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The impact of biometeorological conditions on the landscape perception



Ilona Potocka, Leszek Kolendowicz, Marek Półrolniczak

Project "The impact of biometeorological conditions on the landscape perception and objectification of its evaluation" NCN Grant 2016/21/B/ST10/01864 Authors: L. Kolendowicz, Sz. Kupiński, Z. Młynarczyk, I. Potocka, M. Półrolniczak, M. Rogowski

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Introduction/motivation

Landscape is an inseparable part of our live and impacts its quality.

One's perception of the landscape may be determined by complex factors, like for example:

- > the features of the landscape itself,
- the sociodemographic and cultural characteristics of the observer, as well as their preferences and needs,
- the existing environmental conditions that afect humans, particularly weather conditions



Introduction

Taking into consideration the biometeorological weather we can distinguish two opposite types for the impact of the weather on humans, which can be viewed as most decisive for how we perceive the landscape:







Weather conditions **positively impacting** our perception of the landscape (i.e., stable, high-pressure weather with small cloud cover or without cloud cover) Weather conditions **negatively impacting** our perception of the landscape (i.e., the approach and passage of atmospheric fronts);



The aim of the study

The aim of the study was to determine the impact of the biometeorological (weather) conditions on perception while giving due consideration to the individual traits and general feeling of the observer, in addition to the specificity of the landscape itself.



Research Area



Panorama of the Warta River Valley from the roof of a building of the Faculty of Geographical and Geological Sciences.





Meteo 1 (Spring)





Meteo 4 (Autumn)

Meteo 6 (Winter)





Data and Methods

REFERENCE VIEW

AOI – AREAS OF INTEREST ON REFERENCE VIEW



Areas of interest designated for the analysis: (1) northern forest, (2) road, (3) horizon, (4) construction area, (5) tree-felling area, (6) southern forest, (7) car park.



Data and Methods

Eye tracking - tracking the movement of the pupils and on the basis of this determining points of focus







Data and Methods







Data and Methods

The following indices were calculated:

1. **HTG (hit time gaze)**: The hit time "gaze" metric is calculated by dividing the exposure duration of the stimuli into 250 ms bins. Each respondent's first visit is placed into a bin which results in a histogram. The midpoint of the bin with the most data points is the hit time, and therefore the hit time cannot be less than 125 ms, since 125 ms is the centre point of the first 250 ms bin.

2. **RGR (revisit gaze revisits)**: The number of returns a person makes to the AOI, based on raw data.

3. **TTFFF (time to first fixation)**: The time stamp of the first fixation inside the AOI.

4. RFR (revisit fixation revisits): The number of first returns by a person to the AOI.

5. **FC (fixation count average):** The sum of the first fixation count for all participants according to the number of participants.

6. TSG (time spent gaze): The time spent in the AOI based on raw data (not fixation based).

7. **TSF (time spent fixation):** The time spent in the AOI based on the total duration of all respondents' fixations (excluding data points between fixations).

8. **FFD (first fixation duration):** The duration of the first fixation within the AOI, based on visits.

9. **AFD (average fixation duration—visitors):** The average duration of fixations inside the AOI. Only respondents who looked inside the AOI will contribute to this number.



Data and Methods

Questionnaires:

- moods and general feeling
- Influence od the landscape
 - Wojciszke B., Baryła W., Mood scales and the six emotions
 - Universal Mood Adjective Check List UMACL G. Matthews, D. M. Jones, A. G. Chamberlain
 - Circumplex Model of Affect by Lanius & Russel

Mark words which show your actual mood and feeling

careless cheerful	calm demotivated	What was the influence of the landscape on your mood?	t	sant
worried	uneasy	and scape on your mood :	leasar	Jnplea
relaxed	optimistic	Г	Δ.	
sour	anxious	Stimulating		
bright	full of life	Non-		
nervous	stressed	stimulating		
motivated	nice			
pleasant	discouraged			
suffering	unhappy			



Data and Methods

Research procedure

8 research cycles:

- seasons of the year,
- influence of weather types (conditions)



52 participants (26 women, 26 men)



Data and Methods

- ❑ An eye tracker was used throughout each season of the year to determine how 52 respondents observed the landscape while taking into consideration whether the landscape had a favorable or unfavorable impact on those same respondents.
- □ Additionally, each test was preceded by the completion of a questionnaire intended to assess the mental and physical state of each respondent.
- □ The calculated eye movement indices demonstrated the impact of the biometeorological conditions on their perception of the landscape.
- Statistically significant differences in their perception of the landscape were ascertained depending on the type of weather and the respondents' general feeling irrespective of their sex.





The analisys of the statistical significance of median values differences in landscape perception between **women and men** in all seasons showed no difference of perception.



Example of boxplot statistic for HTG index (ms). On the boxplot, the middle values denote medians, the box extends to the Q1 (first quartile) and Q3 (third quartile), and the whiskers show the range of 99.3%: the upper whisker shows Q3 + 1.5 IQR (the interquartile range), the lower shows Q1 – 1.5 IQR. The notches extend to \pm 1.58 IQR/sqrt(n) and show the 95% confidence intervals.



40000 -

30000 -

20000 -

10000 -

0

TimeSpentG_ms

The EMS Annual Meeting: European Conference for Applied Meteorology and Climatology "The impact of biometeorological conditions on the landscape perception", 12-09-2019



Example of boxplot statistic for TSG, TSF and FFD indexes. On the boxplot, the middle values denote medians, the box extends to the Q1 (first quartile) and Q3 (third quartile), and the whiskers show the range of 99.3%: the upper whisker shows Q3 + 1.5 IQR (the interquartile range), the lower shows Q1 – 1.5 IQR. The notches extend to ± 1.58 IQR/sqrt(n) and show the 95% confidence intervals.



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For respondents with <u>a good frame of mind</u>



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For respondents with *a bad frame of mind*



Example of boxplot statistic for AFD index. On the boxplot, the middle values denote medians, the box extends to the Q1 (first quartile) and Q3 (third quartile), and the whiskers show the range of 99.3%: the upper whisker shows Q3 + 1.5 IQR (the interquartile range), the lower shows Q1 – 1.5 IQR. The notches extend to \pm 1.58 IQR/sqrt(n) and show the 95% confidence intervals









Sequence of visits in areas of interest designated for the analysis during (a) positive and (b) negative weather conditions



Conclusions

- Both women and men perceived the landscape similarly during different types of weather
- Studies conducted without applying a sex-based division indicate that: Under negative weather conditions (cloudy, low-pressure, and with only a small quantity of solar radiation reaching the surface of the earth), respondents devoted nearly twice as much time or even more to exploring areas with a considerable number of details, colors, and contrasts
- Landscape perception is also impacted by feeling of the observer. In periods with a bad feeling and negative weather condition, one needs stronger than expected stimuli from the landscape (an unusual sight, e.g. felling tree area)
- The sequence in which people look at individual elements of the test landscape (AOI) depends on the type of weather and its impact on the individual observers. The results obtained partially confirm the theory concerning the direction of gazing, pursuant to the observer's gaze usually moving from the upper left quadrant of the perceptive field to the upper right quadrant, and thereafter to its lower right and lower left portions







Article

The Impact of Biometeorological Conditions on the Perception of Landscape

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