

Original Article

Perceived safety of the retrofit neighborhood: A location-based approach

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Abstract Urban infill includes a potential to change the track of development of existing, distressed neighborhoods. The investments to a neighborhood as a whole can at best contribute to an increase in residential satisfaction, including perceived safety. Using a location-based public participation geographic information system approach, this study offers insights on how to avoid too simplistic or deterministic thinking in safety planning through a case study of a neighborhood representing urban retrofit in Espoo, Finland. This article concludes that more comprehensive safety strategies are most likely to succeed in breaking the negative development of fear and a spiral of neighborhood decay especially in retrofit neighborhoods.

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Introduction

Urban infill includes a potential to change the track of development of existing, distressed neighborhoods. At best, the vicious spiral of decay can be turned to a more positive direction, to the path of development and renewal. In this study, an urban infill strategy of a somewhat distressed neighborhood in Helsinki metropolitan area in Finland is studied from the point of view of safety planning. Our study area, the neighborhood of Kirkkojärvi offers a testbed for the possibility of urban infilling to improve the perceived safety of an area where residents have reported exceptionally high level of fear.

The extensive research literature concerning 'designing out the fear' have provided two main approaches for improving the perceived safety of a neighborhood: Either more controlled and closed city space has been suggested (segregated approach) or, contrastingly, the enlivening and opening of public space (integrated approach) (Landman, 2009). Segregated approach supports

so-called fortress and panoptic interventions; defending space by controlling access, increasing surveillance and strengthening boundaries and separation of areas in urban environment (Oc and Tiesdell, 1999). The integrated approach is based on the promotion of an open and assimilating urban environment and an increase of human presence and activity, which is believed to improve feelings of safety through association and co-operation. The gated community planning concept can be seen as quite an extreme application of segregated approach while Crime Prevention Through Environmental Design (CPTED) concept has adopted elements from both the approaches (Taylor, 2002; Zahm, 2005). New Urbanism is an example of an integrated approach although it has wider targets, safety being only one outcome (Kitchen, 2005).

In addition to the two approaches above that concentrate on the links between physical characteristics of settings and perceived safety, many scholars emphasize the complex interplay between

the social and physical realms and argue that adopting a simple set of design solutions is not enough. They argue that academics and policy-makers have too much concentrated on built environment at the expense of social causes and the political nature of fear. This third approach, stressing the socio-political constitution of fear has been highlighted by studies based on the critical tradition of social science, in particular feminist research (Koskela and Pain, 2000; Pain, 2000).

The context of the study in Espoo, in Helsinki metropolitan area in Finland, includes design elements from both segregated and integrated approaches, thus allowed us to take further steps in understanding the interrelationships between perceived safety and neighborhood planning and design. In this study a location-based research agenda utilizing public participation geographic information system (PPGIS) methodology allowed us to study the complex associations between specific design characteristics and social qualities of the neighborhood in relation to the safety perceptions of inhabitants. We conclude by discussing how urban infilling could be better used as a means of changing the negative direction of the spiral of decay to a positive one especially in retrofit neighborhoods.

Background

Neighborhood safety planning strategies in various approaches

The traditional approach of crime prevention, *segregated approach*, is based on target-hardening and aims to put up barriers to crime and to assist policing by reducing escape routes (Kitchen, 2005). The functions that adjoin residential spaces as well as the street networks are seen as elements that affect the defensibility of an area (Newman, 1972) and can either encourage or discourage crime opportunities (Clarke and Eck, 2005). If an area is highly accessible to outsiders, and highly attractive because of the types of facilities located within it, it is more difficult for residents to exert control over public and semipublic spaces and the effectiveness of natural surveillance is diminished (Roncek and Maier, 1991).

The segregated approach encourages people to take control over their neighborhoods and intervene and report crime when it occurs. The promotion of territoriality includes a range of interventions: visible policing presence and CCTV

surveillance; physical segregation; favoring private instead of communal or public space inside residential areas; single-use neighborhoods; separation of land uses; using secure gates, barriers and other measures of access control; avoidance of through pedestrian traffic and all unnecessary footpaths in neighborhoods; discouraging forms of street life that can potentially be disrupting or damage private property such as kids playing around parked cars (Newman, 1972; Oc and Tiesdell 1999; Landman, 2009).

The integrated approach for neighborhood safety is connected to the work of Jacobs (1961), who strongly advocated the qualities of urban life such as diversity and vitality and sense of community. She proposed that diverse and mixed land use patterns attract more people generating pedestrian traffic and making streets interesting, lively and safe. This in turn encourages natural surveillance, or what she calls 'eyes on the street' (Jacobs, 1961). In such context strangers are conceptualized also as a source of safety in contrast to segregated approach that aims at restricting their access (Jacobs, 1961; Landman, 2009).

A range of interventions of an integrated approach include mixed land use, 24-hour city, clear demarcation between public and private space using symbolic, not physical boundaries, substantial quantity of stores and other public places on streets, encouraged use of public space, higher densities through appropriate built form and building typologies, accessible smaller parks, open and inviting sidewalks and buildings overlooking the public space and entrances to the streets (Jacobs, 1961; Pain and Townshend, 2002; Landman, 2009).

While the segregated and integrated approaches focus on physical environment, *the social constitution of fear* approach suggests that the experiences of fear should be seen in relation to wider social and geographical context, social relations and power structures. The generic effectiveness of safety planning measures can therefore be questioned and should always be empirically tested and locally fine-tuned (Pain and Townshend, 2002). It is also important to notice that 'fear discourses' themselves create fear by defining and maintaining boundaries between deviance and normality, order and disorder – what and who should be afraid of and excluded from the places (Bannister and Fyfe, 2001; England and Simon, 2010). To break the vicious cycle of fear that often results from increased public awareness of safety issues, careful, situational

strategies need to be complemented with wider strategies – for example – reducing the motivation to commit crime and incivilities through influencing social and economic development (Carmona *et al* 2003, p. 120).

Empirical evidence supporting the various approaches of neighborhood safety planning

Empirical studies mainly have searched evidence for segregated and integrated approaches while the complex social constitution of fear has received less empirical research and fewer suggestions how to concretely support this approach in neighborhood settings. Three key issues in neighborhood safety planning concretize the differences between various approaches.

First are the questions concerning *land use patterns*: the decisive question is whether a single-use residential development pattern or a mixed-use, higher density neighborhoods with good local service accessibility and high share of public spaces is superior in safety planning. The findings concerning direct effects between land-use patterns and perceived safety are mixed and somewhat contradictory. For instance, living in close proximity to a grocery or convenience store has been found to correlate with higher fear of crime (Schweitzer *et al*, 1999) while other studies have not found this correlation (McCrea *et al*, 2005). Wood *et al* (2008) found that as the number of destinations within the range of 800 m of inhabitants' homes increased, feelings of safety diminished. However, this association attenuated after adjusting for mobility arrangements and authors proposed that both the quality and type of destinations needs further consideration.

Mixed-used development has been a target in many urban infill projects, where existing urban structure is densified, and local amenities and public transport services improved. Experiences of these projects, however, suggest that while urban infilling had increased activity in the neighborhood, it also decreased feelings of security and traffic safety (Vallance *et al*, 2005). This is not surprising, because urbanization is among the best predictors of fear of crime (Miceli *et al*, 2004). The follow up studies on perceived safety in urban infill projects are, nevertheless, insufficient.

Second set of issues concern the *mobility arrangements*: whether the highly accessible and permeable neighborhood should be favored, or should the access be controlled. The integrated approach

stresses connectivity and pedestrian accessibility as means of promoting natural surveillance, whereas the segregated approach highlights restricted transit traffic for both vehicles and pedestrians. The former approach usually leads to grid network with higher connectivity, while the latter approach usually suggests *cul-de-sac* and curvilinear layout. Commonalities between those environments that encourage walking and those that influence neighborhood safety has been examined (Foster *et al*, 2010). Evidence in fact suggests that many walkability characteristics are also associated with more crime (Schneider and Kitchen, 2007; Cozens and Hillier, 2008). Wood *et al* (2008) hypothesize in line with integrated approach that walkable suburbs encourage interaction between neighbors leading higher perceptions of safety. However, they found that residents in a conventional suburb (that is, curvilinear street layout) felt safer than those in a hybrid (that is, a mix of grid and *cul-de-sacs*) or traditionally planned (that is, grid layout) suburb.

Third, with regard to *the architectural layout and detailed design*, the integrated approach relies on strengthening perceived safety in a more holistic way while segregated approach concentrates on crime prevention and reducing fear of crime. Natural surveillance promoted by integrated approach is made possible by maximizing visibility and fostering positive social interaction (Reynald and Elffers, 2009; Kajalo and Lindblom, 2010). In practice, natural surveillance is usually furthered with solutions that stress only visibility and defensible space through building physical features that impede escape or incivility and thus relate to segregated approach. Low landscaping, street lights, the removal of hiding and lurking places and the placement of high-risk targets in plain view of legitimate users are examples of these measures (Cozens *et al*, 2005; Reynald and Elffers, 2009). The ability of natural surveillance to deter crime is nevertheless unclear. Some studies have found a link between natural surveillance and incidence of crime. For instance, Sorensen (2003) observed how burglars avoided targets that were readily seen by neighbors and/or passers-by. Research at UCL's Space Syntax Lab claims that linear, integrated spaces with some through movement and strong intervisibility of good numbers of entrances are the safest spaces (Hillier and Shu, 2000). In contrast, Booth (1981) found that natural surveillance in terms of 'opportunities to observe' has only limited utility at least for public spaces outside the dwelling.

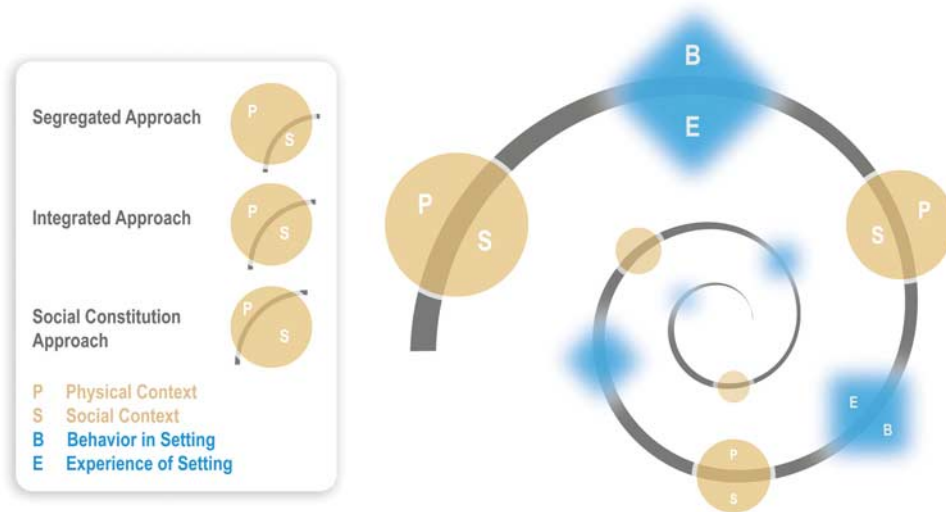


Figure 1: The spiral of decay and the varying strategies of segregated, integrated and social constitution of fear approaches on perceived safety.

Improving lighting seems to be one of the most common suggestions for CPTED (Atkins *et al*, 1991; Lab, 1997). It relates to concealment and prospect by affecting the visibility (Loewen *et al*, 1993; Blöbaum and Hunecke, 2005) that seem to be especially associated with fear (Nasar and Fisher, 1993). A large study on the effects of relighting programs in London (Atkins *et al*, 1991) found that 56 per cent of the respondents reported the program had affected positively their feelings of personal safety.

The presence of green space has also generated some conflicting evidence. Certain types of vegetation can conceal perpetrators (Nasar and Fisher, 1993) and promote fear by limiting visibility in the immediate vicinity (Nasar and Jones, 1997). However, for example in residential settings, the green space has been associated with a greater sense of safety among residents (Kuo *et al*, 1998; Maas *et al*, 2009) and lower reported crime (Kuo and Sullivan, 2001).

In addition, measures related to the maintenance of the neighborhood can be developed to reduce fear. The so called broken windows thesis or perceived disorder hypothesis (Wilson and Kelling, 1982; Roh and Oliver, 2005) – argues that signs of physical (littering, vandalism, vacant housing, abandoned cars and so on) or social disorder (disruptive social behavior) are fear-inspiring because they indicate lack of social control and point up the inability of officials to cope with these problems. Many empirical studies corroborate that perceived signs of physical and social disorder can

amplify feelings of insecurity (Lewis and Maxfield, 1980; Austin *et al*, 2002; Brown *et al*, 2004; Wood *et al*, 2008). Pain and Townshend (2002), nevertheless found in their study, that physical incivilities were relatively minor concerns for inhabitants and had more significance to city’s image for visitors than their own safety. The perceived *positive* signs of active use, care and good maintenance in the environment could act as fear inhibitors but, however, only a few studies have included these concrete visual cues in the study of perceived neighborhood safety so far (Kyttä, 2011).

To conclude, the evidence concerning the associations between perceived safety and the planning and design solutions of a neighborhood is somewhat elusive (Pain and Townshend, 2002; Foster *et al*, 2010). It is evident that both physical characteristics of settings and social contextual aspects can contribute to the perceived safety of inhabitants. When trying to reveal the dynamics of perceived safety in a neighborhood that is under transition – like in the case of urban infill neighborhood – it is useful also to think about the temporal aspects of perceived safety. Here, the well-known conceptualization of ‘the spiral of decay’ by Skogan (1990) is useful. According to it, the temporal process starting from perceived signs of disorder leads first to increased perception of fear and reduced willingness to engage in neighborhood life, then encourages apathy and finally signals potential offenders that the neighborhood is an easy target for criminals. Figure 1 summarizes our understanding of the reviewed research literature: we illustrate

the spiral of decay comprising of the continuous rotation between social/physical contextual measures on the one hand and behavioral/experiential outcomes on the other. We thus argue that a neighborhood is under constant, dynamic process where current context inspires certain behavioral and experiential outcomes that on their part can influence the context, leading again to changes in the behavior/experiences of inhabitants (cf., for example, the sociospatial approach by Gottdiener, 1994). We also believe that the above-reviewed three approaches have an ability to feed this process using specific measures but relying on varying degrees on physical or social measures.

Methodology

Procedure

Data was collected in the residential district of Kirkkojärvi in Espoo, Finland. In September 2011, we sent a letter, including a link to a web questionnaire, to every inhabitant over age 15 within the research area ($N=2\ 712$). There was no other option besides the Internet survey. After about 2 weeks a reminder was sent, but because of limited resources, this time only one per household ($N=1\ 699$). A total number of 325 responses were received. The respondent rate was 12 per cent per the total number of over 15 year-old inhabitants (letters sent in the first round) and 19 per cent per the total number of households (letters sent in the second round).

The mean age was same in the target group and the respondent group: 42 years. In the respondent group 61–65-year-old residents were a little overrepresented, whereas over 75-year-old residents underrepresented compared with the target group. Female respondents were overrepresented with a 62 per cent of ratio while in the target group 51 per cent were women. Concerning the respondents' tenure status 65 per cent were owners and 29 per cent tenants. With respect to household type, 31 per cent of respondents lived alone, 40 per cent as couple without children, 17 per cent in two parent families and 7 per cent in single parent families.

A share of 34 per cent of total 15+ year population of Kirkkojärvi live in the Eastern part and 66 per cent in the Western part. In our survey, 42 per cent of those respondents who made the home location lived in the Eastern part and 58 per cent in

the Western part, so Eastern residents responded slightly more actively.

Methods and measures

A PPGIS method, called softGIS, was developed to study perceived safety within the urban environment.¹ The web questionnaire consisted of two types of pages: (i) pages for conventional survey questions and (ii) map pages to locate personal experiences. When the survey included lists of items, the order of the appearance of them was randomized. Respondents were also asked to mark their home. The web questionnaire had a tube structure: each respondent followed the same route through the application. In the following, we will describe, how we operationalized the studied themes. The queried information about safe and unsafe routes and perceived well-being are not reported here.

Perceived fear and safety

Four types of perceived safety were studied location-based: fear of crime, scary people, traffic safety and accident safety. The respondents were asked to locate possible fearful places and danger locations on the map of neighborhood and after localization they could further define their experiences by choosing one or more of the following four sub-categories: *Fear of crime* such as assault, threatening and robbery; *Scary people* such as drunks, drug addicts and gangs; *Traffic safety* such as high speed, carelessness and poor traffic arrangements; and *Accident safety* such as poor maintenance, poor lighting and slipperiness.

The 'mini query' that appeared after each location and where the experiential subcategories were selected, also included two other questions concerning the possibility to avoid the place and whether the experience is related to the time of day.

The mapping of unsafe and dangerous places was followed by a few conventional questions concerning perceived safety. Respondents reported, how safe do they feel when walking alone in their neighborhood in daytime and late weekend evening by using a 5-point scale (1–5): safe – quite safe – quite unsafe – unsafe – dare not to go outdoors. The respondents also assessed local criminality problem in a scale (1–5): very serious – quite serious – cannot say – not very serious – not at all serious. These questions have been used in the extensive Safety Research of the Finnish Police

(Suominen, 2009). A sum variable, *perceived fear score* was constructed from these three variables for further analysis (Cronbach's $\alpha = 0.64$) ranging from 3 to 15 (the first scale reversed). High value in the scale suggest high degree of fear.

Personal victimization was studied by asking, if the respondent had experiences about violent crimes in Kirkkojärvi. The subjects marked if (i) they had been subjected to violence, (ii) had been under threat of violence, (iii) knew a victim of violence or (iv) had seen violence against others. In further analysis, we used a dichotomous measure: if the respondent had even one of the mentioned victimization experiences, the variable got value 1, otherwise it got value 0.

Perceived disorder was studied by applying the scale of Roh and Oliver (2005) to the degree the items of the scale suited with Finnish circumstances. We used the scale to ask respondents to locate various signs of disorder: drunks, poor lightning, trash, graffiti, unmaintained garden, abandoned car, overgrown vegetation and empty lot. In addition, we asked whether the inhabitants can perceive signs of care and the active use of the environment (Kytta, 2011). Among these were: well-kept house/yard, beautiful yard, used path, good lighting, adults outdoors and playing children. From both variables a sum of locations was calculated.

Local attachment, sense of community and local orientation were measured using conventional survey questions. *Local attachment* was assessed using the three items of a scale by Mesch and Manor (1998) with 5-point Likert scale ranging from strongly disagree to strongly agree. Sample item includes: 'I am proud of living in my neighborhood'. We constructed the sum variable of these three items ($\alpha = 0.72$) that ranged from 0 to 12 (last item reversed). The variable was further dichotomized so that values 0–5 were scored as 'low (0)' and values 6–12 as 'high (1)' local attachment. *The sense of community scale* by du Toit et al (2007) also includes three items with Likert scale. Sample item includes: 'Living in my neighborhood gives me a sense of community'. The sum variable was constructed ($\alpha = 0.65$), that was further dichotomized so that values 0–5 were scored as 'low (0)' and values 6–12 as 'high (1)' sense of community. *The local orientation scale* was assessed by inquiring respondents about orientation either to their own neighborhood or to other areas when using daily services or carrying on various activities, shopping daily consumer goods, other shopping, hobbies, outdoor recreation and meeting

friends. Each five items had 5-point scale from 'own neighborhood' to 'outside areas'. The local orientation variables were summarized ($\alpha = 0.70$) and further dichotomized so that values 0–9 referred 'low (0)' and values 10–20 'high (1)' local orientation.

Community

The neighborhood of Kirkkojärvi was selected to be the site for the case study because problems relating to perceived safety were identified and the safety projects were carried out in the area Espoon turvallisuusohjelma 2011–2012). Kirkkojärvi is located in the city of Espoo (250 000 inhabitants) in the Helsinki metropolitan area. The urban structure of Espoo comprises several urban centers surrounded by expanding network of mainly single-family house subdivisions. Kirkkojärvi is located next to one of these urban centers: Espoo center (see Figure 2), which has good public and commercial services, including two shopping centers, and is well connected in public transport network having its own railway station. Kirkkojärvi, a residential area of apartment blocks, has about 3400 inhabitants out of which approximately 20 per cent have a mother tongue other than Finnish or Swedish.² The share of families with children is smaller than that of Espoo on average whereas the share of people living alone is larger (25 per cent). This is partly because of the smaller share of large apartments (four rooms or more) in Kirkkojärvi compared with city of Espoo or Helsinki metropolitan area on average. The owner-occupied apartments comprise almost half of the dwelling stock in Kirkkojärvi, which is a slightly larger share than that of city of Espoo but nearly same as in Helsinki metropolitan area. The share of inhabitants with higher education is lower in Kirkkojärvi (14 per cent) than in the city of Espoo (23 per cent) or Helsinki metropolitan area (18 per cent). In Kirkkojärvi, the average income among the population over age 15 is € 24 800 per year, which is lower than in Espoo (€ 34 800). This can also be explained by the quite high share of social housing developments, which require income limits for the inhabitants. Along with the new housing developments in the Eastern part of the neighborhood, Kirkkojärvi has, however, approached the average income level of Espoo in recent years.

The study area consists of three parts: The Sub-urban center, the older Western part of Kirkkojärvi

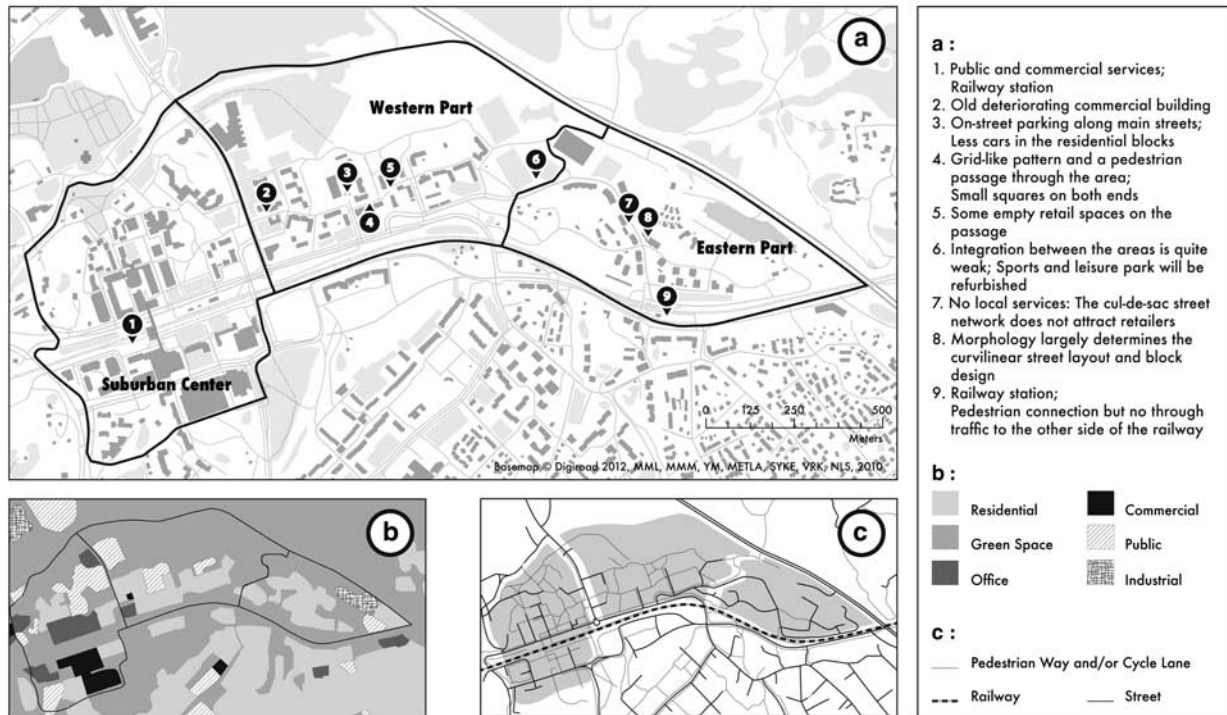


Figure 2: Structure of the study area.

and the retrofit Eastern part of Kirkkojärvi. These three parts are shown in Figures 2 and 3. The Eastern and Western parts have their own characteristics and some structural differences such as different land use patterns, traffic network and street layout. The borderlines of these three parts are drawn considering the distinctive 'paths' and 'edges' in the study area such as Espoo River in the north, railway in the south, the highway in the east and some other main streets. The Western part of Kirkkojärvi has been built mainly in the 1980s and its newer Eastern part, Kulovalkea, was completed in the 2000s. Older Western Kirkkojärvi and especially the Suburban center to which it is closely connected have received negative attention for their problematic developments in recent years and criminal safety projects have been carried out during the 2000s.

The population profiles of these subareas are somewhat different. The Eastern part is a popular residential area among families with children. The share of inhabitants between the age 26 and 36 is high: 46 per cent of the population over 15 years old. In the older Western part all age groups are more evenly represented. The percentage of immigrants among inhabitants is bigger in the Western part (26 per cent) than in the Eastern part (11 per cent). The share of social rental housing

in the Western part is higher than that of the Eastern part (41 per cent versus 0 per cent).

To deepen our understanding of the structure of the study area we consulted Espoo city planners familiar with the area. The older Western part represents a quite typical land use of suburban residential neighborhoods in Finland (cf. Sundman, 1991; Jalkanen *et al*, 1997). Car traffic and parking are segregated and located on the fringe of the area and only two residential streets for car traffic go inside the area from the artery. A basic outline and public space of the residential area is formed by a connecting central pedestrian street, along which the activities and social functions are concentrated. The area is well connected by grid network of footpaths surrounding the residential blocks and is highly accessible for pedestrians. There are many communal yards and playgrounds as well as small public squares and an old commercial center along the central pedestrian street, which suffers from deteriorating signs such as: empty retail spaces, litter, poor lighting, and houses and facades in need of renovation. Only a bar and a restaurant are housed in a rather shabby commercial center but good local services, including two shopping centers, railway station and public services, are provided for inhabitants at walking distance by the Suburban center.



Figure 3: Views of the three subareas.

In both subareas the adjacency to green is emphasized. The Eastern part has slightly lower FAR (floor area ratio) compared with the Western part (2–4 floors versus 3–6). The Eastern part is a single use residential area without local services, except a railway station that is more than 1 km away from the Suburban center. The blocks layout varies according to the demands of topography and is more open than in the Western part. Architecture and design of streetscape give an impression of high-quality and aesthetic values such as brightness, human scale and fine details, diversity and lively colors in facades. Some buildings have their main entrance opening to the street. The street network of the Eastern part is more car-oriented with less connectivity. Lack of traffic connection through the area makes the sidewalks relatively comfortable for pedestrians. There are, however, few interruptions in footpaths, and crossing the curvilinear main street could be inconvenient. The *cul-de-sac* design of the Eastern part does not attract retailers and a site allocated for commercial services has remained empty.

Analysis

The statistical data were obtained from an E-questionnaire that was integrated into softGIS. Two types of data were generated: a respondent-based and a location-based data. Data was analyzed using IBM-SPSS Statistical package version

20 and ArcGIS 10.0. In comparisons between various subgroups of respondents χ^2 test and ANOVA were used. Moreover, logistic regression analysis was applied. The most central GIS analysis was natural neighbor analysis that was used, for example, in the analysis of the locations of signs of disorder and signs of active use and care. This interpolation analysis works well together with the corresponding point-based data. In the GIS analysis, the total of 2920 locations markings were analyzed that were marked by 303 out of 325 respondents.

Results

Polarized safety experiences of inhabitants

The perceived safety and experiences of certain types of fear were unevenly distributed across the research area. Mean for the perceived fear score was significantly lower in the Eastern ($M_{east}=6.6$) than in the Western ($M_{west}=7.4$) subarea ($t=-2.8$, $DF=197$, $P<0.005^{**}$) suggesting that residents of the Eastern area felt more safe. Living in a certain subarea was significantly associated with perceived fear also when the areal differences in gender, age and education level were controlled ($\beta=0.15$, $P=0.035^*$ (*=statistically nearly significant)).

The degree of perceived safety in our study area can be compared with those (see Table 1) of the city of Espoo and Helsinki metropolitan area more generally because we used same measures than

Table 1: Perceived safety (as percentage of residents replying to the three items) in study area and the two subareas compared with that in the city of Espoo and the whole Helsinki metropolitan area

	Helsinki metropolitan region (in percentage)	Espoo (in percentage)	Kirkkojärvi total (in percentage)	Western subarea (in percentage)	Eastern subarea (in percentage)	P-value in χ^2 test
Considering local criminality problem as very/quite serious	26	18	35	44	23	0.005**
Feeling at least 'quite' unsafe in late weekend evening outdoors	22	17	50	58	34	0.008**
At least some violence experience in the neighborhood	—	—	37	50	20	0.000***

=statistically significant; *=statistically highly significant.

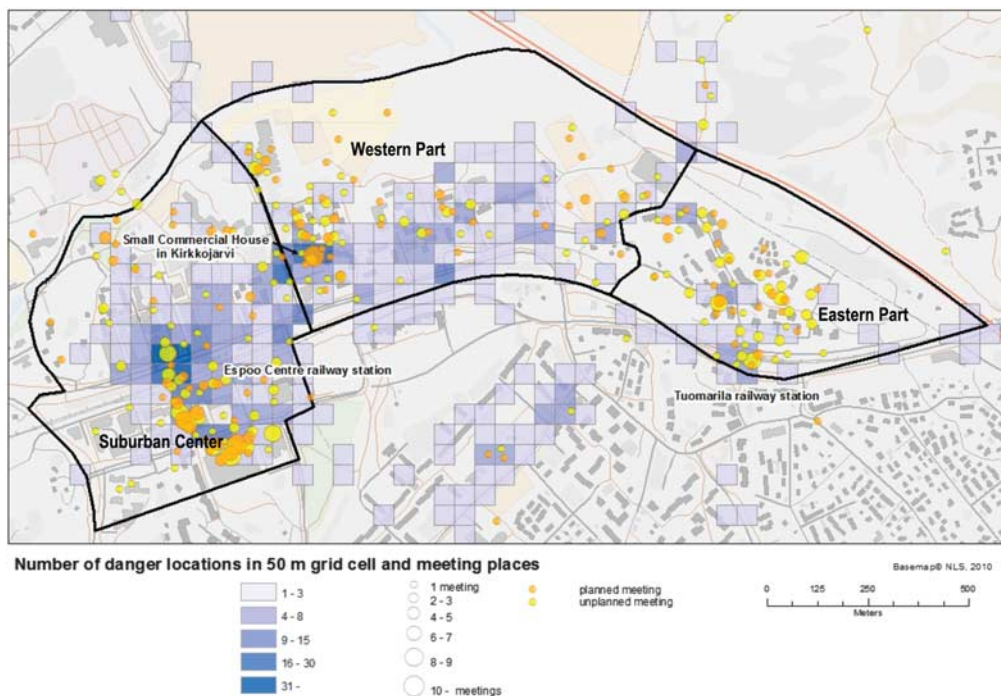


Figure 4: Distribution patterns of danger locations and meeting places.

was used in an earlier study by Suominen (2009). In the Eastern area, local criminality problem was estimated approximately in the same level as of the average level in the Helsinki Metropolitan Region, whereas in the Western part the rate was significantly higher. In the Eastern area also significantly less respondents reported perceived unsafety in weekend evenings, but they still felt less safe than the average level in Espoo or in the Metropolitan Region as a whole.

Moreover, the location-based analysis corroborated the polarized perceived safety experiences: The newer Eastern part appeared as safe and less problematic, whereas the older Western part and the adjacent Suburban center including commercial and administrative buildings were perceived as rather unsafe and deteriorating. A grid cell

visualization of the locations perceived as unsafe illustrated a clear distinction between the three subareas as shown in Figure 4. The Espoo railway station was perceived the most unsafe. The representation of danger locations in the Western part was lower than in the Suburban center but clearly higher than that of the Eastern part. The old small shopping center and its adjacent square were perceived as the most unsafe spot in the Western part. Nevertheless, the same area was also the most frequently marked as a meeting place. Tuomarila railway station and its adjacent pedestrian underpass were among the most often reported spots as a danger location in the Eastern part. The map also shows that those locations used more frequently for both planned and unplanned meetings were generally perceived as rather unsafe places.

The Eastern part is, however, somewhat different and the meeting places are distributed within both safe and unsafe locations.

Perceived safety and four types of fear

The respondents were asked about their perceptions on four types of fear: scary people and criminal threat, and traffic danger and accident danger. They marked a total number of 347 locations of scary people, 282 locations of fear of crime, 249 locations of traffic danger and only 72 locations of accident danger. Each respondent marked 10 locations on average.

The localized perceptions of the four types of fear are illustrated in Figure 5, that also shows how the safety perceptions are associated with the time of the day and the possibility to avoid the place. The Western part is clearly more fearful in the presence of *scary people* whereas the Eastern part is perceived as almost safe except for its train station, Tuomarila. Suburban center is the most frequently marked for being the location of scary people. The majority of the locations marked in the

Suburban center are perceived as fearful during the evening/night time while more than half of the locations marked in the Western part are fearful both in day and evening/night time. The respondents also reported most of these danger locations to be hard to avoid or not avoidable. The more frequently mentioned categories of scary people were drunks (80 per cent), drug addicts (63 per cent), gangs (51 per cent), immigrants (43 per cent) or younger than respondent (39 per cent). Respondents who lived in the Eastern part marked very few locations of scary people or criminal threat to their own home area, but mostly out of it. Respondents who lived in the Western part marked locations of scary people mostly within the Suburban center, but also to their own home area.

With regard to *criminal threat*, similar locational patterns can be observed within the three subareas. Again, the Eastern part represents the lowest level of fear, whereas the Western part is more fearful and the Suburban center has the highest number of criminal threat markings. Residents of Eastern part marked criminal threat mostly out of their own area. The majority of the locations marked in all

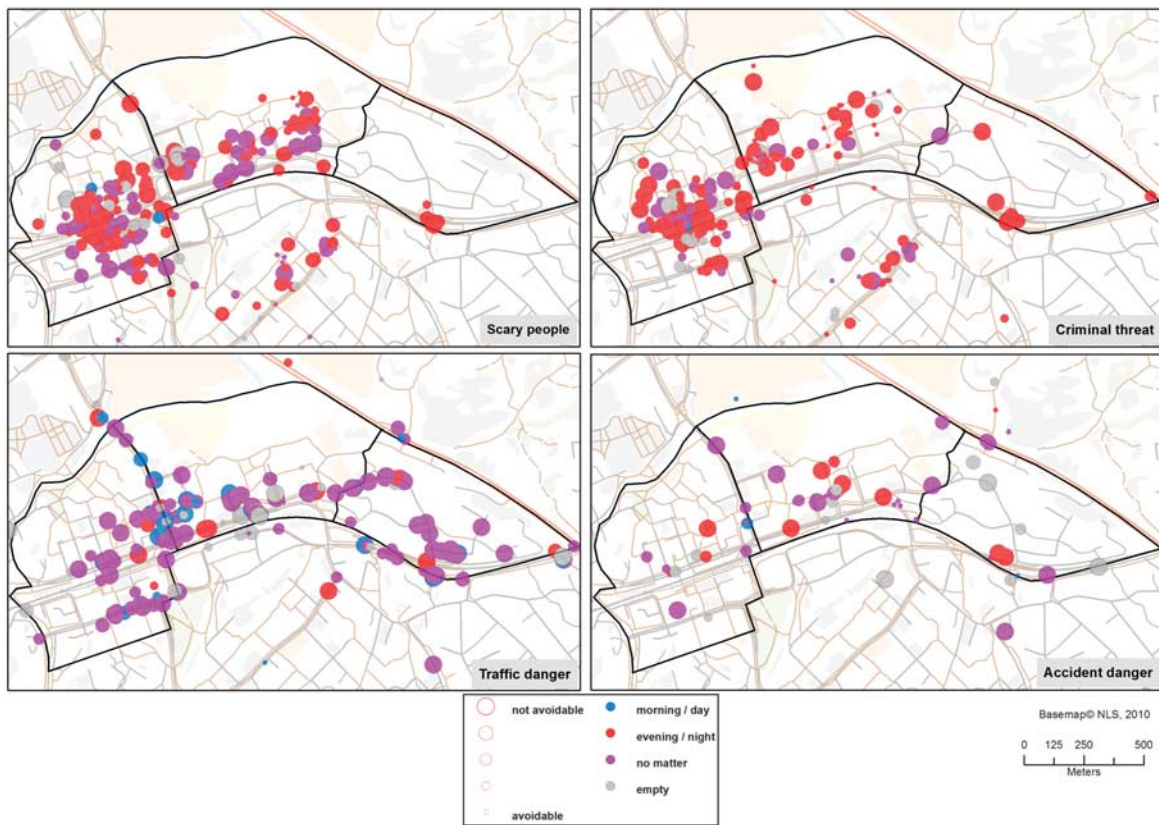


Figure 5: Four types of fear by time and degree of avoidance.

Table 2: Distribution of various danger locations in relation to respondent's home area, *percentage* of locations

	<i>Eastern part (in percentage)</i>	<i>Western part (in percentage)</i>	<i>Suburban center (in percentage)</i>	<i>Other (in percentage)</i>	<i>Total (in percentage)</i>	<i>N</i>
<i>Scary people</i>						
Home in the Eastern part	5	31	45	20	100	111
Home in the Western part	0	23	72	5	100	158
<i>Criminal threat</i>						
Home in the Eastern part	9	18	55	18	100	85
Home in the Western part	0	19	71	10	100	129
<i>Traffic and accident danger</i>						
Home in the Eastern part	30	24	16	30	100	143
Home in the Western part	2	32	51	15	100	123

three subareas were perceived fearful during the evening/night time. However, there are some spots where the fear of crime is not related to the time of the day. Moreover, the locations of criminal threat are mainly either not avoidable or hard to avoid. The more frequently mentioned categories of criminal threats were aggressive talking and shouting (77 per cent), assault (45 per cent), threatening (37 per cent), robbery (35 per cent) or theft (34 per cent).

The locations of *traffic danger* are almost evenly distributed within the three subareas, and with a few exceptions, they are perceived as dangerous regardless of the time of the day. However, the distribution pattern is different in Eastern part where the locations are marked along the main street whereas in the other two subareas the danger locations are mainly at the intersections. The majority of the locations are reported either as unavoidable or hard to avoid. The main categories of traffic danger in the eyes of the respondents were high speed (62 per cent), carelessness (47 per cent), poor traffic arrangements (29 per cent) or poor lighting/visibility (27 per cent). Respondents from the Eastern part marked locations of traffic dangers and accident dangers quite often within their own home area, but also in the Western part or out of Kirkkojärvi neighborhood. This is while respondents from the Western part marked these danger locations mostly within the Suburban center or in their own home area (see Table 2).

The perceived *fear of accidents* is slightly higher in the Western part. In contrast to the other three types of fear, the Suburban center is perceived rather safe when it comes to accident danger. The more frequently mentioned causes of accident danger were unevenness of traffic routes (39 per cent), poor lighting (35 per cent), poor maintenance (35 per cent) or slippery roads (32 per cent).

The respondents of the Western part made significantly more scary people locations to their own home area than the respondents of the Eastern part to their own home area (χ^2 test, $P=0.000^{***}$). Concerning criminal threat locations corresponding difference was nearly significant ($P=0.065^*$) but with regard to traffic and accident dangers there was no difference ($P=0.773$).

The complex background of polarization

From the viewpoint of neighborhood planning, the above shown polarized situation of perceived safety offers an interesting possibility to consider, whether the threat of spiral of decay in the Western part could be tackled and how this could be achieved. We will return to this question in the conclusions but for better understanding of the issue we will next consider the various and complex backgrounds of perceived safety. We will trace factors that may have an effect on putting the two subareas on somewhat different tracks of development concerning perceived safety.

Age, gender and education

The perceived fear score was significantly higher ($t=4.3$, $DF=265$, $P < 0.000^{***}$) for women ($M_{\text{women}}=7.4$) than for men ($M_{\text{men}}=6.4$) and systematically increased with age (ANOVA: $F=3.7$; $DF=292$; $P < 0.012^{**}$). Moreover, the share of various types of danger locations varied according to background factors (see Table 3). In the oldest age group (60 years or more) the share of criminal threat locations was significantly larger (39 per cent), and the share of scary people locations was smaller (27 per cent) than in other age groups. This is while the youngest age group (under 30) was more concerned about the scary people

Table 3: The share of various danger locations according to background variables

	<i>Scary people (in percentage)</i>	<i>Criminal threat (in percentage)</i>	<i>Accident danger (in percentage)</i>	<i>Traffic danger (in percentage)</i>	<i>Total (in percentage)</i>	<i>N</i>
<i>All respondents</i>	37	30	8	26	100	950
<i>Age group</i>						
15–29	40	27	6	28	100	309
30–44	38	24	8	29	100	271
45–59	36	32	10	22	100	183
60+	27	39	8	26	100	147
<i>Gender</i>						
Man	32	29	7	32	100	357
Woman	40	29	8	23	100	575
<i>Education</i>						
Secondary school or less	37	28	12	22	100	169
Vocational school	38	34	4	25	100	114
Vocational high school	36	34	6	24	100	289
University	37	24	9	30	100	348

(40 per cent) and less sensitive to criminal threat (27 per cent) and accident danger (6 per cent). Women made significantly more locations of scary people than men (40 per cent versus 32 per cent), whereas men made significantly more locations of traffic dangers than women (32 per cent versus 23 per cent). Respondents with university education made relatively more traffic danger locations (30 per cent) and less criminal threat locations (24 per cent) than other respondents.

Personal victimization

In comparison with the respondents of the Eastern part, respondents living in the Western part experienced more frequently all four types of violence in the neighborhood: have been subjected, have been under threat, know a victim and have seen. Half of Western residents had experienced violence at least once (personal victimization), whereas in the Eastern part this rate was only one-fifth of respondents. Logistic regression analysis (adjusted for age and gender) revealed that the likelihood for personal victimization increased significantly, if a person moves from the Eastern to the Western subarea (OR=4.7; $P < 0.000$; 95 per cent CI 2.4–9.1).

Signs of disorder, active use and care

Figure 6 shows the location of signs of active use and care versus disorder in the study area. Similar to the distribution patterns of danger locations, the situation for the perception of disorder is worst

and best, respectively in the Suburban center and the Eastern part. The Western subarea is divided into a part in South where signs of disorder dominate in answers and to another part in North with more signs of active use and care. The borderline between these two parts is the main pedestrian passage of the neighborhood extended from the Eastern part to the Suburban center. After the Espoo railway station, this passage has been mostly marked with signs of disorder.

A closer look at the signs of active use and care reveal that the presence of adults in outdoor recreation is more frequently reported in the outer parts of the study area (Figure 7), while children are more frequently seen playing in the inner parts of the neighborhood, mainly around the schools, in the designated playgrounds or in the communal yards in the Western part. Moreover, well-maintained gardens or buildings are mostly located in the Eastern part.

The presence of drunks is the most commonly located sign of disorder that is located almost everywhere in the Suburban center and also in the Southern end of the Western part. Moreover, poor lighting and trash were often reported especially along the pedestrian way in the Western part. Both the ends of this passage, which connect it to the Eastern part and the Suburban center, are also among the most littered places. The walls of the Western half of this pedestrian way include some graffiti. Graffiti, together with poor lighting, were also among the very few signs of disorder reported

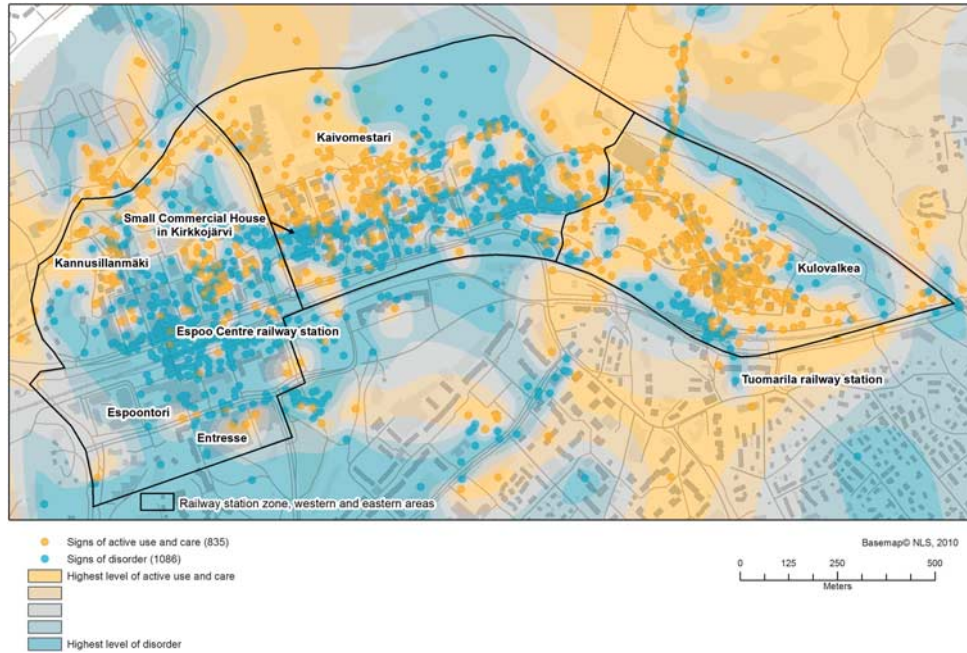


Figure 6: Signs of active use and care and signs of disorder.

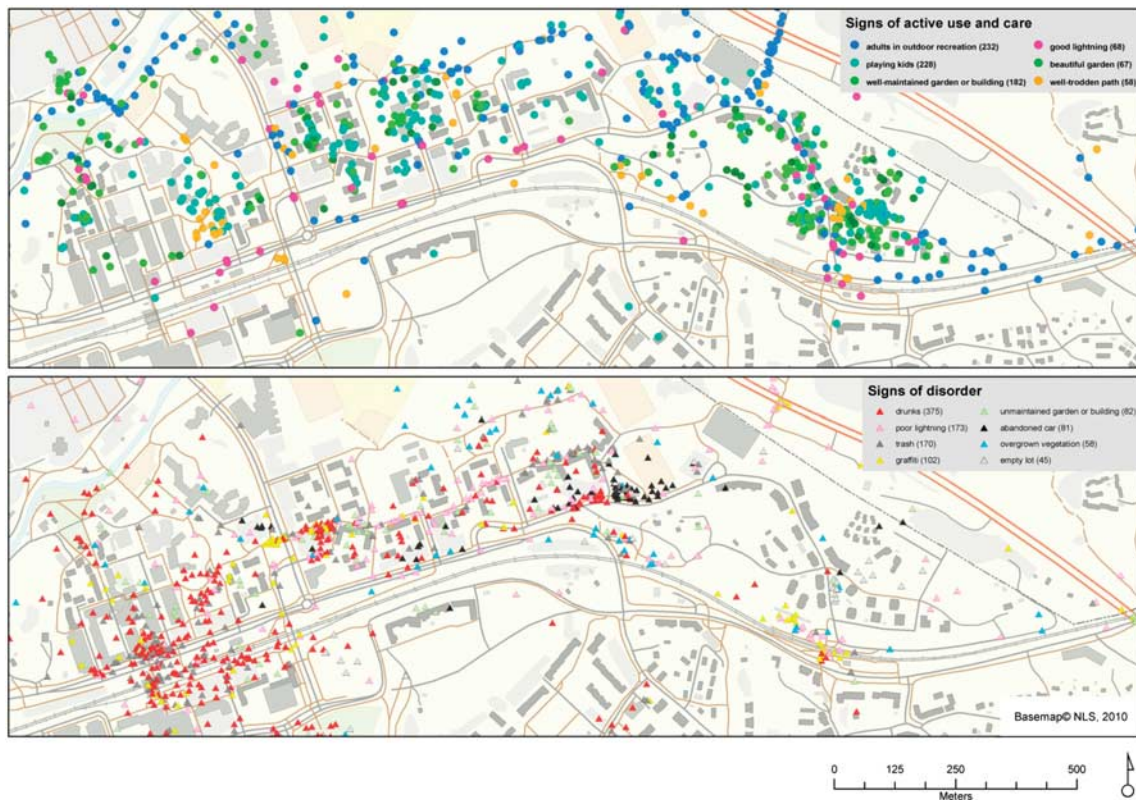


Figure 7: The different signs of active use and care versus signs of disorder.

in the Western part, around Tuomarila railway station. The unmaintained buildings or gardens were also marked in the Western part and

Suburban center, especially at the Southern part of the little square next to the small commercial building.

The overlay of signs of active use and care and signs of disorder reveals that some places can house both positive and negative signs in a micro scale such as the above mentioned little pedestrian square which has negative signs in its Southern side and positive ones in the Northern adjacent block. This finding highlights the complexity of the perceived disorder/care and the significance of micro scale place-based analysis.

Local attachment and sense of community

When local attachment was measured by dividing the summarized scale into dichotomous classes of high- or low-local attachment, it was found that in the Eastern part a significantly larger share of inhabitants belonged to the class of high-local attachment than in the Western part (75 per cent versus 59 per cent, χ^2 test, $P=0.021^*$). Logistic regression analysis (adjusted for age and gender) revealed that the likelihood for high-local attachment if decreased significantly a person moves from the Eastern to the Western subarea (OR=0.43; $P<0.009$; 95 per cent CI 0.23–0.81). Regarding the sense of community, similar difference between the subareas did not occur, 57 per cent of Eastern and 53 per cent of Western respondents reported high sense of community. Not surprisingly, the sense of community was weaker among the respondents who had lived in the area 1 year or less and it strengthened until about 4 years of residence.

Local orientation was significantly higher in the Western part (73 per cent high) compared with the Eastern part (51 per cent high) (χ^2 test, $P=0.002$). Logistic regression analysis (adjusted for age and gender) revealed that the likelihood for strong local orientation increased significantly if a person moves from the Eastern to the Western subarea (OR=1.95; $P<0.036$; 95 per cent CI 1.05–3.62). This may reflect the fact that the Eastern part lacks local services altogether, whereas the Western part has some basic services and is also closer to the big shopping center of the Suburban center.

Half of the respondents (49 per cent) agreed with the statement 'I would be willing to work together with others to improve the living environment of the neighborhood'. The share of active residents was significantly higher in the Eastern (57 per cent) than in the Western (43 per cent) subarea (χ^2 test, $P=0.053$). Supporting the active involvement of inhabitants is perhaps the greatest challenge of the neighborhood development aiming to avoid the spiral of neighborhood decay.

Discussion

Urban infill has a potential to change the track of development of existing, distressed neighborhoods. It can also, potentially, increase the perceived safety in the neighborhood. However, the obvious lesson learnt from our case study of an urban infill neighborhood in Espoo, Finland, is that the building of an additional new residential area cannot be presumed to automatically have these positive effects on the neighboring, distressed older area.

Our results show the higher level of perceived safety of the new, single use residential development in the Eastern part, compared with that of the older Western part. Our data did not allow us to compare the levels of perceived safety before and after the infill development, but it does, however, clearly suggest that from the perspective of distressed older Western part, some potential of infill was missed. Although the average perceived safety might have slightly increased in the neighborhood as a whole, the closer look revealed the highly polarized situation in localized perceived safety. A polarization must be seen as a problem that creates public and social costs within a wider society (Carmona *et al*, 2003). In this concluding section, we will suggest that the investments to a neighborhood as a whole and more comprehensive safety strategies would be needed to break the negative development of fear and a spiral of neighborhood decay especially in retrofit neighborhoods.

In the urban infill case of our study, the dominantly single-use residential new area with *cul-de-sac* street network, weak connectivity of pedestrian network and no local services represent the segregated approach to neighborhood safety planning that supports rather the residential territorialization than the integration of the old and new parts of the neighborhood (Charmes, 2010). Instead of the actual scattered-site, infill development, that does not change the existing neighborhood structure, the urban design in Kirkkojärvi resembles more with the Traditional Neighborhood Development and enclave development (Ryan and Weber, 2007). Although the new part is not gated, it is spatially separated and forms an inward-focused residential pod. The means of segregation are relatively implicit (Carmona *et al*, 2003) but they come out in the experiences and activities of residents. From the viewpoint of this subarea alone, the planners have succeeded to produce a safe heaven, where local attachment is

high and inhabitants are willing to contribute to guarantee this situation. The experiences of safety and security are, however, provided at the expense of connectivity; private, intimate and peaceful atmosphere at the expense of openness and liveliness. Although the segregated strategies are effective in certain localities, they can also produce environments, which do not cohere with other aims and ideals of urban planning (cf. Carmona *et al*, 2003). Resonating with the ideals of Jacobs' (1961) evidence from United States suggests that consumers value more integrated solutions than more dissociated ones (Ryan and Weber, 2007). Moreover, Jacobs argued that the major part of the success of neighborhoods depended on the overlapping and interweaving boundaries between subareas.

The Western, older, part of our case area have potentials described by integrated safety planning approach: mixed use, open and pedestrian friendly environment that could enhance perceived safety through lively streets and actively used public space. However, inhabitants expressed remarkably more experiences of unsafety in the Western part. It can partly be related to the aged and deteriorating physical environment of the Western part and many perceivable signs of disorder. Following the line of thinking of the social constitution approach of fear, larger socioeconomic issues probably play a crucial role here too. The potential of infill project to change the track of development of a distressed neighborhood was missed for the most part when the new development followed a segregated approach. According to Carmona *et al* (2003), the crucial issue for the success of integrated approach and natural surveillance concerns the density of pedestrian movement, which high-density, mixed use urban environment may provide. The layout of infill development could have been designed to target these goals and the old and the new infrastructure could have been better knitted together.

Many of our findings demonstrate the ambiguous, complex and even contradictory nature of safety. The broad picture of the safe Eastern part versus unsafe Western part can be challenged when they are explored in more detail: At micro level, many positive experiences and signs of active use and care were reported in the Western part too. Moreover, simultaneous positive and negative experiences in the same locations were common: meeting places were often perceived as unsafe; the suburban center was marked both for being the location of scary people and a place

for planned and unplanned meetings. These partly conflicting results can be interpreted in two ways: Either people have to use certain places for their daily activities regardless of their perceptions of disorder or fear, or they accept and tolerate certain level of disorder, diversity and conflicts as part of urban life in lively, multifunctional places. Along with Jacobs (1961), Engle Merry (1987) considers conflicts as inevitable by-products of vivid interaction between neighbors. An interesting question to consider both for academics and practitioners is, how the micro-level symbiosis of various meanings is possible? Which experiences, uses and activities can coexist in urban environment and which, in turn, are mutually excluding? In Kirkkojärvi, perceived safety appeared as a continuum and a mosaic although wider patterns of polarization were also found.

In our case, it is encouraging, that despite of reported experiences of fear, the Western part and Suburban center seems to be lively places with social interactions. Moreover, the high level of local orientation of the Western part indicates that respondents performed various activities such as shopping, outdoor recreation, hobbies, meeting friends on their own area. Validating single-use residential areas with safety arguments is short-sighted and easily leads to fortification. Labeling certain groups, such as those of 'scary people', as a particular safety concern and excluding them from common public life can eventually lead to increasing fear in society and exclude some groups and leave them unprotected (Pain and Townshend, 2002). According to the integrated safety planning approach, planning should instead aim at encouraging inhabitants to use their environment in positive ways that do not restrict other uses.

A severe limitation of our study utilizing Internet-based softGIS methodology, was the low respondent rate. It can be questioned if the method reached the groups who may have the greatest concerns about the safety of urban space. Our analysis, nevertheless, did not aim to gain an in-depth understanding about the nature and origins of urban safety or fear, rather we aimed to provide ex-post evaluation about the urban planning solution (Kyttä, 2011) and about the areal distribution of perceived safety experiences in particular sociophysical contexts at different spatial levels. The respondent rate is satisfactory when compared with studies utilizing similar methodology (Brown and Weber, 2011) and in comparison with standard respondent rates in surveys arranged by city planning offices.

Is the evident polarized neighborhood safety situation in our study area remediable? Carmona *et al* (2003) argue that the segregated and introverted layouts, based on the reductions in permeability are difficult to turn into more integrated layouts. Our data gave many hints, how the polarizations can be tackled and the spiral of decay of the Western part still be turned to a more positive one. Although the opportunity was missed to design out fear, new actors can step forward. Comprehensive strategies, which utilize the CPTED principles as part of wider projects of neighborhood development, can be carried out together with residents and new actors representing both public and private sectors such as local social workers, teachers, police, local entrepreneurs and so on. A continuous community development project as a communicative process (Wallin and Horelli, 2010) represent social constitution of fear approach (Pain and Townshend, 2002) where the spectrum of measures contributing to changing the direction of development can be used to improve the local service structure, that is in the key role in promoting social inclusion and leading to shared everyday life.

On the basis of our location-based softGIS data from residents, many concrete hot spots for community project can be derived. Along the central pedestrian passage through the area connecting the two Western and Eastern parts, many signs of disorder were perceived around this badly deteriorating route. Empty retail spaces should be activated, poor lighting improved, pavement surfaces fixed, facades of the houses renovated. The shabby commercial center needs innovative new uses. Opening the building to the square next to it, would create natural surveillance on the area that was perceived as problematic. The housing stock is aging and renovations will soon be needed, which offers the possibility for overall upgrading of the area and an opportunity to get new stakeholders involved. Some efforts have already been realized to better connect the two parts. The sports park in the border of Western and Eastern parts has been refurbished and a new school building was built in the Western part, which has been acknowledged for its architectural quality. Encouraging local empowerment and social cohesion can be assumed to further enhance perceived safety (Landman, 2009).

The future infill projects should develop more balanced safety planning strategy targeting to develop the neighborhood as a whole. To avoid or alleviate polarization, at least some investments to the renovation of the existing urban structure

should be realized simultaneously with the building of the new area. Better integration of the new area to the neighboring old area might have counteracted the polarization. Timing is crucial because the vicious spiral of decay can be hard to stop once it has been started. People are adapting their activities to the physical and socio-cultural context and at the same time they are shaping the conditions and context for their action by material and discursive acts (cf. Gottdiener, 1994). No neighborhood is ready after the building is completed and continuous efforts are needed to keep the neighborhood in positive track of development. Still, the opportunity of urban infill project to change the negative track of development to a more positive one, should not be missed.

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Note

- 1 Survey available (in Finnish only) in <http://www.pehmogis.fi/turvallisuus> (user: pehmogis_guest; password: va.pehmogis).
- 2 The official languages in Finland are Finnish, Swedish and Sami.

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