybinska Matusiak and Klöckner, 2016). According to the authors view of the natural environment is by definition also aesthetic, while in urban motives, the aesthetic component is determined by coordinated architectural elements that contribute to visual richness – geometry, plasticity, variation of colours and textures (e.g. surface texture), decoration or ornament, articulation, accents. Kent and Sciavon (2020) note, that a diverse and dynamic motive is more interesting than a monotonous one, and attentiveness is increased by the complexity and legibility of the motive (Herzog and Shier, 2000; Van den Berg, 2016). The perception of the urban environment is decisively influenced by the age of buildings and their maintenance (Drobne *et al.*, 2022; Szybinska Matusiak and Klöckner, 2016; Herzog and Shier, 2000). People generally prefer well maintained buildings. When older buildings are well maintained, people prefer them, because they excel modern architecture in complexity, legibility of composition and coherence (Herzog and Shier, 2000).

Today's urban densification concept is driven by the efficient use of land. The distance between the buildings is getting smaller, and the window view is restricted by the surrounding buildings. Pallasmaa (2005) points out the influence of planimetry and plasticity of architecture, and the importance of the peripheral vision for the perception of the quality of space. A façade with its tectonics, geometrical proportions, decoration, colour etc. provides the space with artistic identity. The more distant the building is from the observer, the easier it is to assess its interaction with the wider environment, as it only comes to life in the context of its surroundings. The closer it is to the observer, the harder

is the legibility of the tectonic structure of the building, and the more important become details such as composition and maintenance (Joedicke *et al.*, 1975). Consequently, it is the quality of the façade elements that influences the response of the observer to a window view.

Distant motives that are more desirable (Herzog and Shier, 2000; Kent and Sciavon, 2020) are realistically very difficult to achieve in densely urbanized environments. Therefore, in this study, the primary focus is on the response of observers to window views, which only contain a frontally visible view of the opposite building's façade. The research questions are designed to cover residents' reactions to various window views and also the reasons for their reactions:

- How respondents react to urban window views with various features;
- Do certain architectural elements affect the reaction to window view;
- Does the environment to which the respondent is exposed during the day affect the reaction to window view.

The studied factors are the influence of architectural design elements (plasticity, composition, surface texture and colour, maintenance) on various examples of realistic façades. Data was acquired using a questionnaire. Descriptive statistics analysis is used to evaluate reactions to various window views. The results will indicate on how important different architectural features are for user responses and provide guidance for further work.

## 2. Materials and methods

For the purposes of this study only multistorey buildings in residential neighbourhoods were observed. It has

already been proven that greenery improves the quality of the window view, so we did not include it in this study. On the other hand, in multi-apartment buildings, a substantial share of the apartments is located above the tree canopy, and in this study, we addressed precisely these positions. A representative sample of 10 façades in close-up view was selected for the analysis of window views. These façades were chosen to encompass a selection of variously designed and maintained façades, with varying composition features (balance, proportion, rhythm), visual attractiveness (richness of texture, details and attractiveness of colour scheme) and plasticity. The examples were not selected on the basis of the quality of architecture but rather as views of the façades that encompassed elements suitable for this study. The view is framed in way that the 3rd and 4th floors of the adjacent building can be seen through the window. The selection deliberately excluded any additional elements that might disturb or distract the questionees, like people, greenery, animals etc. The photos were taken in residential neighbourhoods in Ljubljana, Slovenia. All the façades are realistic and were photographed frontally, from the same distance and in sunny weather, in order to eliminate influence of weather that could affect the responses (Fig. 1).

A questionnaire based on online survey tool 1KA (<https://www.1ka.si>) was designed to collect the quantitative data, which was sent to available contacts with Slovenian email addresses in the repository of the New University. Predominantly working population was targeted, with sedentary/office work, performing it for at least part of the working day. The questionnaire consists of two parts.

Table 1. Reactions to the window views available in the questionnaire.

Type of response	Because it is (stimulus)...	Because of (dominant cause)...
Positive	- Interesting, stimulating, coherent - Pleasant, calming, harmonious	- Materials and colouring of the façade surface - Design harmony of the whole and its elements
Negative	- Boring, depressing, incoherent - Unpleasant, annoying, discordant	- Variety of forms and quantity of details - Chance to observe activities on a building across
Neutral	- Acceptable, undisturbing - Does not evoke specific emotions	- Building maintenance, deterioration - I don't know, can't define

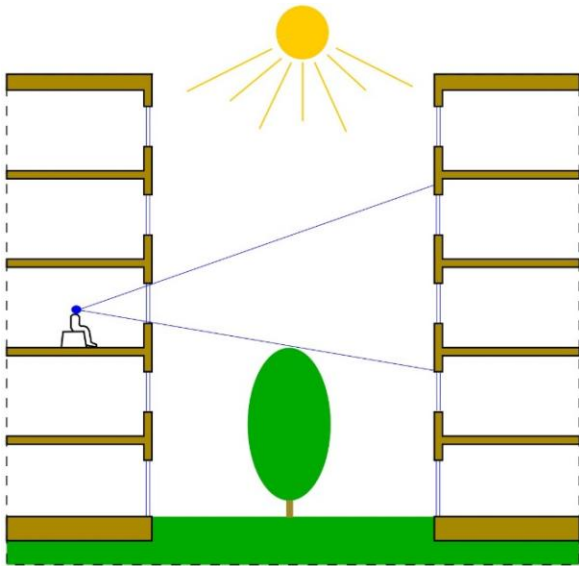


Fig. 1. Issues discussed – view from the 3rd floor, two floors of the neighboring building are visible in the window view (one layer, no distant view).

The first part includes demographic questions and questions related to how the respondents assess their personality (extroverted or introverted), where and how they spend their day and which is their preferred window view. The second part consists of visual assessment of ten window views. The process is designed in two steps. First, the respondents were asked to select a reaction to an individual window view, depending on the selected reaction, a sub question about the evaluation and the causes for such evaluation follows. The questions are of the closed type.

To test the respondents' reactions to window views and the influence of various architectural features, descriptive statistics was used. The differences between the reactions and the reasons were analysed based on the frequency of answers and the selected responses. Further, the Chi-Square

test was used to analyse the relationship between two categorical variables (reaction to window view and where the respondent spends the day) and determine potential association.

### 3. Analyses of results

The survey was conducted in May 2023, resulting in a total of 112 fully completed questionnaires. Among the respondents, 38% were men and 62% were women. The participants belong into four age groups, which can be paired with the main life periods: up to 20 years - students (15%), 21 to 40 years – young working population (27%), 41 to 60 years – mature working population (38%), and above 60 years - seniors (20%). The majority of the participants are employed (71%), 23% are students, and 6% are retired. The goal was to cover the active population, which mainly performs office work. According to the results, this was accomplished. The results further show that half of the respondents spend their work day in several locations (50%), about a third, 34%, are mostly situated in the office and 16% work mainly from home. Previous research (Drobne *et al.*, 2022) showed that age does not significantly affect the preferred window view, therefore the interest was rather on whether preferences are affected by the way in which respondents spend their day and on reactions to specific window views. The main focus was on mobility during the day and on the question whether exposure to different environments and activities during the day increases tolerance to the window views included in the questionnaire.



### 3.1 Analyses of the window views

In this part are presented and analysed the results of the survey, which relate to the individual motives of window views. As mentioned above, the process of obtaining the respondents' reaction to a specific window view was designed in two steps. First, the respondents were asked to select a reaction to an individual window view; depending on the selected reaction, a sub questions about the evaluation and the causes for such evaluation followed. In the tables below are presented separate cases with the prevailing reaction on the right side of the table and the causes for such reactions on the left side. The causes are divided into two sections, which reveal the stimulus and the predominant reasons for the selected reactions on the scale 0 – 4 (0=do not agree, 1=partly not agree, 2=partly agree, 4=agree).

The Case 1 (Table 2) is a uniform façade with a symmetrical composition, neutral colours and textures, and few details. Such a case was deliberately chosen as one of the control cases used to determine the accuracy and consistency of the reactions. A standard deviation 0.6 shows the expectedly undeviating responses. For just under 2/3 of responders, the motive is primarily negative. As the reason for such an answer, about ¾ of those respondents considered the motive boring, depressing, and incoherent.

Among the causes, only the answer "façade design is harmonious" received a somewhat high rating of 3.1. Respondents rated the variety of forms and the quantity of details as the most discordant. Since the façade has very few details, this was expected. At the same time, such result indicates, that the respondents were assessing the façades attentively. Because the building is quite

new and well maintained, the reactions to the materials used and the colour of the façade surface were not particularly rejecting (2.3).



Fig. 2. Window view of Case 1.

The Case 2 (Table 3) is a façade with an easily legible composition and distinct surface treatment, with a slightly higher number of details compared to Case 1.



Fig. 3. Window view of Case 2.

The closer analyses show wide dispersion of answers (0.9). For over half of the respondents, the motive is pleasing to the eye and approximately a third of respondents rated the motive as neutral (and primarily chose cause "does not evoke reactions"). This means that only 15% of respondents chose a negative reaction. Of those who rated the motive positively, for close to two thirds the motive is primarily pleasant, calming and harmonious.

Table 2. Reactions to the Case 1 window view.

Predominant reaction:		Causes: window view is...
Negative: 58%	Of negative reactions:	76% : boring, depressing, incoherent 24% : unpleasant, annoying, discordant
Positive: 30%	Of positive reactions:	11% : interesting, stimulating, coherent 89% : pleasant, calming, harmonious
Neutral: 12%	Of neutral reactions:	20% : acceptable, undisturbing 80% : does not evoke specific emotions

Table 3. Reactions to the Case 2 window view.

Predominant reaction:		Causes: window view is...
Positive: 52%	Of positive reaction:	37% : interesting, stimulating, coherent 63% : pleasant, calming, harmonious
Negative: 15%	Of negative reaction:	39% : boring, depressing, incoherent 61% : unpleasant, annoying, discordant
Neutral: 33%	Of neutral reaction:	35% : acceptable, undisturbing 65% : does not evoke specific emotions

Most of the ratings for the dominant cause are in the neutral or positive zone. The majority of respondents tend to think that the façade is harmoniously designed and has an attractive surface treatment, with enough variety of forms and quantity of details. Above all, the material used, the colour of the surface and the coherence of the façade have a favourable response.

The Case 3 (Table 4) is a façade with an easily legible composition and distinct

surface treatment, with a slightly larger number of details compared the Case 1. The motive was the only one that received quite a variety of predominant responses in the positive and negative parts. Here, the standard deviation was 0.8. 40% of respondents chose a negative reaction, and 34% a positive one. Among those who specified that the motive was not attractive, the majority (77%) thought the motive was unpleasant, annoying, or discordant. In the case of positive reactions, the respondents mainly opted

for the reasons pleasant, calming, and harmonious. Given that approximately the same share of respondents opted for a positive and negative response, the share of the selected causes follows the same pattern - a large standard deviation in all responses. For instance, 21% of respondents agree that the materials used and the colour of the surface are attractive, while a similar percentage disagrees, and a maximum of 40% partly agree with the statement.



Fig. 4. Window view of Case 3.

Table 4. Reactions to the Case 3 window view.

Façade design is harmonious		2,6
Materials used and colouring of the façade surface are attractive		2,6
I like to observe activities on a building across		2,4
I like variety of forms and quantity of details		2,5
Predominant reaction:		Causes: window view is...
Negative: 40%	Of positive reaction:	23% : boring, depressing, incoherent 77% : unpleasant, annoying, discordant
Positive: 36%	Of negative reaction:	30% : interesting, stimulating, coherent 70% : pleasant, calming, harmonious
Neutral: 24%	Of neutral reaction:	39% : acceptable, undisturbing 61% : does not evoke specific emotions

The Case 4 (Table 5) is a plastic façade with easily legible composition and simple surface treatment, with a similar number of details compared the case 1. Further, a standard deviation 0.6 is the result of quite similar shares of negative and neutral reactions. Slightly more than half of respondents rated the façade negatively, of which the vast majority (73%) thought it was unpleasant, annoying, discordant. The rest of the respondents mainly chose a neutral response (41%).

That is why the assessment of reasons for the responses is in the negative zone. Such a reaction is surprising, since the building is fairly new, and the motive contains a

considerable number of diverse elements that are arranged in a legible composition. From the answers, we can conclude that the selection of materials and the colour scale of the façade are the main reasons for the negative reactions.

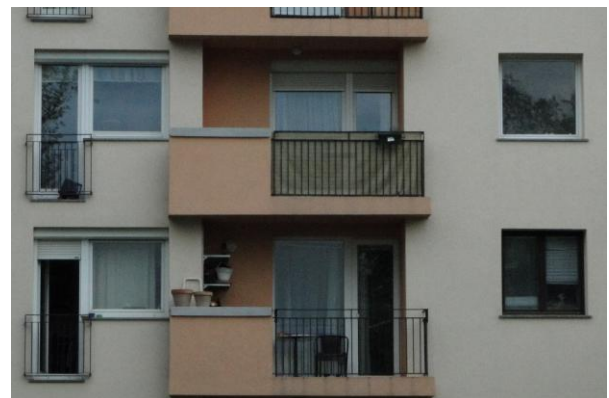


Fig. 5. Window view of Case 4.



Table 5. Reactions to the Case 4 window view.

Façade design is harmonious		2,1
Materials used and colouring of the façade surface are attractive		2
I like to observe activities on a building across		1,9
I like variety of forms and quantity of details		2,1
Predominant reaction:		Causes: window view is...
Negative: 53%	Of positive reaction:	27% : boring, depressing, incoherent 73% : unpleasant, annoying, discordant
Positive: 6%	Of negative reaction:	57% : interesting, stimulating, coherent 43% : pleasant, calming, harmonious
Neutral: 41%	Of neutral reaction:	43% : acceptable, undisturbing 57% : does not evoke specific emotion

The Case 5 (Table 6) is a planimetric façade with easily legible composition and simple surface treatment, with a similar number of details compared the Case 1.



Fig. 6. Window view of Case 5.

A standard deviation 0.3 shows the expectedly undeviating responses. The vast majority (88%) of respondents rated the motive negatively, mainly because it is unpleasant, annoying, discordant. The ratings of the selected causes are all beneath 2. The quality of composition is rated highest with 1.7, while the lowest rated are the surface treatment and number of details. Based on previous studies, the rating on the surface treatment can be at least in a part interpreted in conjunction with the maintenance issues (e.g., Drobne *et al.*, 2022; Szybinska Matusiak and Klöckner, 2016) and lack of visual attraction (Aries *et al.*, 2010; Ulrich, 1979).

Table 6. Reactions to the Case 5 window view.

Façade design is harmonious		1,7
Materials used and colouring of the façade surface are attractive		1,4
I like to observe activities on a building across		1,5
I like variety of forms and quantity of details		1,4
Predominant reaction:		Causes: window view is...
Negative: 88%	Of positive reaction:	36% : boring, depressing, incoherent 64% : unpleasant, annoying, discordant
Positive: 1 %	Of negative reaction:	100% : interesting, stimulating, coherent 0% : pleasant, calming, harmonious
Neutral: 11%	Of neutral reaction:	15 % : acceptable, undisturbing 85% : does not evoke specific emotions

The Case 6 (Table 7) is a planimetric façade with a very simple composition and distinct surface treatment. The case is extreme, without windows or similar architectural elements and was designated as a control case to learn how respondents would react to the texture of the surface without other visual elements.

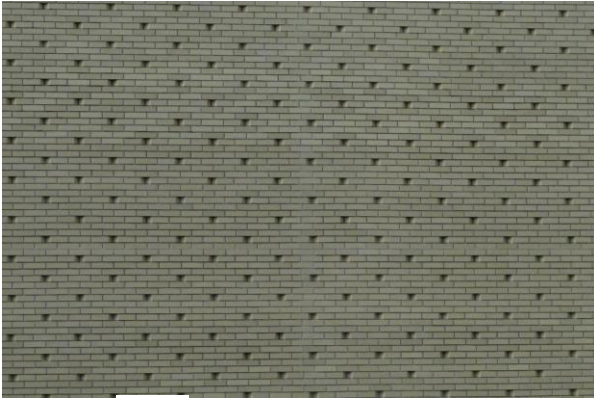


Fig. 7. Window view of Case 6.

A standard deviation 0.7 shows the unexpectedly deviating responses, with practically the same proportion of negative and neutral reactions. Interestingly, the rate of responses was similar to Case 4, i.e. with a significant share of negative responses (44%), and a

similar share of neutral responses (43%) and higher than the Case 5. In particular, the design and surface treatment were rated above 2. This is an important finding, because it shows that visually appealing surface texture can significantly shift otherwise distinctly negative reactions toward neutral response zone.

The Case 7 (Table 8) is a plastic façade with an easily legible composition and simple surface treatment, with a slightly higher number of details compared the Case 1.



Fig. 8. Window view of Case 7.

Table 7. Reactions to the Case 6 window view.

Façade design is harmonious		2,3
Materials used and colouring of the façade surface are attractive		2,1
I like to observe activities on a building across		1,9
I like variety of forms and quantity of details		1,9
Predominant reaction:		Causes: window view is...
Negative: 44%	Of positive reaction:	73% : boring, depressing, incoherent 27% : unpleasant, annoying, discordant
Positive: 13%	Of negative reaction:	38% : interesting, stimulating, coherent 62% : pleasant, calming, harmonious
Neutral: 43%	Of neutral reaction:	10% : acceptable, undisturbing 90% : does not evoke specific emotions

Table 8. Reactions to the Case 7 window view.

Façade design is harmonious		1,8
Materials used and colouring of the façade surface are attractive		1,6
I like to observe activities on a building across		1,7
I like variety of forms and quantity of details		1,7
Predominant reaction:		Causes: window view is...
Negative: 75%	Of positive reaction:	25% : boring, depressing, incoherent 75% : unpleasant, annoying, discordant
Positive: 3%	Of negative reaction:	100% : interesting, stimulating, coherent 0% : pleasant, calming, harmonious
Neutral: 22%	Of neutral reaction:	19% : acceptable, undisturbing 81% : does not evoke specific emotions

A standard deviation of 0.5 shows the expectedly undeviating responses. A vast majority of respondents (75%) rated the motive negatively, of which three-quarters (75%) thought it was unpleasant, annoying, or discordant. The valuation of causes for the responses is in the negative zone. Such a reaction is surprising, since the building is well maintained, and the motive contains a considerable number of diverse elements that are arranged in a legible composition. The results show, that the surface treatment (selection of materials and colour) of the façade were attributed to the most negative reactions followed by activities on buildings and the variety of form and details.

The Case 8 (Table 9) is a planimetric façade with an easily legible composition and simple surface treatment, with a similar number of details compared the Case 1.

A standard deviation 0.4 shows the expectedly undeviating responses. The vast majority (84%) of respondents

rated the motive negatively, mainly because it is boring, depressing, and incoherent (53%), but a similar share of respondents also thought that the motive was unpleasant, annoying, and discordant. The ratings of causes are all beneath 2. The quality of composition is rated highest with 1.5, while the lowest rated is the surface treatment. Similarly, as in the Case 5, the rating on the surface treatment can be at least in part linked to maintenance issues (e.g., Drobne *et al.*, 2022; Szybinska Matusiak and Klöckner, 2016) and lack of visual attraction (Aries *et al.*, 2010; Ulrich, 1979).



Fig. 9. Window view of Case 8.

Table 9. Reactions to the Case 8 window view.

Façade design is harmonious		1,5
Materials used and colouring of the façade surface are attractive		1,2
I like to observe activities on a building across		1,3
I like variety of forms and quantity of details		1,3
Predominant reaction:		Causes: window view is...
Negative: 84%	Of positive reaction:	53% : boring, depressing, incoherent 47% : unpleasant, annoying, discordant
Positive: 3%	Of negative reaction:	33% : interesting, stimulating, coherent 67% : pleasant, calming, harmonious
Neutral: 13%	Of neutral reaction:	12% : acceptable, undisturbing 88% : does not evoke specific emotions

The Case 9 (Table 10) is a plastic façade with a hardly legible composition and simple surface treatment, with a larger number of details compared the Case 1.

A standard deviation of 0.5 shows the expectedly undeviating responses. A vast majority of respondents (72%) rated the motive negatively, of which a declarative share (81%) thought the motive was unpleasant, annoying, and discordant. The assessment of causes for such responses is in the distinctly negative zone. Such a reaction is to some point surprising since the motive is plastic and contains a considerable number of diverse elements that are arranged in a dynamic composition. The results show, that respondents were most disturbed by the quality of composition and activities on the building. The variety of forms and number of details are rated highest.

The Case 10 (Table 11) is a plastic façade with a legible composition and distinct

surface treatment, with a larger number of details compared the Case 1.



Fig. 10. Window view of Case 9.



Fig. 11. Window view of Case 10.



Table 10. Reactions to the Case 9 window view.

Predominant reaction:		Causes: window view is...
Negative: 72%	Of positive reaction:	19% : boring, depressing, incoherent 81% : unpleasant, annoying, discordant
Positive: 8%	Of negative reaction:	90% : <u>interesting, stimulating, coherent</u> 10% : pleasant, calming, harmonious
Neutral: 20%	Of neutral reaction:	39% : <i>acceptable, undisturbing</i> 61% : <i>does not evoke specific emotions</i>

Table 11. Reactions to the Case 10 window view.

Predominant reaction:		Causes: window view is...
Positive: 64%	Of positive reaction:	84% : interesting, stimulating, coherent 16% : pleasant, calming, harmonious
Negative: 12%	Of negative reaction:	29% : <u>interesting, stimulating, coherent</u> 71% : <u>pleasant, calming, harmonious</u>
Neutral: 24%	Of neutral reaction:	39% : <i>acceptable, undisturbing</i> 61% : <i>does not evoke specific emotions</i>

A standard deviation of 0.8 shows the expectedly deviating responses, with a significant proportion of positive reactions (64%), a significant proportion of neutral (24%) and only 12% of negative reactions. As can be observed, a considerable number of respondents evaluated this motive positively, mainly because it is interesting, stimulating, coherent (84%). The assessment of causes for such responses is predominantly in the positive zone. Such a reaction is not surprising, since

the motive is plastic and contains a considerable number of diverse elements that are arranged in a dynamic composition. The variety of forms and the number of details, the materials used and the colour of the surfaces are rated highest; with considerable probability the reason is because they add to high visual interest.

#### 4. Discussion

A detailed examination of the results shows that the studied motives of

window views can be analysed according to the similarities of the indicated reactions and causes. Above all, it is vital to define whether the respondents reacted consistently to similar motives. For this purpose, Cases 1, 2 and 3 were included in the survey. In addition, the survey results showed that the respondents evaluated some cases quite negatively, and these evaluations were also uniform among the majority of the respondents. Therefore, the next step was to examine in more detail why these façades evoked such responses. An important question is also whether façades that are plastic (for example, façades with balconies, loggias and similar) trigger different responses from views with planimetric façades.

A general review of causes for the reactions shows that none of the presented cases reached a score close to 4 (I agree) and evoked predominantly positive responses. This was expected, since the survey only included cases with views of the nearby façades with only one visible layer, which did not contain greenery, distant views and similar features, which proved to have a positive effect in previous studies (Aries *et al.*, 2010; Ko *et al.*, 2020; Drobne *et al.*, 2022; Elsadek *et al.*, 2020). On the contrary, the respondents rated most of the motives quite negatively.

#### 4.1. Consistency of reactions

In order to determine the consistency of the respondents' reactions, Cases 1, 6 and 8 are compared in the first step (Fig. 12). These include the most basic compositions with little variety that allow establishing of the consistency of the respondents' answers to similar façades and the impact of various

compositional differences on the reactions of respondents. A comparison of the initial response shows that all façades were evaluated unfavourably (boring, depressing, incoherent), but with different portions of negative reactions. The results indicate that the respondents reacted consistently to façades with similar characteristics. However, if another interesting feature was added (such as the visually appealing surface texture in Case 6), part of the respondents migrated to a neutral response. It can also be seen that if another negative feature was added to the composition with little variety (for example, the poor maintenance of façade surface in Case 8), the share of negative reactions increased. This confirms the assumption that the respondents' reactions are consistent with the quality of the façade motives used in the survey.




Case 1	Façade characteristics:
	-Static composition -Low level of variety Uniform surface
Case 6	Façade characteristics:
	-Static composition -Low level of variety -Appealing texture
Case 8	Façade characteristics:
	-Static composition -Low level of variety -Uniform surface

Fig. 12. Comparison of cases 1, 6 and 8 to test consistency of respondents' reactions.

Similar findings can be made if reactions to the Cases 7 and 9 are compared, both of which contain a view of a plastic façade with balconies on which many traces of the residents' activities can be observed. The results show that the reactions and cause ratings are quite comparable.

In order to further determine the consistency of the respondents' answers the Cases 1, 2 and 3 are compared in the next step (Fig. 13). These motives are similar in terms of design properties (planimetric façades with 6 evenly spaced windows). The compositional key is simple and clearly visible in all cases. A closer look also reveals the differences: in two façades, the windows are offset, which adds dynamism and an element of surprise to the composition. In addition, they differ in minor details, such as the colour scale of the façades, the texture of the façade surface and the number of details. The comparison shows that in these three cases, the respondents again reacted quite consistently. For example, the degree of negative or positive response changes depending on the richness of the surface treatment. I.e., 58% of negative responses in Case 1, 40% in Case 3 and 52% positive responses in Case 2, respectively. The same applies to the rating of causes, where the rate increases according to the attractiveness of design, number of details and visual interest evoked by surface treatment. This result suggests that it can be expected that similar façade designs can evoke similar reactions in respondents. However, it should be noted that the reactions are also linked to the specifics of the surveyed population and the general cultural environment (expectations,

preferences, building culture, etc.) and should be understood in such context.




Case 1	Façade characteristics:
	Planimetric Simple composition Static
Case 2	Façade characteristics:
	Planimetric Simple composition Dynamic
Case 3	Façade characteristics:
	Planimetric Simple composition Dynamic

Fig. 13. Comparison of cases 1, 2 and 3 to test consistency of respondents' reactions.

#### 4.2. Component of plasticity

The influence of plasticity of design was assessed in the basis of Cases 4, 9 and 10, which were compared to Cases 6, 8 and 2, respectively (Fig. 14). Primarily, it was examined whether the plasticity introduced into the composition by elements such as balconies, loggias, etc. influences the respondents' reactions. The analyses shows that there are no indicative differences in terms of positive, negative and neutral reactions between the considered cases. For example, a comparison of Cases 4 and 6 shows that approximately the same portion of respondents chose a negative or neutral reaction. A similar pattern is observed when comparing the reactions to pairs of Cases 8 and 9 and Cases 2 and 10.





Case 4	Façade characteristics: -Plastic -Neutral surface treatment -Well maintained
	
Case 9	-Plastic -Neutral surface treatment -Visible wear
	
Case 10	-Plastic -Lively surface treatment -Well maintained
	
Case 6	-Planimetric -Neutral surface treatment -Well maintained
	
Case 8	-Planimetric -Neutral surface treatment -Visible wear
	
Case 2	-Planimetric -Appealing texture -Well maintained
	

Fig. 14. Comparison of cases 4, 9 and 10 in contrast to cases 6, 8, and 2 to test influence of plasticity on the respondents' reactions.

An interesting difference can be observed in the defined causes of the reactions. In the case of planimetric façades, "passive" emotional reactions such as boredom are highlighted, while in the case of a positive response, the window view is defined as pleasant, calming, harmonious. In the case of plastic motives, negative reactions are mostly related to responses such as inconsistency, disturbance and unpleasantness, while positive reactions are related to visual attractiveness. The general conclusion is that plasticity in motive does not evoke a positive reaction in itself and has to be linked to other visually attractive features like quality of composition, visually attractive surface treatment and colour scheme. Although observing human activities is a very important part of information from the environment (Littlefair, 1996), the participants were surprisingly disinclined to observing activities on the opposite building. This could be related to the cultural characteristics of the population in general which cherishes privacy. Partly the answers could also be the result of misunderstanding the question in terms of social control, which in such context could have a negative connotation.

#### 4.3. Component of maintenance

The influence of the maintenance of building elements on the reaction of the respondents was tested with the help of Cases 5, 7 and 8 (Fig. 15). These are the cases in which the wear of the façade surfaces is visible due to exposure to atmospheric conditions and general usage.

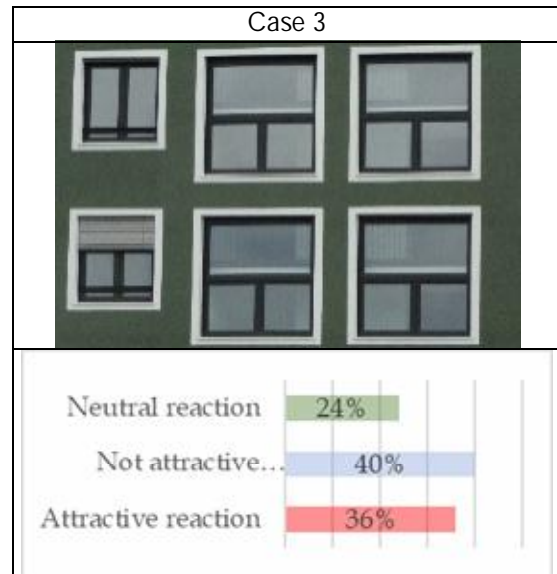
Poorly maintained older façades (Cases 5 and 8) were rated negatively by the respondents, but Case 7 received the largest share of negative responses. This



is surprising as the surface does not show substantial visible wear. Comparison of the results suggests that the ratings are quite similar and appeal of surface treatment was rated quite low (between 1.4 and 1.6), while the majority of respondents rated the compositional quality slightly higher (1.2b-b1.8). This result is consistent with the previous studies (e.g., Drobne *et al.*, 2022; Szybinska Matusiak and Klöckner, 2016) which have indicated that the maintenance of the built environment is an important aspect of visual appeal that can significantly influence the general impression and thus influence the responses of observers.

the reactions were 40% negative and 36% positive (Table 12).

Table 12. Reactions to the Case 3 window view.






Case 5		Façade characteristics: -Some visible wear -Low level of variety -Neutral surface treatment
Case 7		-Slight visible wear -Low level of variety -Neutral surface treatment
Case 8		-Visible wear -Low level of variety -Neutral surface treatment

Fig. 15. Comparison of cases 5, 7 and 8 to test influence of maintenance on respondents' reactions.

#### 4.4. Chi-square analyses of the selected case

Case 3 was the only case with suitably dispersed responses that enabled further analysis. As can be seen from the results,

In this case, the primary interest was in the correlation between the age of the respondents, the way they spend their day and their reaction to the window view. The research question was: does exposure to different types of environments during the day have an impact on the preferences of defined groups of respondents regarding window views or on tolerance to visually unfavourable stimuli? For this purpose, two hypotheses were defined:

H1: Age affects the reaction of respondents to the specific window view of the nearby facade (Fig. 1).

H1: Exposure to different environments during the day affects the respondents' reaction to a window view of the nearby facade (Fig. 1).

The respondents were divided into four age groups (Fig. 16).

Chi-Square test was used to calculate whether there is a statistically significant association between two

category variables (variable “response to the window view” and independent category variable “age group”). In the test, 93 complete answers were included. Chi-Square statistic and a p-value were compared with the chosen significance level  $\alpha = 0,05$ .

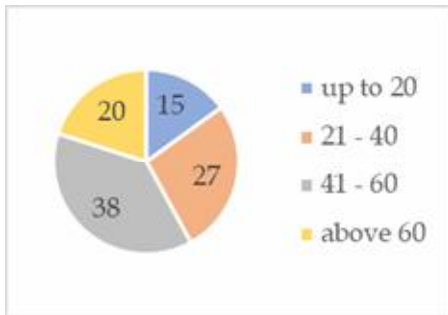


Fig. 16. Age structure of the respondents.

The second question concerns the environment, e.g. the way the respondents spend their day. Respondents were divided into three groups according to their answers (Fig. 17).

Group 1: My day is always different; I have many different obligations and hobbies.

Group 2: My day is mostly routine with some deviations; I occasionally perform new activities.

Group 3: My day is always the same; the activities are repetitive with little deviations.

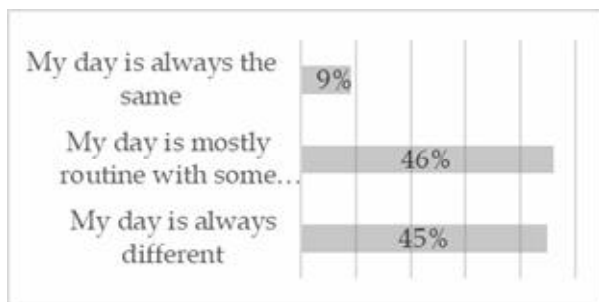


Fig. 17. The way the respondents spend their day.

The calculated Chi-Square statistic is 20.87, with a p-value of 0.0019 (Table 12). Since the p-value is less than the significance level  $\alpha = 0.05$ , we can conclude that age does have a significant influence on individuals' reaction to the window view, and therefore the hypothesis 1 cannot be confirmed. Previous research (Drobne *et al.*, 2022) already showed that age does not significantly affect the preferred window view as described by the respondents. This result confirms this finding and further shows that in a studied population, age is not a significant factor and does not notably influence reactions to window views.

The question was whether respondents' way of spending the day affects what kind of reaction they will have to the window view, shown in Fig. 1. The main interest was on whether dynamically spending time with intensive social interaction and going about affects tolerance regarding motives of window views. The Chi-Square test was employed to calculate whether there is a statistically significant association between two categorical variables. For this test 110 complete answers were included. Chi-Square statistic and a p-value were compared with the chosen significance level  $\alpha = 0.05$ . The calculated Chi-Square statistic is 20.87, with a p-value of 0.4204. Since the p-value is more than the significance level  $\alpha = 0.05$ , we cannot confirm the hypothesis 2 (Table 13). The result shows that all respondents, regardless of the level of variety in their day, experience and react similarly to the motive of window view.

Table 12. Chi-Square test of the association between two category variables (variable “response to window view” and independent variable “age group”).

Age group		Response to the view through the window			Total	$\chi^2$
		Positive	Negative	Neutral		
Up to 20	f	9	3	6	18	20.87
	%f	10%	3%	6%	20%	
21 - 40	f	11	11	8	30	
	%f	12%	12%	9%	32%	
41 - 60	f	1	21	8	30	
	%f	1%	22%	9%	32%	
Above 60	f	2	8	5	15	
	%f	2%	9%	5%	16%	
TOTAL	f	23	43	27	93	
	%f	25%	46%	29%	100%	

Table 13. Chi-Square test of the statistically significant association between two category variables (variable “response to the window view” and independent variable “the way the respondents spend their day”).

Age group		Response to the view through the window			Total	$\chi^2$
		Positive	Negative	Neutral		
Group 1	f	23	17	10	50	3,895
	%f	21%	15%	9%	45%	
Group 2	f	15	22	15	52	
	%f	14%	20%	14%	47%	
Group 3	f	2	4	2	8	
	%f	2%	4%	2%	8%	
TOTAL	f	40	43	27	110	
	%f	36%	39%	25%	100%	

### 5. Conclusions

Densely built urban environments that do not allow window views comprising distant elements, sky and ground are challenging to design. Especially because the users are bound to observe such motives though their windows continually for a long time. This study showed that only two out of ten cases received a slightly favourable response and none of them reached a high level of agreement from participants. The research also showed that it is very difficult to incite and retain enough visual interest with classical architectural approaches and restrained architectural language. On the contrary, a lot of effort has to be put into the design of façades, especially surface textures and colour schemes.

The research indicates that the close window view that restricts the building from the context of the space, obscures the legibility of the buildings’ tectonic structure. Thus, the more important become details. This, for example, was demonstrated by the reactions of the respondents in relation to e.g., the maintenance of the façades, where in case of poorly maintained façades, the respondents generally opted for declaratively negative responses. If the façades were well maintained and at the same time not visually attractive (for instance had planimetric design and low level of variety and detail), the reaction was predominantly negative, but not declaratively dismissive; in such cases, a considerable proportion of answers was also in the neutral range. Simply treated

façade surfaces, even when combined with various elements, also received rather negative reactions. It is also worth noting that the neutral colour scheme of the façades, which is characteristic of most buildings, had rather negative feedback. Respondents reacted positively to more pronounced surface treatments like rich textures and bold colours. The dynamism of the composition and high visual interest evoked a positive response, but the composition had to be harmonious. Above all, playfulness of the composition was important, which contributed to the effect of surprise and reduced the impression of boredom.

On the basis of the above the following findings can be articulated:

- Close window views increase importance of architectural details;
- Increase importance of surface treatment of façades (texture, colour, maintenance);
- Decrease importance of building geometry (composition and plasticity), although have some influence at a smaller scale.

A very significant conclusion is that the age of the respondents and the way the respondents spend their day (moving around or always repeating same activities), do not significantly affect the response to motives of window views. This means that in the working population, the mode and place of performing the work does not influence the reactions regarding the window view. This also means that the respondents who spent their time in various environments during the day were not significantly more tolerant of the unfavourable motives of window views.

Since the respondents reacted very consistently to similar window views of the nearby façades, it can be noted with considerable certainty that in densely built urban environments that do not allow a variety of views through the windows, predominantly negative reactions from observers can be expected. In such cases it is therefore recommendable to design for window views that contain several visual layers, allow for distant views and include greenery.

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