PREDICTING THE IMPACT OF URBAN DEVELOPMENT ON LOCALS' PLACE ATTACHMENT IN PERIPHERAL SETTLEMENTS

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Abstract. As urban development reshapes cityscapes, residents in peripheral settlements face challenges in maintaining Place Attachment. This study examines the potential disruption of Place Dependence, Place Identity, and Place Affection—core components of Place Attachment—amid urban development in peripheral settlements. A within-subject experimental research design involved 256 residents from two inner-city peripheral communities in Malang, Indonesia. Participants envisioned scenarios of urban development, which are formal housing construction, new city streets, loss of public spaces, and loss of trees. Paired sample t-tests and SEM-based regression analyses were conducted. Results showed urban development scenarios significantly reduced Place Attachment, with the emergence of city streets having the least impact, while formal housing, loss of open spaces, and tree removal were equally disruptive. Among the components, Place Dependence was most critical in maintaining attachment, while Place Affection was the most sensitive to disruption. Place Identity, Dependence, and Affection were least affected by new streets. Conversely, public space loss most disrupted Place Identity, while formal housing had the greatest disruptive effect on Place Dependence and Affection. These findings highlight the nuanced impacts of urban development on peripheral settlements, offering systematic insights into preserving Place Attachment during urban transformation.

Key words: Peripheral communities, Malang Indonesia, experimental scenario analysis, urban transformation, emotional–spatial attachment

1. Introduction

The rapid urbanization of cities worldwide has raised concerns about changes in urban landscapes and their significant effects on peripheral settlements (Portnov and Pearlmutter, 1999; Gu, 2019; Buchecker and Frick, 2020). Disruption of place attachment (Brown and Perkins, 1992; Clarke *et al.*, 2018) - the deep-seated emotional and cognitive bonds that individuals and communities develop with their environment (Low and Altman, 1992; Scannell and Gifford, 2010, 2014) - is one of the complex and emotionally charged effects of this urban evolution's many facets (von Wirth *et al.*, 2016).

Place attachment is crucial as it arises from the fundamental human need for belonging and connection (Low and Altman, 1992; Lang and Moleski, 2010). It encompasses a complex web of emotions, memories, cultural identities, and a sense of belonging that people and communities associate with physical locations (Scannell and Gifford, 2010). These attachments are powerful, influencing not only the physical environments in which individuals live but also their social interactions, overall well-being, and community resilience. The psychological process of place attachment is commonly understood as a combination of place affect, place identity, and place dependence (Cole *et al.*, 2021).

Urban development is generally intended to strengthen these bonds and improve residents' emotional well-being by enhancing the value of their homes and neighborhoods (von Wirth *et al.*, 2016). However, unintended consequences of urban development often have detrimental psychological effects, including stress, mental strain, and solastalgia—a form of existential distress (Albrecht *et al.*, 2007; Mehdipanah *et al.*, 2013; Galway *et al.*, 2019; Phillips and Murphy, 2021). Many peripheral settlements face the challenge of maintaining these essential connections amidst the accelerating pace of urbanization (Buchecker and Frick, 2020). As concrete jungles expand, green spaces shrink, and landmarks are transformed, a critical question emerges: How does the relentless march of urban development affect the individuals and communities who have called these places home for generations? Understanding the complex mechanisms underlying the disruption of place attachment may provide key insights into potential solutions.

While there is a substantial body of exploratory research on place attachment, confirmatory studies remain limited, impeding empirical progress in this field (Lewicka, 2011a). Promising confirmatory research includes experiments that establish causal relationships between variables and place attachment (Scannell and Gifford, 2014, 2017a; Reese *et al.*, 2019; Jacobs and Munis, 2020; Leviston *et al.*, 2023). Psychological experimentation is particularly effective in identifying cause-and-effect relationships (Abdi *et al.*, 2009). By asking participants to imagine familiar places and simulating specific changes, these studies reveal how place attachment might be influenced. Building on this understanding, our research seeks to determine the extent to which specific changes disrupt place attachment.

The emergence of formal housing—where land ownership and the housing is legally recognized. Includes various forms such as self-help housing, public housing, and cross-subsidized developments (Rukmana, 2018).

1. The emergence of new city streets.

2. The loss of public open space.
3. The loss of trees.

These scenarios represent some of the most common environmental changes affecting peripheral communities (Portnov and Pearlmutter, 1999; Nechyba and Walsh, 2004; Harun *et al.*, 2015; Song *et al.*, 2016), particularly in Indonesia (Puspitasari, 2013; Fatma and Deguchi, 2016). Our study contributes to the literature by conducting causal analyses of these effects and examining the relationships between physical changes and place attachment dynamics. Furthermore, we enhance the experimental methodology by using imaginative techniques to manipulate participants' place attachment to their neighborhoods through a within-subject study design.

2. Framework

Place attachment is a significant person-environment phenomenon associated with numerous psychological consequences (Hidalgo and Hernández, 2001). It is a critical concept in understanding how urban design and architecture influence residents' and visitors' behavioral intentions (Shamai and Ilatov, 2005; Shamsuddin and Ujang, 2008; Ujang and Zakariya, 2018). Furthermore, place attachment plays a pivotal role in fostering sustainable communities and encouraging sustainable habits (Razem and El Kaftangui, 2020). It can also serve as a foundation for environmental activism (Devine-Wright, 2009, 2011).

This study adopts the place attachment framework developed by Scannell and Gifford (2010), which offers a multidimensional approach to defining place attachment. Their framework organizes various conceptions of place attachment into a comprehensive three-dimensional model encompassing the Person dimension, Psychological Process dimension, and Place dimension (PPP). The PPP framework is considered inclusive, covering most existing definitions of place attachment and accommodating both quantitative and qualitative methodologies (Lewicka, 2011a; Hernández *et al.*, 2020; Manzo and Devine-Wright, 2020). According to this model, place attachment is defined as "a positive bond between individuals/ groups and places that can vary in terms of spatial levels, levels of specificity, and social or physical features of places, and is manifested through affective, cognitive, and behavioral dimensions."

Additionally, this study operationalizes place attachment using the organizing structure of place affect, place identity, and place dependence—three core psychological dimensions of place attachment (Jorgensen and Stedman, 2001; Scannell and Gifford, 2013; Cole *et al.*, 2021). These three concepts and their corresponding measurements are considered suitable for representing the affective, cognitive, and behavioral components of the psychological process of place attachment (Hidalgo, 2013).

The first component, affect, is a central element included in most definitions and measures of place attachment (Jorgensen and Stedman, 2001; Scannell and Gifford, 2010). The affective component contributes to the formation of the person-place bond, capturing the experiential content of that bond. The second component, place identity, refers to the integration of a place into an individual's self-concept, described as the "physical world socialization of the self." Lastly, place dependence reflects the extent to which a place's characteristics

support an individual's needs and goals (Williams and Vaske, 2003). The PPP framework posits that the psychological processes of affect, identity, and dependence adapt in response to changes in either the Person or Place dimensions.

Disruptions to place attachment often occur during relocation (Inalhan and Finch, 2004; Batudoka, 2005; Stedman, 2006; Hernández *et al.*, 2007; Boğaç, 2009; Lewicka, 2010, 2011b; Kamalipour *et al.*, 2012; Scannell and Gifford, 2014; Karsono *et al.*, 2016; Manzo and Devine-Wright, 2020), or when there is a loss of significant social or physical elements of a place (von Wirth *et al.*, 2016; Reese *et al.*, 2019). Changes that carry a negative stigma can significantly reduce place attachment (Brown *et al.*, 2003). However, environmental changes are often unavoidable, especially in urban development, where shifts are perceived as necessary and bring a mix of costs and benefits. This is particularly true in peripheral areas, where development is often stigma-neutral yet inevitable.

Thus, it is crucial to systematically examine disruptions in place attachment, particularly in the context of urban development. This study aims to assess the extent to which place attachment changes in response to perceptions of specific urban development scenarios. Given the rapid changes in peripheral environments due to urban infrastructure expansion, biodiversity loss, and population growth, this topic is increasingly relevant.

The degree of place attachment is influenced by a place's stability and changes (Brown and Perkins, 1992). Therefore, it can be hypothesized that place attachment is disrupted dynamically, with varying levels of impact depending on the nature of specific urban development changes. This study seeks to validate this hypothesis through experimental data, aiming to demonstrate that different types of urban development have varying effects on the depth of place attachment disruption.

3. Methodology

The experiment was conducted in peripheral settlements of Malang City, East Java, Indonesia. Malang City, the second most populous city in East Java, is characterized as a student and agro-industrial hub, with a population growth rate of 0.86%, exceeding the provincial average of 0.75% (Mahendra and Pradoto, 2016). Among the 41 identified inner-city peripheral settlements, two settlements—Dusun Baran Tempuran and Dusun Baran Tlogowaru—were selected for the study (Error! Reference source not found.).

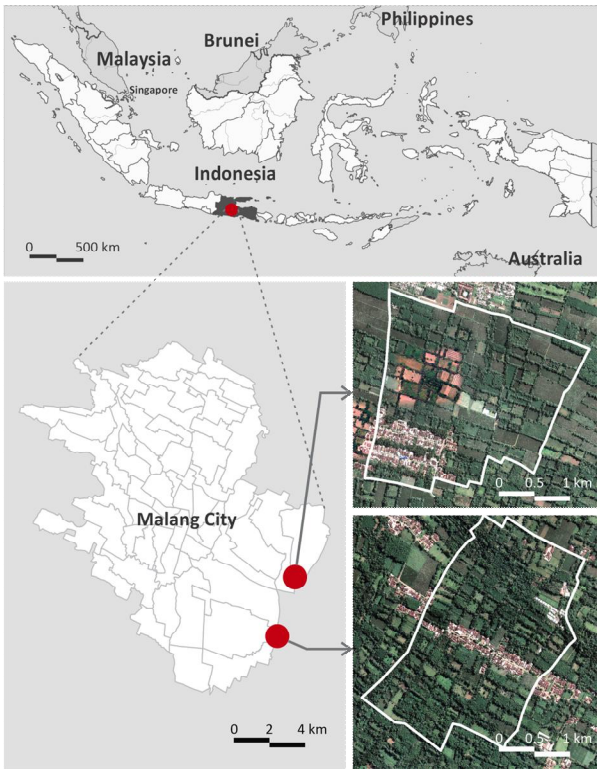

Fig. 1. Study Locus: Dusun Baran Tempuran (top) and Dusun Baran Tlogowaru (bottom).

These settlements were chosen based on their minimal exposure to urban development projects, ensuring that none of the four pre-identified urban development scenarios had occurred there.

The two settlements share similar demographic, cultural, and environmental characteristics. Both are predominantly inhabited by Javanese people with Madurese ancestry. The majority of residents work as farmers and have limited formal education. The communities are culturally rooted in Islamic Javanese traditions, and their overall atmospheres are comparable. Due to these similarities, the data collected from the two settlements were merged for analysis.

3.1. Experiment Design

To investigate place attachment dynamic holistically, this study adopted a within-subject design, which is well-suited for examining disruptions to place attachment and their direct effects. A within-subject design offers greater statistical power and reduces error terms compared to between-subject designs (Keren and Lewis, 1993). To mitigate practice and learning effects, participants were exposed to distinct stimuli, ensuring that the same or similar stimulus was not presented to any participant more than once.

The experiments utilized questionnaire-based surveys, with participants randomly assigned to one of four conditions using a raffle hat. A priori power analysis, conducted using G*Power (Faul *et al.*, 2007) determined that a sample size of 54 participants per condition was needed to detect a medium effect size (0.5) with a power of 0.95. Accordingly, a minimum of 216 participants (108 per settlement) was required. To ensure validity and account for potential incomplete or suspicious responses, 128 participants per settlement (64 per condition) were recruited.

3.2. Participant Recruitment and Characteristics

Participants were eligible if they were at least 18 years old and had resided in the selected settlements for a minimum of two years. Each family group in the settlements was represented by at least one participant. Participants completed the questionnaires at home under the supervision of the researchers, ensuring their responses were free from external influence. Among the 256 recruited participants, four were excluded for failing a trap question designed to verify attentiveness. The final sample consisted of 252 participants, with 53% identifying as female. The mean age was 37.6 years (SD = 12.65), and the average length of residence was 29.2 years (SD = 16.18). The majority were farmers (37.7%), followed by private sector workers (27.7%) and self-employed individuals (21.8%).

3.3. Experiment Procedure

The experiment consisted of five stages:

1. Neighborhood Visualization: Participants were instructed to think about their neighborhood, its boundaries, and one specific potential urban development scenario.
2. Imagination Task: Participants visualized their neighborhood after the hypothetical urban development scenario using a guided imagination task based on previous research (Scannell and Gifford, 2017a; Reese *et al.*, 2019). Participants closed their eyes and vividly imagined the changes.

3. Attachment Rating: Participants rated their place attachment while imagining the urban development scenario already happened in their neighborhood.
4. Resting Phase: A ten-minute break allowed participants to disengage from the imagination task and reset their focus.
5. Current State Focus: Participants reflected on the current state of their neighborhood, answering questions about socio-demographic variables and their attachment to social, environmental, and cultural aspects.

In disrupted and pre-disrupted phase, participants completed a 19-item place attachment scale adapted from Scannell and Gifford (Scannell and Gifford, 2013, 2017a), Responses were recorded on a 6-point Likert scale (1 = strong disagreement, 6 = strong agreement). The scale included subscales for place dependence, affective attachment, and place identity. Subscale means were averaged to calculate overall place attachment, with high reliability (Cronbach's α = 0.86). The treatments were conducted at the same location and time for all participants to control for time-related effects.

4. Results

With a large sample size (N > 30), this study follows the Central Limit Theorem, a statistical rule that assumes a normal distribution (Kwak and Kim, 2017). Consequently, we employed parametric statistics to examine the data. With Likert data, small sample sizes, various variances, and non-normal distributions, parametric statistics can be used without worrying about "coming to the wrong result" (Norman, 2010). Therefore, using means and standard deviations to summarize evaluations on Likert scales is acceptable. Additionally, parametric approaches are appropriate for examining Likert scales (Carifio and Perla, 2008).

The levels of pre-disrupted place attachment in the four groups were not significantly different with the value of p = 0.517, according to additional analysis of the data using Analysis of Variance (ANOVA), indicating the four group had the same consistency of pre-disrupted place attachment (Table 1). This demonstrates the test's baseline stability as well.

Table 1. ANOVA - Pre-disrupted Place Attachment.

Cases	Sum of Squares	df	Mean Square	F	p
Urban Dev. Scenarios	0.87	3	0.29	0.76	0.52
Residuals	94.0	248	0.38		

A paired-samples t-test comparing the mean place attachment in each of the four scenario groups at two different points in time revealed a significant main effect of all four urban development scenarios on place attachment. Participants who imagined the urban development scenarios occurring in their neighborhoods reported lower place attachment compared to before the treatment.

Participants who imagined the emergence of formal housing in their neighborhood experienced the most significant decrease in place attachment, with a mean difference of 1.227 ((t = 8,549), (df = 58), (p <0.001)), a standard error (SE) difference of 0.143, a Cohen's (d) of 1.113, and a SE Cohen's (d) of 0.199. Specifically, participants imagining formal housing in their neighborhood (M = 4.03), (SD = 1.13) reported significantly

lower place attachment than before the treatment (M = 5.25), (SD = 0.51).

The second most significant decrease in place attachment occurred among participants who imagined the loss of public open space in their neighborhood, with a mean difference of 1.077, ((t = 7,265), (df = 66), (p < 0.001)), SE difference = 0.148, Cohen's (d) = 0.888, and SE Cohen's (d) = 0.177. In more detail, participants imagining the loss of public open space (M = 4.20, SD = 1.18) reported lower place attachment compared to the pre-treatment condition (M = 5.28, SD = 0.70).

The third most significant decrease occurred among participants imagining a loss of trees or greenery in their neighborhood, with a mean difference of 0.992, ((t = 7,856), (df = 58), (p < 0.001)), SE difference = 0.126, Cohen's (d) = 1.023, and SE Cohen's (d) = 0.196. Participants imagining this loss (M = 4.16), (SD = 0.90) reported significantly lower place attachment compared to their current neighborhood (M = 5.15), (SD = 0.65).

Finally, imagining the emergence of a new city street resulted in the least significant decrease, with a mean difference of 0.74, ((t = 8,329), (df = 66), (p < 0.001), SE difference = 0.089, Cohen's (d) = 1.018, and SE Cohen's (d) = 0.158. Participants imagining this scenario (M = 4.56), (SD = 0.77) reported significantly lower place attachment compared to their current neighborhood (M = 5.30), (SD = 0.57).

Across all four groups, the highly significant differences (p < .001) indicate a disruption in place attachment between pre-treatment (Pre-Disrupted Place Attachment Group 1 to 4) and post-treatment scenarios (Disrupted Place Attachment Scenario 1-4), demonstrating the significant effect of imagining urban development on participants' place attachment levels (Table 2).

In the disrupted place attachment affected by urban development scenarios, only the group in Scenario 2 showed a significant difference compared to the other groups (p = 0.004, 0.019, 0.015). In contrast, the groups in Scenarios 1, 3, and 4 did not demonstrate significant differences (p = 0.564, 0.511, 0.982), according to a paired-samples t-test comparing all groups (Table 3).

This finding indicates that place attachment dynamics can occur when urban development takes place in peripheral areas, even though only one group exhibited a significant difference. Nevertheless, in most scenarios, the effects of imagining urban development on residents' place attachment levels appear to be similar (Fig. 2).

Regression analysis using structural equation modeling (SEM) in JASP, as suitable tools for it (Marsman and Wagenmakers, 2017; Faulkenberry *et al.*, 2020), examined the relationship between pre-disruption and post-disruption stages across all four scenarios. The models showed a significant positive relationship between pre-disruption place attachment as a predictor and post-disruption place attachment as an outcome. Goodness of Fit Indexes (Byrne, 2016), confirmed that the models were appropriate for all scenario groups (Table 4).

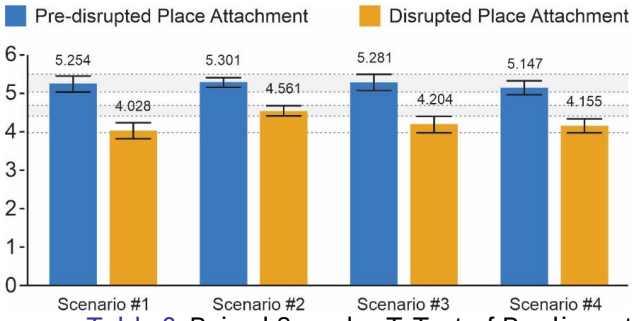

Fig. 2. The dynamic of place attachment from imagining of urban development scenarios in peripheral settlements.

Table 2. Paired Samples T-Test of Predisrupted and disrupted Place Attachment in all group.

	Measure 1	Measure 2	t	df	p	Mean Diff.
1	Pre-Disrupted Place Attachment (Group 1)	Disrupted Place Attachment (scenario 1)	8.55	58	< .001	1.227
2	Pre-Disrupted Place Attachment (Group 2)	Disrupted Place Attachment (scenario 2)	8.33	66	< .001	0.74
3	Pre-Disrupted Place Attachment (Group 3)	Disrupted Place Attachment (scenario 3)	7.27	66	< .001	1.077
4	Pre-Disrupted Place Attachment (Group 4)	Disrupted Place Attachment (scenario 4)	7.86	58	< .001	0.992

Table 3. Paired Samples T-Test of disrupted Place Attachment between scenarios.

Measure 1	Measure 2	t	df	p	Mean Diff.
Disrupted Place Attachment (scenario 1)	Disrupted Place Attachment (scenario 2)	-3.03	58	0.004	-0.502
Disrupted Place Attachment (scenario 1)	Disrupted Place Attachment (scenario 3)	-0.58	58	0.564	-0.123
Disrupted Place Attachment (scenario 1)	Disrupted Place Attachment (scenario 4)	-0.66	58	0.511	-0.128
Disrupted Place Attachment (scenario 2)	Disrupted Place Attachment (scenario 3)	2.41	66	0.019	0.357
Disrupted Place Attachment (scenario 2)	Disrupted Place Attachment (scenario 4)	2.50	58	0.015	0.375
Disrupted Place Attachment (scenario 3)	Disrupted Place Attachment (scenario 4)	-0.02	58	0.982	-0.004

Table 4. Regression coefficients and their Goodness of Fit.

Predictor	Outcome	Est	SE	z-value	p	Goodness of Fit
Pre-Disrupted Place Attachment (Group 1)	Disrupted Place Attachment (scenario 1)	0.4	0.04	10.35	< .001	CFI 0.992, TLI 0.991, IFI 0.992, RMSEA 0.057, GFI 0.959
Pre-Disrupted Place Attachment (Group 2)	Disrupted Place Attachment (scenario 2)	0.22	0.03	6.88	< .001	CFI 0.974, TLI 0.972, IFI 0.974, RMSEA 0.080, GFI 0.940
Pre-Disrupted Place Attachment (Group 3)	Disrupted Place Attachment (scenario 3)	0.25	0.06	16.60	< .001	CFI 0.993, TLI 0.992, IFI 0.993, RMSEA 0.063, GFI 0.971
Pre-Disrupted Place Attachment (Group 4)	Disrupted Place Attachment (scenario 4)	0.18	0.02	8.07	< .001	CFI 0.965, TLI 0.962, IFI 0.963, RMSEA 0.089, GFI 0.924

Further paired-samples t-tests revealed that each scenario produced distinct disruptions in the three aspects of place attachment: place identity, place affect,

and place dependence (Table 5). Among these, place affect showed the greatest disruption (sum mean dif: 4.460), followed by place identity (sum mean dif: 4.248), and finally, place dependence (sum mean dif: 3.016).

Furthermore, Scenario 2 (emergence of city streets) caused the least disturbance on place identity, dependence and affect (mean dif: 0.796, 0.866, 0.442). Scenario 3 (the loss of public space) caused the greatest disruption to place identity (mean dif: 1.224), while scenario 1 (the emergence of formal housings) caused the greatest disruption to place dependence (mean dif: 0.908) and affect, (mean dif: 1.409). Scenario 4 (loss of trees) had similar effects on place identity and affect (mean diff: 1.059 and 1.075, respectively). These findings underscore that different urban development scenarios impact specific aspects of place attachment in distinct ways.

The minimal disturbance caused by the emergence of city streets suggests that functional enhancements may be more easily integrated into the community's sense of place. In contrast, the loss of public spaces and trees emphasizes the importance of shared and natural environments in preserving place identity and affective bonds. Meanwhile, the emergence of formal housing, while improving infrastructure, appears to disrupt residents' dependence and emotional connections, potentially due to changes in social dynamics or disruptions to their livelihoods as farmers.

Table 5. Detailed Paired Sample T-Test of Place Attachment core component.

	Sc #1		Sc #2		Sc #3		Sc #4		
Paired t test	Mean Dif.	p	Mean Dif.	p	Mean Dif.	p	Mean Dif.	p	SUM
PLACE IDENTITY									
This place is part of me	1.475	< .001	1	0.006	1.224	< .001	1.271	< .001	
I can be myself here	0.983	< .001	0.515	0.071	1.522	< .001	0.898	< .001	
This place represents my character	1.051	< .001	0.667	0.015	1.373	< .001	1.322	< .001	
There is an energy that binds me here	1.169	< .001	1	0.002	0.776	0.003	0.746	0.003	
AVERAGE DIFERENCE	1.170		0.796		1.224		1.059		4.248
PLACE AFFECT									
I am relax here	1.78	< .001	1.121	< .001	1.567	< .001	1.034	< .001	
I am happy here	1.831	< .001	0.909	0.004	1.373	< .001	1.271	< .001	
This is my favorite place	1.492	< .001	0.424	0.165	1.03	< .001	1.323	< .001	
I miss this place	1.305	< .001	0.906	< .001	0.776	< .001	1.068	< .001	
I am attached to this place	1.441	< .001	0.636	< .001	1.119	< .001	1.051	< .001	
I am proud here	1.305	< .001	0.667	< .001	1.328	< .001	1.305	< .001	
I am familiar with the beauty here	1.542	< .001	1.273	< .001	1.164	< .001	1.203	< .001	
My real home is in this place	1.271	< .001	1.061	< .001	1.104	< .001	0.983	< .001	
This is my heritage	1.085	< .001	1	0.002	1.015	< .001	0.915	0.002	
I will live here forever	1.034	< .001	0.667	0.008	0.627	0.007	0.593	0.007	
AVERAGE DIFERENCE	1.409		0.866		1.110		1.075		4.460
PLACE DEPENDENCE									
This is the best place for my activity	1.22	< .001	0.545	0.027	0.806	< .001	0.915	< .001	
This place unmatched	0.949	< .001	0.697	0.013	0.701	0.001	0.814	0.004	

	Sc #1		Sc #2		Sc #3		Sc #4		
Paired t test	Mean Dif.	p	Mean Dif.	p	Mean Dif.	p	Mean Dif.	p	SUM
for my activity									
This place is not a good place for my activity	0.712	0.01	0.455	0.165	1.104	< .001	0.983	< .001	
There is a better place	0.305	0.221	-0.212	0.608	0.582	0.03	0.051	0.847	
This place does not suit my nature	1.356	< .001	0.727	0.115	1.269	< .001	1.102	< .001	
AVERAGE DIFERENCE	0.908		0.442		0.892		0.773		3.016

Some items are negative correlation – The table has been adapted accordingly.

5. Discussion

To the best of our knowledge, the current experiments are the first to employ a within-subject design to examine how urban development in peripheral areas influences place attachment. Place attachment significantly decreased when participants were asked to visualize urban development occurring in their peripheral community. The data indicate that certain urban development scenarios have a significantly smaller impact on the decline in place attachment compared to others. This study provides further evidence that place attachment is dynamic (Brown and Perkins, 1992; Scannell and Gifford, 2017b; Reese *et al.*, 2019; Manzo and Devine-Wright, 2020;), and additional analysis highlights the high probability of disruption in the place attachment of peripheral residents.

Therefore, it is conceivable that place attachment becomes more dynamic during periods of urban infrastructural development in peripheral areas, such as when green spaces or natural areas are replaced by buildings or streets, and elements and features of a place are removed, which tend to change the well eastablished environmental meaning (Nazaruddin *et al.*, 2024). This research further empasize that urban development scenarios in the peripheral communities, though often regarded as neutral and inevitable, are still perceived as potential threats capable of disrupting place attachment. As a result, once urban development begins, people may become less inclined to build a sustainable community or protect their place.

Second, Buchecker and Frick, (2020) emphasize the challenges faced by peripheral communities. Based on our research, these challenges are not caused solely by urbanization, but also by urban development. In this study, the emergence of city streets, as one of the urban development scenarios, is preferred over other types of urban development. However, the emergence of formal housing is believed to be just as harmful as the removal of open spaces and trees for peripheral communities. Although the impact of city streets was less severe, it still did not effectively support the existing state of the peripheral community.

The discernible pattern of threats posed by urban development scenarios, resulting in a significant average difference between the pre-disruption and post-disruption phases of place attachment—with the affective aspect being the most vulnerable dimension—sheds light on the mechanism of disruption. The primary cause of this disruption is the perceived threat to the

affective attachment component. This finding reaffirms earlier research suggesting that the deeply personalized emotions cultivated within these environments, referred to as the personal context of place attachment, cannot be fully understood in isolation from the physical and social attributes of the setting (Raymond *et al.*, 2010).

On the other hand, this research demonstrates that place dependence is the dimension least affected by urban development. While place dependence is more cognition-focused, affective attachment is primarily emotion-driven (Williams and Vaske, 2003; Mandal, 2016). This research contributes to understanding how each concept plays a role. Place dependence emphasizes the physical characteristics of a place as essential to attachment, as it provides amenities or resources that support individuals' goals (Scannell and Gifford, 2010; Cole *et al.*, 2021). As an inevitable environmental change, urban development in peripheral settlements poses a greater threat to residents' ingrained emotions than to the functional aspects of place and place dependence. Despite feeling threatened, people are likely to remain and adapt, prioritizing the practical utility of the location.

The disruption of place attachment is most significant in the affective dimension and may result in solastalgia, a phenomenon observed in studies on environmental risks, which is comparable to this disruption model (Albrecht *et al.*, 2007; Clarke *et al.*, 2018). In the context of environmental risks, place dependence is the weakest expression of attachment, suggesting an ongoing relational adaptation to place. Therefore, the disruption of place attachment caused by urban development in peripheral communities is analogous to disruptions resulting from environmental threats.

The observation that strong place dependence does not always correspond to strong place identity is evident in this context. This finding diverges from earlier studies, which suggested that place identity mediated the influence of place dependence on pro-environmental intentions, underscoring the significant role of place identity as a mediator of place dependence (Halpenny, 2010). This study reveals that, while place identity may become more fragile during urban development, place dependence can persist. Due to its resilience and dynamic nature, urban development may cause place dependence and place identity in peripheral communities to shift in opposite directions rather than in tandem. This contrasts with previous research, which indicated that prolonged interactions with a place could lead to the development of place identity and that place dependence could strengthen place identity (Vaske and Kobrin, 2001).

The results from the regression analysis between pre-disrupted and disrupted place attachment across four scenarios reveal a significant positive relationship, indicating that a person's initial attachment to their community serves as a predictor of how they will react when their attachment is disrupted. In other words, a higher level of pre-disrupted place attachment tends to lead to fewer disruptions in place attachment. These findings suggest a regression relationship between place attachment in the pre-disrupted stage and place attachment in the disrupted stage, implying that initial attachment likely influences how people respond to urban development. The results of this study contribute additional insights to the findings of previous

research by von Wirth *et al.* (2016) in the context of urban development and place attachment. Therefore, to fully understand the disruption in place attachment, it is essential to first comprehend its initial state.

Understanding the mechanisms of place attachment disruptions can provide valuable insights into place-bound dynamics and the impact of urban development on urban peripheral settlements. Targeting the most vulnerable aspects can facilitate the implementation of coping mechanisms and risk management programs to maintain place affinity in the face of urban development scenarios in peripheral communities.

These findings open up intriguing new research directions. Considering that people's attachment to a place is deeply intertwined with the meaning they attribute to it, exploring the relationship between place and change in the context of urban development would be fascinating, as urban development is frequently perceived as the process of altering a place. The interplay between pre-disrupted place attachment, the meaning of a place, the meaning of each urban development scenario, and disrupted place attachment could be the focus of future investigation, shedding light on influencing factors and providing a more nuanced understanding of the mechanisms of place attachment disruption. Furthermore, considering the substantial impact of time on the development of place attachments, longitudinal research could serve as a valuable approach to gaining further insights into how place attachments regenerate after disruptions. This becomes particularly crucial in light of the extensive and profound physical (and social) changes that may result from urban development in peripheral areas.

However, this study has several limitations that need to be addressed. Most importantly, due to the nature of the design, we had to mentally contrast actual place attachment with expected place attachment (derived from visualizing urban development). In addition, we believe that future research should consider meaning as a crucial component supporting the development of place attachments, particularly the meaning of place and the meaning of urban development for peripheral residents. This would help better understand the underlying causes of place attachment disruption and identify dynamic factors affecting place attachment in peripheral communities.

Another limitation of this study lies in its geographic focus on peripheral settlements in Indonesia. Future research could explore the mechanisms of place attachment disruption in different contexts or settlement types. For instance, comparative investigations could be conducted in planned formal housing areas—where neighborhoods are legally owned and professionally designed—and unplanned formal housing areas, where land ownership is legal but development occurs informally and without professional planning. Further studies might also examine urbanized and semi-urbanized settlements, while excluding illegal housing areas, as their informal status may obscure or distort residents' expressions of place attachment.

Further investigation is also needed to explore potential connections between the relationship under analysis and other variables that might serve as mediating or moderating factors. One such example

could be the significance and satisfaction associated with urban development scenarios.

Despite the limitations, we believe this work significantly advances the field of place attachment research by demonstrating the adaptability of place attachment to physical attributes and providing a valuable within-subject design experimental manipulation of place attachment in peripheral areas.

6. Conclusions

The objective of this research was to understand and validate the relationship between place attachment among residents of peripheral settlements and the urban development scenarios occurring in those areas. Despite its limitations, the study's findings reveal that certain urban development scenarios, although perceived as neutral and unavoidable, were strongly regarded as potential threats capable of undermining place attachment. Moreover, the majority of the urban development scenarios examined in this study are believed to have a similar impact on place attachment.

Utilizing a within-subject design, this study demonstrates that place affect is the most dynamic aspect of place attachment, while place dependence is the most resilient in adapting to changes in place. Furthermore, a person's pre-disrupted place attachment is a strong positive predictor of their disrupted place attachment. This implies that individuals with a high level of place attachment are generally less affected by alterations to their environment resulting from urban development.

Future studies could compare attachments formed before and after actual urban development takes place to explore the mechanisms of disruption on place attachment, as presented in this study. Alternatively, researchers could focus on the emotional aspects of disruption, such as stress and grief. Nevertheless, the mechanisms outlined here offer researchers a more comprehensive explanation and supporting evidence for the disruption of place attachment caused by urban development in peripheral settlements.

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