



Academic Greenspace and Well-Being — Can Campus Landscape be Therapeutic? Evidence from a German University

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ARTICLE INFO

Keywords:

Greenspace
Health perception
Health promotion
Healthy Academic Greenspace Framework
Place identity
Social interaction

ABSTRACT

This paper aims to provide a deeper understanding of green spaces as health-promoting campus environments. Our study of a campus green space at the University of Bonn, Germany, is one of the first attempts to quantify health-promoting effects of Academic Greenspace among students, adding to our understanding of how green spaces can serve as everyday therapeutic landscapes. We take a closer look at the interlinkages between students' perceptions of their health and physical, social and mental well-being in place and academic space. We focus on identity-creating elements, personal experiences, emotional bonding, subjective symbolic meanings, and social interaction. Based on our study results, a *Healthy Academic Greenspace Framework* (HAGF) was developed to reveal the processes by which Academic Greenspace becomes an important health resource on campus for many students. As a facilitator for recreation and attention restoration, as a place of identity as well as a place of social encounter and exchange, Academic Greenspace is meaningful as a place for experiencing everyday life with the potential to support healthy campus planning.

1. Introduction

University campus sites and academic spaces offer an integral environment for daily routines of living, working and learning for an increasing number and diversity of students. Students spend a considerable amount of their time on campus involved in activities that constantly require highly focused attention and concentration (Felsten, 2009). A university serves not only as a place of formal education and as a large-scale employer, but also provides an environment in which students develop their personal and social identity at a significant stage in their lives (Abercrombie, et al., 1998). Mental health issues are a growing concern for college and university students all over the world, both in terms of prevalence and severity (Hunt and Eisenberg, 2010). An online survey of more than 6000 German students in 2017 revealed that students tend to report physical and mental health concerns more often than their peers; this study also indicated that one quarter of the students indicated feeling considerably stressed and exhausted, and every fifth female student suffered from generalised anxiety disorder (Grützmacher, et al., 2018). In Germany, students are expected to complete their degrees within the standard period of study in order to stay competitive for scholarships or to be eligible for federal financial training assistance. In 2018, however, only 30.1% of all graduates from German universities finished their studies within the standard period (Statistisches Bundesamt, 2019). At the

University of Bonn, this share dropped from 39.9% in 2016 to 33.17% in 2018 (Rheinische Friedrich-Wilhelms-Universität Bonn, 2019). Close to one in three German undergraduates and one in four graduate students break off their studies; this share is even higher among international students at German universities. Heavy course loads, financial constraints and health, social or psychological matters (including illness, feelings of discrimination or discomfort at the place of study) are common causes for students to drop out (Kercher, 2018).

In accordance with the Ottawa Charter's principle that 'health is created and lived by people within the settings of their everyday life; where they learn, work, play and love' (World Health Organization, 1986), universities offer immense potential for improving public health of both their staff and students. A healthy learning and working environment in this context should support people in maintaining an appropriate balance between coping with pressure in stressful situations and ensuring sufficient periods of rest (Felsten, 2009). Many educational institutions have adopted a socioecological understanding of health promotion, recognizing that dynamic interactions between personal and wider environmental factors shape health and well-being (Dooris, et al., 1998). However, an important health resource is still widely overlooked, namely campus Greenspace, referred to in this paper as *Academic Greenspace* (Windhorst and Williams, 2015). Serving as a setting for physical activity and recreation, a place of identity as well as a place of social en-

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<https://doi.org/10.1016/j.wss.2020.100003>

Received 26 March 2020; Received in revised form 6 July 2020; Accepted 27 October 2020

Available online 2 November 2020

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counter and exchange, Academic Greenspace may potentially enhance health in place by enabling effective breaks on campus to reduce mental and attention fatigue (Abraham, et al., 2010). For students facing a high perceived level of stress, Academic Greenspace may serve as an essential health-promoting resource in everyday university life (Matsuoka, 2010). In this context, it is important to understand how students' perceptions of Academic Greenspace impact their self-assessed physical, mental and social well-being (Felsten, 2009; Windhorst and Williams, 2015).

There is increasing evidence for a positive correlation between Greenspace and well-being [e.g. (Abraham et al., 2010; Frumkin, 2001; Groenewegen, et al., 2006; Maller, et al., 2006; Völker et al., 2018)]. Numerous studies have shown that viewing or spending time in Greenspace appeared to have stimulating effects on better self-reported health (De Vries, et al., 2003); faster illness recovery (Ulrich, 1984); encouragement of physical activity (De Vries et al., 2011); reduced morbidity and obesity as well as reduced prevalence of cardiovascular and respiratory diseases (Maas et al., 2009a; Nielsen and Hansen, 2007; Richardson and Mitchell, 2010); stress reduction (Honold, et al., 2015; Ward Thompson et al., 2012); recovery from concentration fatigue (Hartig, et al., 2003; Kaplan and Kaplan, 1989); and avoidance of negative moods, such as anger, frustration and aggression (Aspinall, et al., 2015; Roe and Aspinall, 2011). Besides these positive impacts on physical and mental well-being, Greenspace facilitates social interaction, the establishment of stronger community ties, and a sense of achievement. Moreover, Greenspace has the potential of fostering new social identities, thus also enhancing social well-being (Leyden, 2003; Maas et al., 2009b).

Whilst these findings provide valuable basic insights into the salutogenetic potential of Greenspace, little research has been done on the interlinkages between Academic Greenspace and well-being. Few studies, focusing almost exclusively on anglophone campus settings, have explored the way in which students perceive and evaluate campus Greenspace in their daily routine with regard to its impact on individual well-being (Speake, et al., 2013). Recent studies have primarily focused on identifying specific restorative campus areas or, alternatively, on spatial patterns of use and satisfaction with available campus Greenspace (Akhir, et al., 2018; Felsten, 2009; Hanan, 2013; Hipp, et al., 2016; Lau and Yang, 2009; Lu and Fu, 2019; McFarland, et al., 2010, 2008; Seitz, et al., 2014; Speake et al., 2013; van den Bogerd, et al., 2018; Wallner et al., 2018; Windhorst and Williams, 2015).

Speake et al. (2013) found that students at Liverpool Hope University considered campus Greenspace as important for the aesthetic image of a university and as an essential component of the campus. In line with Felsten (Felsten, 2009), a recent study from the Netherlands suggests that students prefer indoor and outdoor university spaces with at least some type of greenery: such university spaces were regarded as more restorative than study-breaks or learning spaces without any greenery or views of nature (van den Bogerd et al., 2018). Similarly, a study targeting three universities in the USA and Scotland (Hipp et al., 2016) showed that students who perceive their campus as being green also tend to rank campus restorativeness more highly. Highly ranked campus restorativeness, in turn, was associated with a greater quality of life (QOL). A beneficial effect of the use of campus Greenspace on perceived QOL could be confirmed in a survey among undergraduate students in Texas (McFarland et al., 2008). Further, Matsuoka's (Matsuoka, 2010) study of 101 public high schools in Michigan (USA) indicated a positive impact of nearby nature on students' academic achievement. Improved well-being and cognitive performance after study breaks in Greenspace was also reported by a recent study in Vienna, particularly among pupils who visited larger parks or forests (Wallner et al., 2018).

The findings of previous studies indicate that there is a need for a more profound and holistic examination of the salutogenetic potential offered by Academic Greenspace as an everyday health-promoting resource. This paper intends to fill this gap and aims at revealing the interlinkages between students' perceptions of their health and physical, social and mental well-being in place and academic space. In so doing, the investigation focuses on patterns of use of campus Greenspace, identity-

creating elements, personal experiences, emotional bonding, subjective symbolic meanings, and social interaction. Moreover, absent a prior clear definition of the salutogenetic potential of campus Greenspaces, a definition of the term *Academic Greenspace* is suggested based on the study's outcomes.

2. Materials and methods

To thoroughly explore and assess the effects of Greenspace on physical, mental and social well-being, the complex interplay between physical-material environment, perception, and individual behavioural patterns must be acknowledged (Bell, et al., 2014). This holistic framework, provided by the concept of therapeutic landscapes (Gesler, 1992), served to support a systematic investigation of the relationship between Academic Greenspace and students' well-being. As 'a product of the human mind and of material circumstances' [43, p. 743], therapeutic landscapes should not only be understood solely as physical-material landscapes (referred to as physical space), but also as dynamic places, shaped by the interplay between diverse social, cultural, symbolic, spiritual and mental associations of meaning (Kistemann, 2016).

Salutogenetic health processes arising from the use of Academic Greenspace among students were analyzed through adoption of a framework extending the therapeutic landscape concept, based on four dimensions of appropriation: social space, symbolic space, activity space, and experienced space. The appropriative dimension of symbolic space considers identities, sense of place, historical meanings, and emotional feelings towards a therapeutic landscape. Whereas the dimension of social space covers issues like shared rituals, everyday routines, social relationships and social activities, the dimension of activity space regards physical activity in space in more detail. This includes both active and passive recreational activities in blue and green spaces and their impact on health and well-being. The dimension of experienced space helps to uncover perceptions and preferences by analyzing how people interpret landscape design in the context of their own values, associations and images (Völker and Kistemann, 2011, 2015). How Academic Greenspace as a physical space becomes a health resource for students through these four dimensions of appropriation guided and informed both the discussion of our findings as well as the design of our Healthy Academic Greenspace Framework (HAGF) (Fig. 5).

We focus our attention on the students' perceived physical, mental and social well-being in relation to perceived significance and use of Academic Greenspace, and address the following questions:

- What importance do students assign to Academic Greenspace in their everyday university life?
- To what extent does the individual perception of Academic Greenspace affect the physical, mental and social well-being of students?
- To what extent does Academic Greenspace function as a therapeutic landscape in students' everyday university life?

2.1. The research site

The study was conducted in the *Hofgarten*, a publicly and freely accessible academic green space adjacent to the main building of and owned by the University of Bonn, Germany.

In addition to more than 11,000 employees (Rheinische Friedrich-Wilhelms-Universität Bonn, 2019), 38,329 individuals are enrolled at the University of Bonn, representing almost 12% of the city of Bonn's 330,224 inhabitants, and accounting for almost 8% of all university students in the federal state of North Rhine-Westphalia (Bundesstadt Bonn, 2019; Statistisches Bundesamt (Destatis), 2019). Having recently been declared an 'Excellence University', the University of Bonn is ranked as one of Germany's 11 leading universities and one of the top universities internationally (German Research Foundation, 2019). The University of Bonn is part of the 'Science Region' of



Fig. 1. The Hofgarten, the main building of the University of Bonn, and its location close to the Rhine river and the city center of Bonn (copyright: Volker Lannert/University of Bonn).

Bonn, an extensive network of scientific institutions, federal ministries, United Nations entities, international non-governmental organisations, and business companies (Rhein-Sieg-Kreis, 2014).

The Hofgarten was chosen as research site for several reasons, including: i) being a university property; ii) being highly frequented by students due to its central location and easy accessibility, thus forming central part of daily campus life; and iii) containing historical and symbolic significance due to its history as an impressive residence garden in the 18th century (Stadt Bonn, 2016). The Electoral Palace, a former residential place, has been used as the main building of the University of Bonn since 1818, and is currently under monument protection (KuLaDig, 2014) (Fig. 1).

The Hofgarten fundamentally shapes the urban image of the city of Bonn, in part due to its considerable size of 7.5 hectares, as well as its proximity to the Rhine river which has a symbolic meaning throughout the entire region. Being located close to the city center, the Hofgarten is a popular recreational place among all age and population groups. While university departments are dispersed all over the city, this campus Greenspace serves as a central meeting point for students (Stadt Bonn, 2016). Surrounded by the main building of the university (Faculty of Arts) and the nearby Juridicum (Faculty of Law and Economics), the Hofgarten is part of the University of Bonn City Campus, where almost 19,000 students attend their classes (Rheinische Friedrich-Wilhelms-Universität Bonn, 2019) (Fig. 2).

2.2. Data collection

Data collection took place in situ in July 2016, since this month marks the end of lecture period and, at the same time, the beginning of the end-of-year exam period. At German universities, the academic year is divided into a summer term and a winter term, separated by a lecture-free period intended for writing essays or exams. The timing of the study allowed for a detailed analysis of the Hofgarten's significance for students' well-being and academic success, with consideration of both its role during daily routines and schedules as well as during a period of considerable stress.

Prior to starting the survey, the study protocol was approved by the Ethics Committee of the University of Bonn (reference number: 242/16). A cross-sectional sample of $n = 100$ students (female: 55, male: 45) was chosen in compliance with the gender ratio of University of Bonn students and in view of data suggesting use of Academic Greenspace as influenced by gender (Speake et al., 2013). Students were surveyed directly in the Hofgarten. Subsequent to obtaining informed consent, participants were asked to fill in a paper questionnaire. This procedure facilitated immediate assessment of the impacts of the Hofgarten on well-being more specifically and intuitively thanks to a direct engagement with the research site (Völker and Kistemann, 2015).

A standardized questionnaire was formulated consisting of four open-ended questions and several multiple choice questions. The questionnaire was divided into three parts covering the four dimensions of appropriation as outlined in the enhanced therapeutic landscape concept.

The research tool (Appendix A) comprised questions providing (i) insight into personal attitudes on the relevance of the Hofgarten for the reputation and life at university as well as insight into reasons for, lengths and frequencies of students' stays.

Moreover, (ii) subjective well-being was operationalized by three dimensions, i.e. physical constitution, mental constitution, and social relationships (Table 1). The formulation of this part of the questionnaire has been inspired by the MOS 36-Item Short-Form Health Survey (SF-36) questionnaire by Ware and Sherbourne (Ware and Sherbourne, 1992) and the World Health Organization Quality of Life - Spirituality, Religiousness and Personal Beliefs Field-Test Instrument (WHOQOL-SRPB) (World Health Organization, 2002). Measures included both salutogenetic and pathogenetic perspectives in order to capture subtle differences in well-being. With regards to physical constitution, for example, physical discomfort and bodily pain, e.g. due to sleep disorder, fatigue, backache or inactivity, were considered alongside feelings of physical strength, vitality and ability to work, e.g. 'I feel able-bodied'.

Additionally, (iii) socioeconomic and personal data as well as individual lifestyle routines were captured. These questions were derived from the human ecological Dahlgren-Whitehead model of health determinants (Dahlgren and Whitehead, 1991), and helped to identify subgroups that differ regarding their perceived well-being, health-related behavior or use of Academic Greenspace.

Students rated all multiple-choice questions on 5-point scales to allow for a nuanced assessment of subjective perceptions. In accordance with the widely tested and used response scales of the SF-36 (Ware and Sherbourne, 1992) and WHOQOL-SRPB (World Health Organization, 2002) questionnaires, Likert scales referred to frequency, intensity, and level of agreement, ranging from 1 as the lowest and 5 as the highest value.

Several open-ended qualitative questions were included, aiming at complementing the quantitative data by in-depth subjective statements. Students were asked to describe the unique characteristics of the Hofgarten as well as its influence on their stress perception, physical well-being, and academic achievement.

2.3. Data analysis

The quantitative data from the paper questionnaires were digitalized and analyzed with IBM SPSS® Statistics 23. Descriptive statistics, including measures of central tendency and variability, were applied to help describe and understand the role and use of the Hofgarten in university life. We also calculated Spearman rank correlation coefficients

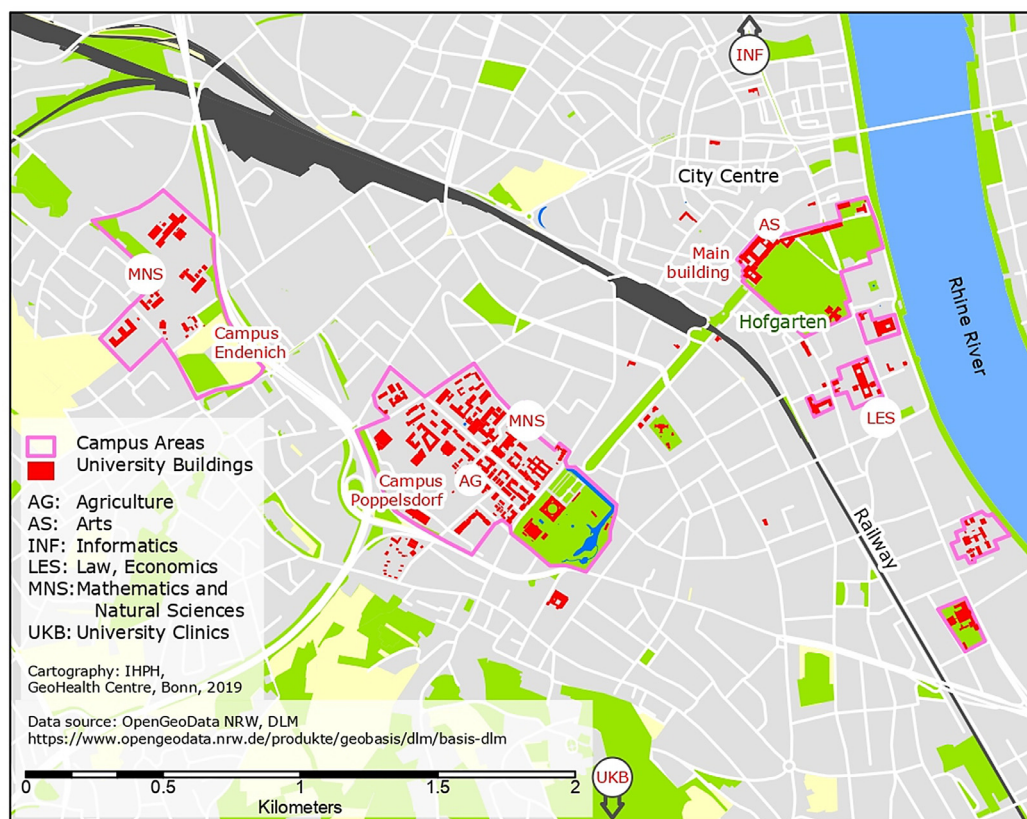


Fig. 2. The *Hofgarten*, its location within the campus areas of the University of Bonn, and its proximity to Bonn city center and the Rhine River. The green spaces *Hofgarten* – Poppelsdorfer Allee – Poppelsdorfer Schlosswiese serve as a green axis between the three main campus areas: City, Poppelsdorf, Endenich and UKB. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

r_s to analyze the associations between perceptions and use of Academic Greenspace and students' well-being on campus. The confidence level was determined as 95% with a corresponding significance level of 0.05. Only significant correlations are reported and highlighted in the analysis, and their respective p-values are included to indicate the strengths of associations (Table 3–5).

The open-ended questions were transcribed, and each questionnaire was assigned a self-generated identification number to guarantee confidentiality of the statements integrated into the analysis. This qualitative data was analyzed by content analysis. Keywords were derived directly from the respondents' statements, and eventually reduced to main coding categories. The process of category development was oriented to the respective quantitative themes addressed by the questionnaire (Hsieh and Shannon, 2005; Mayring, 2000), i.e. physical-material characteristics, place of social encounter, perceived level of stress, and influence on students' academic achievement, mental and physical well-being. Representative statements were integrated into the discussion. Additionally, we conducted a summative content analysis, which involved counting the frequencies of the initially coded categories (Tables 2–5). The quantification was not intended to infer meaning from the absolute frequencies but, rather, to explore the usage of keywords (Hsieh and Shannon, 2005).

All results were triangulated with existing scientific literature. The integration of our study results into other theoretical and empirical concepts (Abraham et al., 2010; Maller et al., 2006; Kistemann, 2016; Völker and Kistemann, 2011, 2015; Claßen, 2016) served as a basis to develop a framework on *Healthy Academic Greenspace* (HAGF) (Fig. 5) and derive a definition of Academic Greenspace. Our HAGF provides a valuable resource for healthy campus planning insofar that it complements health benefits of exposure to urban Greenspaces, as derived

from a broad body of literature, with therapeutic experiences in campus green spaces specifically drawn from our *Hofgarten* study.

3. Results

3.1. Sociodemographic and academic profile of respondents

The average respondents were 23 years old. Female participants were slightly over-represented in comparison with the gender ratio of the university. The vast majority of students surveyed were enrolled in the Faculty of Arts, located directly adjacent to the *Hofgarten*. Approximately half of the respondents were undergraduate students with the other half being graduate students.

The catchment area of the *Hofgarten* mainly consists of its surrounding districts, although 15 respondents lived outside the city boundaries. Almost half of the respondents reported that their residence was located at a distance of more than 2 km from the *Hofgarten*. At the same time, the majority confirmed that their nearest Greenspace was situated less than 100 m away from their place of residence. The average duration of stay in the *Hofgarten* was up to two hours on weekdays or up to one hour on weekends (Appendix B).

3.2. Use of the *Hofgarten*

The primary motivation for student time spent in the *Hofgarten* differed between genders and academic degrees. In general, all groups most frequently indicated reasons such as meeting friends, taking a break between courses or at lunchtime to relax from everyday life, spending free time, and benefiting from time spent in nature (Fig. 3a). However, some discrepancies could be detected. Female students, for example, attached

Table 1

Conceptualization of well-being in the research tool, rated on 5-point scales. The formulation of questions on physical constitution, mental constitution and social relationships has been inspired by the MOS 36-Item Short-Form Health Survey (SF-36) questionnaire by Ware and Sherbourne (Ware and Sherbourne, 1992) and the World Health Organization Quality of Life - Spirituality, Religiousness and Personal Beliefs Field-Test Instrument (WHOQOL-SRPB) (World Health Organization, 2002).

Dimension of well-being	Composite measure
<i>Physical constitution</i>	My health is excellent. I feel able-bodied. I do not have enough energy for everyday life. Please indicate how much the following areas of life contribute to your well-being. ... leisure activities ... sports/ physical activity How often do you suffer from... ... tension (e.g. sleep disorder, sweating, cramps)? ... impaired general condition (e.g. fatigue, poor appetite, dizziness, backache, weather sensitivity)? ... inactivity? I have enough exercise on a normal working day. I am satisfied with my level of physical activity. My level of physical activity positively influences my health. I am satisfied with my present well-being in the Hofgarten. What influence does the Hofgarten have on your physical well-being?
<i>Mental constitution</i>	In general, how satisfied are you with your life? How often do you suffer from... ... time pressure? ... lacking ability to recover? ... heavy course loads? ... concentration difficulties? ... uncertainties regarding your future career? ... inner restlessness? Please estimate your study-related stress level... ... in general. ... during examination phases. ... during this summer term. In my everyday life, I maintain a balance between fulfilling my duties and ensuring sufficient periods of rest. I am able to cope with pressure in stressful situations without feeling weak afterwards. During this summer term/ During your current stay in the Hofgarten, how often did/ do you feel... ... full of energy? ... nervous? ... discouraged? ... calm and relaxed? ... annoyed? ... exhausted? ... happy? A stay in the Hofgarten provides me with the necessary energy for a successful graduation. I have a bad conscience spending time in the Hofgarten instead of learning. I feel more satisfied and balanced after a stay in the Hofgarten. I can better concentrate after a break in the Hofgarten. What influence does the Hofgarten have on your... ... personal stress perception? ... academic achievement?
<i>Social relationships</i>	Please indicate how much the following areas of life contribute to your well-being. ... school/work ... family ... marriage/relationship During this summer term/ During your current stay in the Hofgarten, how often did/ do you feel lonely? I feel bothered by the presence of other students. The presence of other students creates a sense of belonging.

greater importance to the *Hofgarten* as place of recreation than males (4.06 vs. 3.55), as did graduate students when compared to undergraduate students (3.98 vs. 3.75, whereby 1 = totally disagree and 5 = totally agree).

At the time of the survey, students accessed the *Hofgarten* instead of other urban Greenspaces due to its proximity to the university, its easy accessibility, its relaxed atmosphere, and because of positive place

associations (Fig. 3b). Notable differences between undergraduates and graduate students could be identified. Whereas graduate students considered proximity to their place of residence as the least accurate reason (2.06), undergraduates rated it as quite important reason for their stay (3.35). As undergraduates tended to live closer to the *Hofgarten* than graduate students, undergraduates rated its accessibility (4.31) as a de-

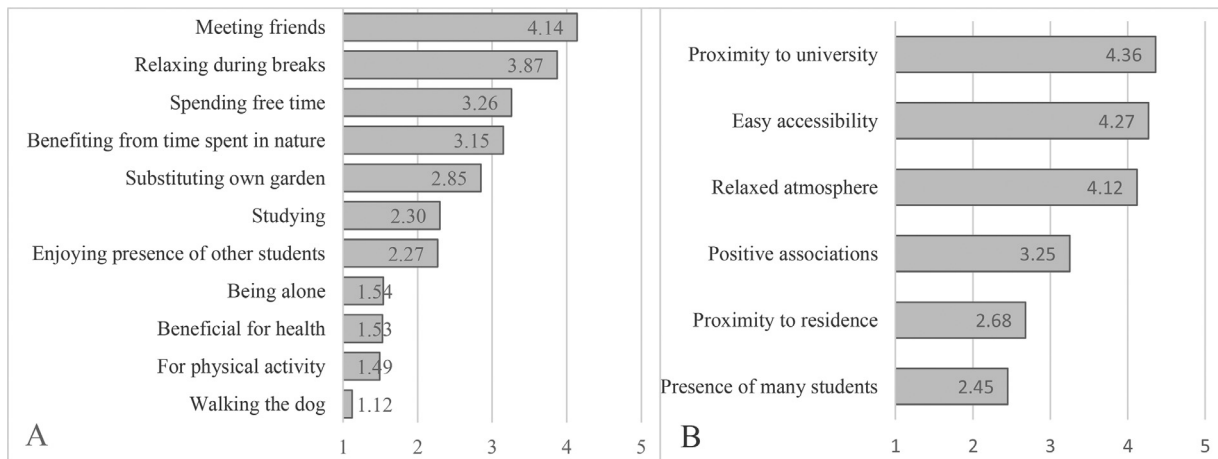


Fig. 3. (a-b): The use of the Hofgarten: a = main motives for a stay in the Hofgarten; b = reasons for a stay in the Hofgarten instead of other urban green spaces. Frequency distributions [means] on five-point scales from 1 = totally disagree to 5 = totally agree (n = 100).

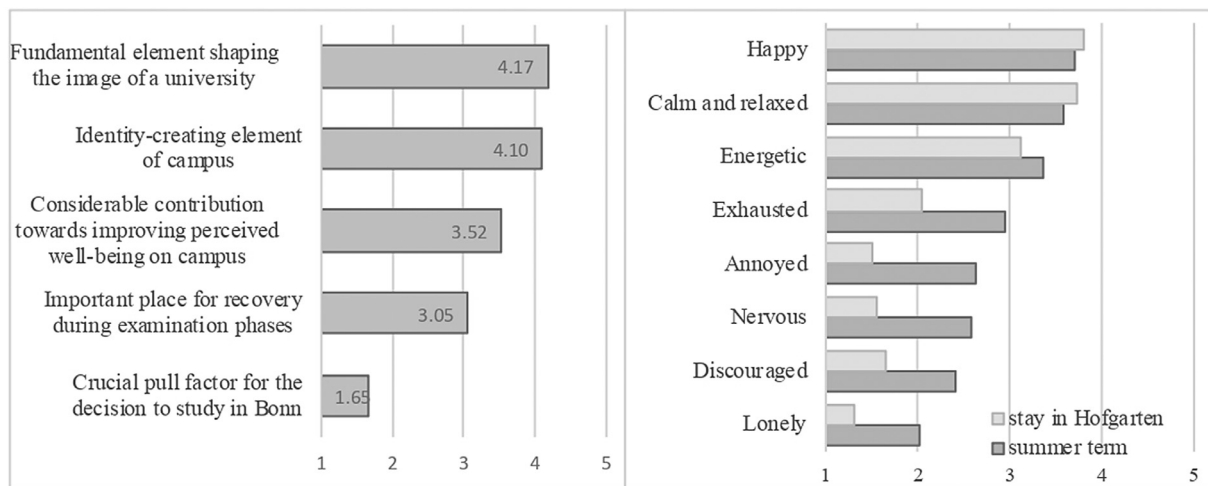


Fig. 4. (a-b): The role of the Hofgarten in university life: a = importance of Academic Greenspace in relation to image of and life at the University of Bonn; b = experienced moods during summer term in general and during the stay in the Hofgarten. Frequency distributions [means] on five-point scales from 1 = totally disagree to 5 = totally agree (n = 100).

cisive factor while, by contrast, graduate students indicated proximity to university (4.70) as decisive.

3.3. The role of the Hofgarten in university life

The majority of participants did not regard the Hofgarten as a crucial pull factor for the decision to study in Bonn (1.65), but most students considered Academic Greenspace as a fundamental element shaping the image of a university (4.17), especially undergraduates (4.28) and females (4.23). Moreover, all subgroups agreed that the Hofgarten served as an identity-creating element of the University of Bonn’s campus (4.10). While undergraduates strongly agreed that the presence of other students conveys a feeling of belonging (2.75), females equally felt a sense of belonging (2.54) and disturbance (2.53) due to the presence of others.

Concerning the role of the Hofgarten regarding student academic success, there was a stronger consensus for the item ‘I have a bad conscience spending time in the Hofgarten instead of learning.’ (2.35) than for the statement ‘A stay in the Hofgarten provides me with the necessary energy for a successful graduation.’ (2.25). Women rather than men (2.50 vs. 2.11), and undergraduates rather than graduate students (2.52 vs. 2.18), expressed having a bad conscience in this regard. Graduate students

(3.05) and undergraduates (3.06) equally appreciated the Hofgarten as an important place for recovery during examination phases. Yet, disparities in attached significance were noteworthy between the genders (women: 3.28, males: 2.68), strongly deviating from the overall average (3.05) (Fig. 4a). Places for effective study breaks on campus appear to be particularly important since Bonn students reported suffering from concentration difficulties, inner restlessness, and a sense of time pressure more frequently (average values between 3.05 and 3.32) than from inactivity (2.46), a lacking ability to recover (2.50), heavy course loads (2.59), and impaired general condition (2.72). These health complaints were reported more frequently among women and undergraduates. Even though students did not consciously acknowledge a strong influence of the Hofgarten on their academic success, the statements ‘I can better concentrate after a break in the Hofgarten’ and ‘I feel more satisfied and balanced after a stay in the Hofgarten’ were particularly true for graduate students (3.47 and 3.51) and women (3.54 and 3.56).

A comparison between experienced moods during summer term and during the stay in the Hofgarten provides a deeper insight into the potential of Academic Greenspace as a health resource on campus. Overall, negative moods were experienced less frequently and happiness and calmness were felt more strongly in Academic Greenspace (Fig. 4b). During the academic term, females were much more likely to feel ex-

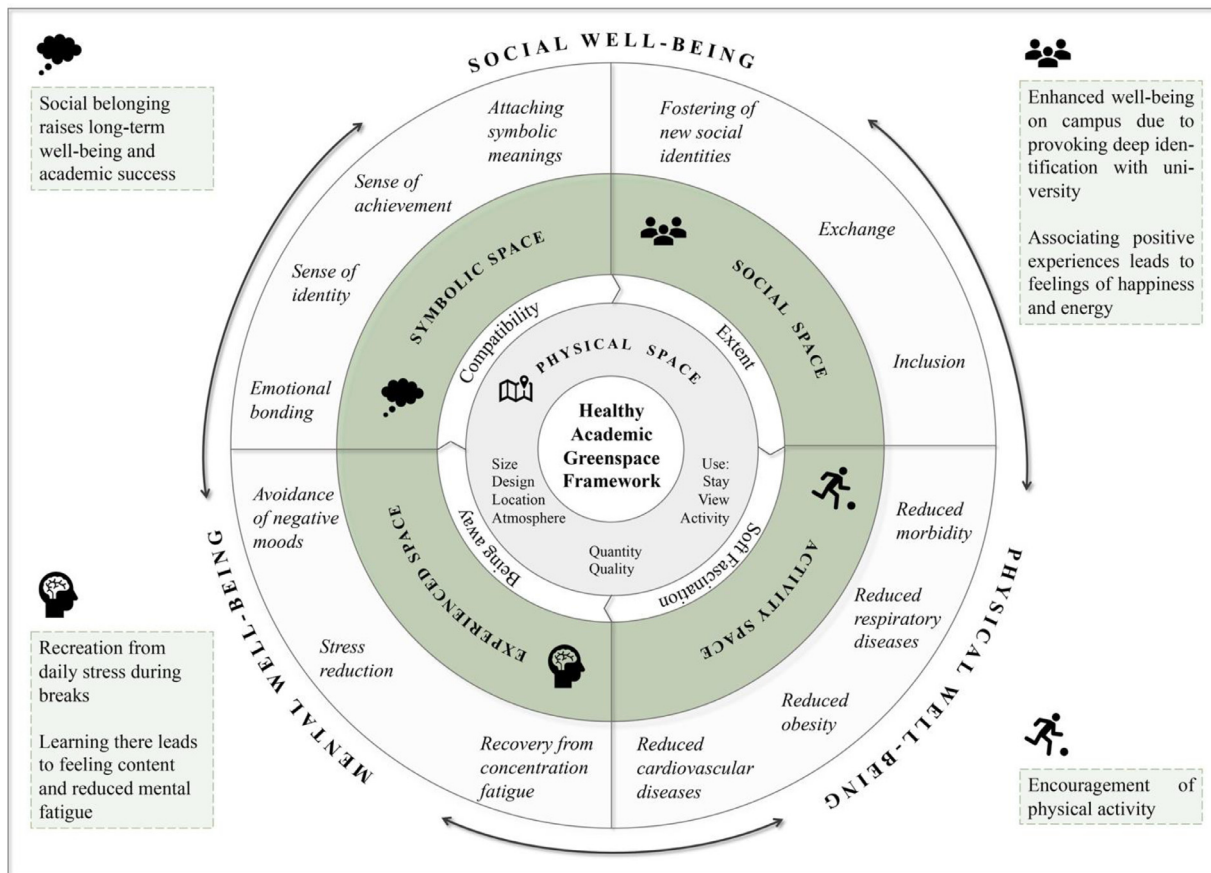


Fig. 5. Healthy Academic Greenspace Framework (HAGF), building on Völker and Kistemann’s (Völker and Kistemann, 2011) four dimensions of appropriation extending the therapeutic landscape concept. Social, physical and mental health benefits of exposure to urban green spaces, derived from a broad body of literature (marked in italics) are complemented with mixed-methods results of our study on the Hofgarten as a therapeutic landscape in the everyday university life in Bonn, Germany (green text boxes). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

hausted (3.10 vs. males 2.68), annoyed (2.77 vs. 2.38), and nervous (2.69 vs. 2.37) than males. Nevertheless, women experienced a feeling of happiness more frequently than men (3.84 vs. 3.50). Negative feelings prevailed among undergraduates as compared to graduate students. In contrast, a stay in Academic Greenspace triggered a homogenisation of experienced moods, both between and within the different subgroups. The sole exception was that men reported feeling calm and relaxed significantly more often than women (4.03 vs. 3.56). Accordingly, there was a high level of agreement that ‘the Hofgarten makes a considerable contribution towards improving perceived well-being on campus’ (3.52). This was especially appreciated by females (3.68, males: 3.26), whereas variances between the students in different university program levels were not obvious (graduate students: 3.51, undergraduates: 3.60).

4. Discussion

4.1. Adopting the extended concept of therapeutic landscapes to academic Greenspace

The most important interlinkages between Academic Greenspace and students’ social, physical and mental well-being are compiled in the framework on *Healthy Academic Greenspace (HAGF)*, which allows discussion of the findings on use of the *Hofgarten*, attached significance, and perceived well-being in more detail (Fig. 5).

From the center to the edge of the circle, the HAGF seeks to advance our understanding of how Academic Greenspace as a physical space with specific material features, such as design, location or size, is experienced as therapeutic through different types of interaction and allocations of

meaning. Framing health-relevant experiences within well-established theories on Greenspace and well-being, building upon Völker and Kistemann’s (Völker and Kistemann, 2011) four dimensions of appropriation extending the therapeutic landscape concept and upon Attention Restoration Theory (Kaplan and Kaplan, 1989), helps place the findings from our *Hofgarten* study in the context of previous research done in other settings or among different population groups. It is important to recognize that the appropriative dimensions are not clearly distinguishable but rather dynamic, intertwining dimensions of an interdependent framework for health promotion (Völker and Kistemann, 2015). From intangible symbolic or experienced meanings to tactile interactions in form of physical engagement or social contacts, these dimensions suggest various interventions for health policy-making. In the following discussion, we uncover how quality of life on campus can be improved through a setting-based approach to health promotion which takes into account both physical-material conditions and non-monetary aspects of health and well-being.

4.2. Physical space

Considering physical-material landscape elements besides the four dimensions of appropriation facilitates a holistic understanding of the *Hofgarten* as a dynamic construct combined of material conditions and allocated meanings. Students frequently mentioned size, location, and design of the *Hofgarten* as unique characteristics of this Greenspace. Some participants exclusively highlighted its central location as its most important feature:

Table 2

Qualitative results of the *Hofgarten's* Academic Greenspace as a physical space, based on inductive coding of open questions. Code system with both absolute and relative information of persons who appoint a specific code at least once, multiple allocations possible.

Physical space Qualitative results Code system	Frequency [absolute]	Frequency [%]
What characteristics make the <i>Hofgarten</i> unique? (<i>n</i> = 49, <i>n/a</i> = 51)		
Size and central location	17	34.7
Design	15	30.6
Atmosphere	10	20.4

'being situated in the center of the city' (id 14) and 'location and accessibility' (id 15).

Others took pleasure from the combination of location and atmosphere

'central location and view' (id 74) or 'flair, centrality' (id 62),

or size and atmosphere

'size and flair' (id 27) and 'size; atmosphere and view: palace; trees etc' (id 7) (Table 2).

Investigating preferred Greenspaces among students, Schipperijn et al. (2010) concluded that size rather than distance is an important selection criterion. Speake et al. (2013), however, suggested that size is not an important pull factor within a given campus. Our results suggest that both size and proximity to university are unique characteristics of the *Hofgarten* being highly valued among students. Additionally, students appreciated design aspects, such as cleanliness and calmness:

'large, clean area, beautifully arranged with surrounding trees and view of the main building' (id 8).

One student summarized the main aspects in her statement:

'The *Hofgarten* is a large green area in the heart of Bonn within easy reach of both the city center, the Rhine and lecture halls. The tree-lined avenues together with the old university building generate a pleasant atmosphere' (id 45).

These findings are in line with the Attention Restoration Theory: exposure to nature encourages an improvement of mental fatigue and concentration, while presence at the *Hofgarten* is characterised by ful-

fillment of the four properties, i.e. extent (feeling immersed in nature), being away (feeling far removed from a stressful everyday life), soft fascination (effortless brain activity), and compatibility (appreciating time spent in nature) (Kaplan and Kaplan, 1989). As a large green area, the *Hofgarten* promotes a feeling of being away from demands and daily stress.

4.3. Social space

Students highlighted the significance of the *Hofgarten* as place of encounter and exchange. They equally valued planned meetings with friends as well as spontaneous encounters:

'pleasant meeting point for students' (id 30),

'It is special that so many diverse people come together and that one always meets fellow students or friends' (id 89).

Staying in the *Hofgarten* to 'enjoy the presence of other students' is positively associated with students' present well-being during their stay in Academic Greenspace ($r_s = 0.38, p \geq 0.000$). Additionally, students who appreciate this social dimension of the *Hofgarten* tend to agree that Academic Greenspace makes a decisive contribution to their long-term well-being on campus ($r_s = 0.36, p \geq 0.000$). This can be explained by the fact that the presence of fellow students in Academic Greenspace helps to relieve perceived loneliness in everyday life. A positive relation between self-rated present well-being in the *Hofgarten* and agreeing that the presence of other students creates a sense of belonging ($r_s = 0.23, p = 0.023$) confirms this assumption.

The presence of like-minded people not only triggers social belonging, but also promotes a feeling of energy that, in turn, enhances present well-being ($r_s = 0.40, p \geq 0.000$). Students who feel a sense of belonging attach great importance to the *Hofgarten*, not only with regard to their present well-being, but especially to their academic success ($r_s = 0.56, p \geq 0.000$) (Table 3).

Serving as a meeting point and a place of inclusion, the *Hofgarten* facilitates the encounter of like-minded people. As such, Academic Greenspace is an important social space on campus that fosters a sense of identity.

4.4. Symbolic space

Perceived well-being is affected by attaching subjective, symbolic meanings to the physical-material characteristics of the *Hofgarten*. Numerous participants expressed that the *Hofgarten* is an integral part of

Table 3

Qualitative and quantitative results of the *Hofgarten's* Academic Greenspace as a social space. Qualitative results are based on an inductive code system with both absolute and relative information of persons who appoint a specific code at least once, multiple allocations possible. Quantitative results show Spearman rank correlation coefficients (r_s) and p-values (p) with a significance level of 0.05.

Social space Qualitative results Code system	Frequency [absolute]	Frequency [%]
What characteristics make the <i>Hofgarten</i> unique? (<i>n</i> = 49, <i>n/a</i> = 51)		
Meeting point	7	14.3
Quantitative results (<i>n</i> = 100)		
Variables	r_s	p
Enjoying presence of other students in the <i>Hofgarten</i>		
↔ Satisfaction with present well-being in the <i>Hofgarten</i>	0.38	0.000
↔ <i>Hofgarten</i> makes a decisive contribution to long-term well-being on campus	0.36	0.000
Presence of other students creates a sense of belonging		
↔ Satisfaction with present well-being in the <i>Hofgarten</i>	0.23	0.023
↔ <i>Hofgarten</i> makes a significant contribution to academic success	0.56	0.000
Feeling full of energy during stay in <i>Hofgarten</i>		
↔ Satisfaction with present well-being in the <i>Hofgarten</i>	0.40	0.000

Table 4

Qualitative and quantitative results of the *Hofgarten*'s Academic Greenspace as a symbolic space. Qualitative results are based on an inductive code system with both absolute and relative information of persons who appoint a specific code at least once, multiple allocations possible. Quantitative results show Spearman rank correlation coefficients (r_s) and p-values (p) with a significance level of 0.05.

Symbolic space Qualitative results Code system	Frequency [absolute]	Frequency [%]
What characteristics make the <i>Hofgarten</i> unique? (n = 49, n/a = 51)		
Part of the university	16	32.7
Quantitative results		
Variables	r_s	p
Associating positive experiences with the <i>Hofgarten</i>		
↔ Feeling particularly happy there	0.21	0.037
↔ Feeling energetic there	0.20	0.042
↔ <i>Hofgarten</i> makes a decisive contribution to well-being on campus	0.24	0.017
<i>Hofgarten</i> is an identity-creating campus element		
↔ <i>Hofgarten</i> makes a decisive contribution to well-being on campus	0.47	0.000

the university. On the one hand, its spatial proximity is particularly valued, as expressed in statements like:

'located directly at the main building of the university' (id 22),

'with a view to the university' (id 65),

'size, location, part of the university' (id 37),

'in close proximity to my lecture halls' (id 18).

On the other hand, the *Hofgarten* is described as a symbolic part of the university resulting in a unique atmosphere, including:

'easy-going, directly next to the university' (id 3)

'when leaving the main building, there is an immediately pleasant atmosphere in the Hofgarten' (id 39).

Windhorst and Williams (2015) assumption that students prefer Greenspaces located away from the buildings and social campus environment is not confirmed by the results of our survey. On the contrary, students who associate positive experiences with the *Hofgarten* feel particularly happy ($r_s = 0.21, p = 0.037$) and energetic ($r_s = 0.20, p = 0.042$) during their stay (Table 4).

The *Hofgarten*'s strong symbolic meaning is deeply rooted in university life through identity-creating events for students of all age groups, ranging from a *Science Rallye around the Hofgarten* for prospective students, all the way to the traditional graduation ceremony. In 2005, the University of Bonn was the first German university to introduce a joint graduation ceremony across all faculties, attended by almost 5,000 graduates, academic staff and relatives in the *Hofgarten* every year. Holding traditional events in this Academic Greenspace helps to promote a long-lasting impression of a 'perfect campus space'. In a visual sense, photos of graduates, who are dressed in gowns and throw their graduation caps in the air as a symbolic gesture to close a chapter in a student's life, are commonly associated with Bonn's university campus. On a symbolic level, traditional events in the *Hofgarten* promote a university-wide sense of community and establish a university culture of respect and appreciation (Universität Bonn, 2006). These symbolic allocations of meaning, in turn, evoke an *'overall positive feeling in Bonn'* (id 47), and enhance well-being on campus. Staying in the *Hofgarten* because of positive associations with this place positively correlates with the statement *'The Hofgarten makes a decisive contribution to my well-being on campus'* ($r_s = 0.24, p = 0.017$). Additionally, a strong link between the statements *'The Hofgarten makes a decisive contribution to my well-being on campus'* and *'I consider the Hofgarten as an identity-creating element of Bonn's campus'* can be observed ($r_s = 0.47, p \geq 0.000$) (Table 4).

4.5. Activity space

No significant correlations between being in the *Hofgarten* for physical activity and perceived level of stress, experienced moods or attached significance to Academic Greenspace could be detected. Eighty-nine percent of the respondents stated that they never or rarely engage in physical activity in the *Hofgarten*. The *Hofgarten* is thus not mainly appreciated as a site of physical exercise.

Yet, designing campus Greenspaces in a way to support physical activity may be an effective measure for health promotion and therefore constitutes a valuable long-term investment. Students spend a considerable amount of time marked by physical inactivity in university buildings being educated for sedentary occupations. Thus, campus settings potentially shape sedentary behavior patterns that may persist lifelong. Since universities constitute an everyday environment for future decision makers and opinion leaders, it is important to promote healthy lifestyles on campus (Leslie, et al., 2001). Therefore, specific environmental characteristics of Academic Greenspace that contribute to increased levels of physical activity among students need to be further investigated (Bedimo-Rung, et al., 2005). Detailed dose-response data on how varying types of Greenspace interactions, frequency and duration of exposure benefit students' health and well-being would be particularly valuable for tailoring campus initiatives and promoting opportunities for students to integrate active use of campus Greenspace into their daily routines (Holt, et al., 2019).

The promotion of physical activity on campus is a relatively new area of research (Holt et al., 2019), so how activities become therapeutic or how campus design facilitates physical activities has not been well understood to date (Pitt, 2014). While some studies have suggested that physical activity is an underlying mechanism in the link between access to Greenspace and self-perceived well-being (Coombes, et al., 2010; Roemmich et al., 2006; Sugiyama, et al., 2010), positive associations are often weak or challenged by other studies that could not confirm an influence of Greenspace on levels of physical activity (Maas, et al., 2008; Schipperijn, et al., 2013). A recent study found that undergraduate students strongly value performing both active and passive recreational activities near water features and gardens on campus. Passive Greenspace interactions (sitting, studying, eating or socializing) positively contributed to well-being, but only frequent active interactions (running, hiking/walking, biking) were significantly linked to a higher quality of life, improved overall mood, and reduced stress level within university life. What remains to be explored is why different forms of engagement with campus Greenspace appeared to evoke varying levels of restoration. Holt et al. (2019) acknowledge that results from this private suburban campus university, surrounded by natural areas, might be of limited applicability to urban university campuses with a higher

Table 5
Qualitative and quantitative results of the *Hofgarten's* Academic Greenspace as an experienced space. Qualitative results are based on an inductive code system with both absolute and relative information of persons who appoint a specific code at least once, multiple allocations possible. Quantitative results show Spearman rank correlation coefficients (r_s) and p-values (p) with a significance level of 0.05.

Experienced space Qualitative results	Frequency [absolute]	Frequency [%]
<i>Code system</i>		
What influence does the <i>Hofgarten</i> have on your...		
... personal stress perception? (n = 83, n/a = 17)		
Positive influence	16	19.3
Calming effect	10	12.0
Reduced stress level	10	12.0
Relaxing	9	10.8
Little influence	8	9.6
No influence	6	7.2
... physical well-being? (n = 84, n/a = 16)		
Positive influence	29	34.5
No influence	22	26.2
Relaxing	12	14.3
Little influence	11	13.1
High influence	6	7.1
Sun, fresh air	5	6.0
Calming effect	3	3.6
... academic achievement? (n = 84, n/a = 16)		
No influence	51	60.7
Positive influence	14	14.3
Little influence	10	11.9
Pleasant atmosphere for learning	7	8.3
Quantitative results		
<i>Variables</i>	r_s	p
Hofgarten is an important place for recreation during examination phases		
↔ Deciding for a stay there because of ...		
... relaxing during breaks	0.51	0.000
... proximity to university	0.31	0.002
... benefiting from time spent in nature	0.25	0.014
... enjoying relaxed atmosphere	0.24	0.019
... learning there	0.25	0.011
... enjoying presence of other students	0.26	0.009
↔ Being able to better concentrate after a break in the Hofgarten	0.38	0.000
↔ Feeling more satisfied and balanced after a stay in the Hofgarten	0.36	0.000
Learning during the stay in the Hofgarten		
↔ Feeling more satisfied and balanced after a stay in the Hofgarten	0.27	0.007

share of commuter students. Therefore, we direct our focus on the mechanisms through which the *Hofgarten* as a publicly accessible Academic Greenspace in an urban setting promotes restoration, including through primarily passive interactions.

4.6. Experienced space

Despite the *Hofgarten's* immediate proximity to the university, almost all students experienced recovery and a feeling of being away from daily stress while in there. The vast majority of respondents linked the degree of restorative effects of the space to the duration of their stay:

'short-term easing and recovery' (id 6) and *'A stay in the Hofgarten makes me forget the word stress and enables me to focus completely on this restorative moment'* (id 46).

One female student confirmed a long-term effect on mental well-being:

'I am less prone to stress thanks to the Hofgarten' (id 31).

Students who regard the *Hofgarten* as an important place for recovery during examination phases gave the following reasons for a stay there: taking a break between courses or at lunchtime to relax from everyday life ($r_s = 0.51, p \geq 0.000$), proximity to university ($r_s = 0.31, p = 0.002$), benefiting from time spent in nature ($r_s = 0.25, p = 0.014$), relaxed atmosphere ($r_s = 0.24, p = 0.019$), learning ($r_s = 0.25, p = 0.011$), and presence of other students ($r_s = 0.26, p = 0.009$). Based on these responses,

it was apparent that the *Hofgarten* exerts a restorative effect due to multiple attributions of meaning: health-promoting effects of Greenspaces in general, spatial-material proximity to university, and being part of the university at a symbolic level. The spatial proximity to the university was a decisive factor especially for students who indicated a high study-related stress level. Without a time-consuming walk to access this Greenspace, recovery in nature can be ensured even in short breaks on campus.

Positive correlations between considering the *Hofgarten* as important place for recreation during examination phases and recovery from concentration fatigue ($r_s = 0.38, p \geq 0.000$) and reduced stress ($r_s = 0.36, p \geq 0.000$) could be confirmed. This link is underlined by statements such as

'Spending time there has a restorative effect so that I can concentrate better in seminars and start refreshed' (id 46).

Of note, learning during the stay correlates more strongly with feeling content after having spent time in the *Hofgarten* ($r_s = 0.27, p = 0.007$) as compared to other motives of stay, such as meeting friends or spending free time there. Accordingly, the restorative effect of Academic Greenspace is increasingly apparent among students engaged in activities that require sustained attention:

'Here it is possible to learn and feel relaxed at the same time' (id 45).

Students frequently associate attributes with the *Hofgarten* which may seem contradictory at first glance, such as *'sun, time-out, learning'*

(id 16). Again, these findings are consistent with the Attention Restoration Theory. Studying in the *Hofgarten* did not seem to be more effective, since most students did not consciously consider the *Hofgarten* to have positive effects on their academic success. Nevertheless, mental fatigue appeared to be reduced by learning in the *Hofgarten* as students were convinced to pursue a meaningful activity during their 'break' instead of having a bad conscience (Table 5). Exploring the meanings of privately owned domestic gardens across the lifespan, Gross and Lane (Gross and Lane, 2007) found that taking stressful or work-related indoor activities into a more pleasant outdoor environment is most common at the age of late adolescence and early adulthood than at any other age. Students not only need to retreat in their home environment, but also in everyday campus settings, where this age group spends a considerable amount of time. Spending time in Academic Greenspace can be regarded as a best practice for 'work-life integration', supporting students to create meaningful breaks on campus in accordance with their own life and academic goals.

4.7. Academic Greenspace as a therapeutic landscape

Based on its health-promoting potential, the investigated Academic Greenspace could be verified as important everyday therapeutic landscape for many students.

As a therapeutic landscape, Academic Greenspace encompasses all campus green spaces that enhance physical, mental and social well-being of students, not only because of their specific physical-material landscape elements, but especially due to identity-creating elements, personal experiences, emotional bonding, subjective symbolic meanings, and social interaction. Within everyday university life, Academic Greenspace serves as place of recreation and recovery from concentration fatigue on the one hand and as place of social encounter and inclusion on the other hand. Consequently, Academic Greenspace as a health-promoting campus environment possesses great potential for improving health conditions for students, in terms of providing the necessary energy for a successful graduation.

Providing a unique combination of physical, social, symbolic, activity and experienced space, our *Healthy Academic Greenspace Framework (HAGF)* (Fig. 5) shows that Academic Greenspace is an important health resource for students where daily routines and tasks exist among leisure. It helps students realign their academic goals with personal life priorities by providing a space for both studying and socializing, thus stimulating health and well-being in place and academic space. Students' well-being can be further enhanced by promoting their physical activity and encounters with nature in Academic Greenspace, allowing them to shift from an effortful to an effortless mode of operation (Hartig et al., 2003). Taken together, these characteristics of Academic Greenspace help students blend positive life experiences into their daily working environment by offering a favorable compromise between compatibility and a feeling of being away from daily demands (Gross and Lane, 2007).

From a health promotion perspective, the multidimensional (re-)evaluation of green spaces provides an important basis for creating, preserving, expanding, and optimizing Academic Greenspace (Brei and Hornberg, 2009). In order to optimize their potential as a health resource, campus green spaces should easily be accessible and interconnected, provide opportunities for social interaction as well as be designed in a visually appealing and functional way, equally providing a sense of security (Bedimo-Rung et al., 2005; Claßen, 2016; Hanan, 2013). Safety issues, such as appropriate premises lighting at different times of the day or year or avoidance of Academic Greenspace at certain times, did not come up in our study, but warrant further attention. Moreover, in accordance with the findings of a photovoice study (Seitz et al., 2014), Speake et al. (2013) concluded that a campus requires various forms of Greenspace, i.e. man-made structures equally as natural areas, to ensure the diverse needs of student users. All of these criteria apply to the *Hofgarten*. Consequently, students value the *Hofgarten* as an essential part of the campus.

At the University of Bonn, the *Hofgarten* plays a significant role in projected campus development, with classroom buildings that are currently dispersed over the city to be concentrated on four campus areas. In the course of this development, Greenspaces including the *Hofgarten* will serve as a spatial connection between the different campus sites (Fig. 2) (Bund Deutscher Architekten, 2011). In the course of this restructuring, the health-enhancing effects of Greenspace need to be promoted. In this context, it would be worth exploring students' well-being across different campus sites and the extent to which this is supported by different qualities of campus Greenspace. Even though a considerable area of Campus Endenich, for example, is covered by vegetation, this campus location has a reputation of being a less favorable academic space of low recreational value. Potential implications for inequalities in students' satisfaction, well-being on campus and academic success warrant further attention during campus planning.

The proximity of the *Hofgarten* and the university's main building to the Rhine river (Fig. 2) may be considered as a further cornerstone of healthy campus planning. Investigating therapeutic experiences at the Rhine in two German cities close to Bonn, Völker and Kistemann (2015) claim that urban blue spaces can complement and extend health-promoting qualities of green spaces. The authors regarded water as a symbolic metaphor that supports self-development, a site-specific identity, and emotional bonding. They described the movement of water as facilitating intense recreation by attracting people's senses, thoughts, and encouraging physical activity. Integrating the Rhine as an extended campus in the analysis of students' well-being would provide a valuable basis to explore therapeutic experiences in Academic Bluespace for the first time. Understanding how different types of blue and green spaces meet students' various needs bears significant potential for future research and campus design projects (Völker and Kistemann, 2015). Comparing different variations of campus Greenspace across the entire University of Bonn would further facilitate the development of comprehensive guidelines for healthy campus planning (Holt et al., 2019). Similar in design to the City Campus, Campus Poppelsdorf is characterized by a central point of a baroque castle which hosts a University museum and several institutes of the Faculty of Mathematics and Natural Sciences. This university property is surrounded by a campus Greenspace resembling the *Hofgarten* in design but which is smaller in size on one side, and by the Botanic Gardens of the University of Bonn on the other side. Visits to botanic gardens were recently shown to improve physical and mental well-being, but more research is needed to link specific design features to restoration outcomes across different sociodemographic groups (Carrus et al., 2017). Since botanic gardens are often managed by universities or other research organizations, it would be worth exploring if this type of Academic Greenspace with a high concentration of plant species differs from less intensively designed campus Greenspaces in terms of fulfilling the relaxation, escape and socializing needs of students. Moreover, botanic gardens not only have aesthetic and recreational value but are also important places for environmental education, and thus have great potential for promoting the health benefits of contact with nature among students and the general public (Carrus et al., 2017).

Our Healthy Academic Greenspace Framework underpins the proposition that Academic Greenspace plays a fundamental role in everyday university life by supporting both well-being and academic success of students. Therefore, Academic Greenspace needs to be promoted as an indispensable long-term investment which has the potential to assist universities meet their targets in educational attainment and health promotion.

5. Limitations

Our findings demonstrate that Academic Greenspace has a strong potential in promoting physical, mental and social well-being by provoking feelings of restoration, renewed concentration, symbolic connected-

ness, emotional bonding and inclusion. However, some limitations of the study need to be critically considered.

Deciding for a survey in situ allows the respondents to provide responses on perceived impacts of the *Hofgarten* on their well-being more specifically and intuitively. However, such a survey implies that primarily students who already appreciate Academic Greenspace and who are attuned to possibilities of enhanced well-being were interviewed. Conducting the survey on consecutive afternoons over a relatively short period of time facilitated a thorough consideration of the role of Academic Greenspace within daily university life, but less within leisure time or working hours.

Moreover, the sample only included 100 respondents. Given the relatively small sample size, significant correlations need to be treated with caution. For this reason, significant correlations were interpreted rather as trends, without further considering the strengths of association.

In addition to these direct effects, self-reporting bias may have influenced the results indirectly (Althubaiti, 2016). As participants completed the questionnaire sitting in groups of 2–8 students, a mutual influence cannot be disregarded. We are also aware of a weather distortion due to the cross-sectional survey being conducted exclusively in summer. Students spend time in the *Hofgarten* mostly during the summer season, indicating a seasonality of Academic Greenspace experiences. However, focused on an end-of year exam period, our study showed that Academic Greenspace is not only meaningful for students' well-being during breaks on campus, but especially provides support for their well-being and academic success during periods of considerable stress.

This study included primarily quantitative methods, with the exception of a few open-ended qualitative questions included in the questionnaire. For a deeper understanding, more extensive qualitative data gathering, e.g. through in-depth interviews, focus group discussions and participatory approaches, should be adopted in future studies.

Despite these limitations, the present quantitative survey provides valuable insights into the salutogenetic potential of Academic Greenspace, and contributes to a sparse literature on therapeutic experiences on campus.

6. Conclusions

This paper reveals that Academic Greenspace and well-being interact in three significant ways:

- i) By promoting a feeling of detachment from daily stress, Academic Greenspace serves as place of recreation and recovery from concentration fatigue within everyday university life. This restorative effect becomes even more apparent among students engaged in activities that require sustained attention.
- ii) By being an identity-creating element of the campus, Academic Greenspace promotes mental well-being and evokes positive emotions, like happiness and energy.
- iii) As a place of social encounter and inclusion, Academic Greenspace triggers social belonging which, in turn, potentially supports academic success.

All of these implications were integrated into an innovative *Healthy Academic Greenspace Framework (HAGF)* (Fig. 5). Following the *HAGF*, campus Greenspaces need to be considered as spaces for recovery, recreation, interaction and activity which affect students' well-being through symbolic, identity-creating, social, cognitive and emotional experiences (Völker, et al., 2012).

Our study was able to evaluate the extent to which the *Hofgarten* acts as therapeutic landscape in the everyday life of university students, yet only scratches the surface of a wider research area. First, Academic Greenspace may not only constitute a health-promoting resource for students, but also for university staff. Mental health in academic staff was found to be highly correlated with quality of teaching and availability of research grants (Boyd, et al., 2003), demonstrating the potential of Academic Greenspace as a long-term investment in univer-

sity performance. Future research is needed to determine how campus Greenspace as a place of social encounter between students and academic staff might affect student-teacher relationships. In terms of social inclusion, future studies should address perceptions of Academic Greenspace among international students and students from other cultures. As campus Greenspace often takes form as university property freely accessible to the general public, future work should also be directed towards Academic Greenspace as a place of social inclusion beyond university life between academics and diverse population groups.

Thus, the *HAGF* not only provides a foundation for further systematic research approaches aiming to promote well-being in university settings, but also for informing practical public health interventions more widely. We need to better understand how spatial interaction between the 'town' and 'gown' shape experiences of Academic Greenspace through different forms of social relations, meanings and practices beyond the immediate student cohort. Temporary encounters, informal socializing or coordinated and regular activities can create a sense of security and familiarity, and provide opportunities for building stronger community ties by bringing together people from various backgrounds. During our survey, students unanimously approved the *Hofgarten* as a place of social inclusion and identity among like-minded people. However, strong attachments to place and a sense of ownership might potentially cause tensions between different social groups about use and meaning of Academic Greenspace. Activities enjoyed by one group may enhance or interfere with the well-being experienced by other users. Loud music, people exercising or children playing, for example, could lead to frustration among students trying to learn, and the juxtaposition of homeless people or drinking students with young children might be an issue of concern for parents. Healthy campus planning should, therefore, seek to design and manage Academic Greenspace in a way that it promotes the well-being of not only university students and employees. Healthy campus planning and associated management practices need to balance the multiple demands between different user groups as they co-produce Academic Greenspace, opening up a wider field of research (Dinnie, et al., 2013). A health-promoting university campus can help foster social ties and well-being across a city by providing opportunities for recreation, social encounter and identity for both university students and employees and the general public. In this context, it would be particularly worthwhile to compare the contribution of Academic Greenspace to students' and city residents' well-being among different types of university campuses globally, ranging from highly built-up city center campuses with dispersed buildings, like the University of Bonn, to stand-alone campuses in rural settings.

Secondly, future research should seek to uncover underlying causes of health-relevant processes in Academic Greenspace. Interesting insights into the drivers of individual well-being-place-relations could be gained by examining health effects of indirect visual experiences of Greenspace, such as viewing Academic Greenspace out of windows of lecture halls. Not only exploring additional passive forms of Greenspace interaction, but also placing greater emphasis on active use of Academic Greenspace through the involvement of physically active students would help improve our understanding of the way people use Academic Greenspace for well-being experiences.

Longitudinal surveys would be valuable in tracking the significance of Academic Greenspace over the course of the studies, e.g. by analyzing if its therapeutic effects vary among freshmen and senior students, or of an academic term, e.g. by comparing its health-promoting effects between periods of considerable stress and mid-term breaks. Additionally, a methodological triangulation of quantitative measures and in-depth qualitative approaches as well as participatory research would allow for deeper insights into individual health responses to Academic Greenspace. The use of PhotoVoice, for example, may help to discover preferred design criteria to stimulate well-being on campus.

Our multidimensional approach for investigating health-relevant processes in Academic Greenspace reveals the mechanisms by which Academic Greenspace becomes meaningful as a place for experienc-

ing everyday life, and therefore provides the basis for future-oriented, healthy campus planning. As health is expected to be created within the settings of people's everyday life (World Health Organization, 1986), our findings from the *Hofgarten* clearly demonstrate the importance of taking into account non-monetary aspects of health and well-being. Relating the physical-material aspects of the university setting to the social living environment, Academic Greenspace has the ability to stimulate health and well-being in place and academic space (Hanan, 2013). Mental, social and symbolic experiences in academic space, therefore, need to be integrated into campus planning to promote holistic health enhancement in the academic environment.

Declarations of Competing Interest

None.

Acknowledgments

Ethical clearance for the conduct of this study was obtained from the Ethics Committee of the University of Bonn (reference number: 242/16). For the language check we wish to thank Jennifer Lew Schneider. We are particularly grateful to the students who participated in this study and made their data, experiences, and personal statements available for research purposes.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A

Appendix A
Survey Questionnaire.

I – The Hofgarten

- | | |
|---|---------------------------------|
| 1. How often do you visit the Hofgarten during summer? | <i>rarely to often</i> |
| 2. How often do you visit other green spaces during summer? | <i>rarely to often</i> |
| 3. On average, how much time per day do you spend in the Hofgarten on working days? | <i>never to often (> 3h)</i> |
| 4. On average, how much time per day do you spend in the Hofgarten during the weekends? | <i>never to often (> 3h)</i> |
| 5. Why do you <i>usually</i> spend time in the Hofgarten? | |
| - benefiting from time spent in nature | |
| - being alone | |
| - meeting friends | |
| - enjoying the presence of other students | |
| - relaxing during breaks | <i>totally disagree</i> |
| - studying | <i>to totally agree</i> |
| - spending free time | |
| - for physical activity | |
| - walking the dog | |
| - beneficial for my health | |
| - substituting an own garden | |
| - other | |
| 6. Why are you visiting the Hofgarten <i>right now</i> instead of any other green space in Bonn?/ What made you choose visiting the Hofgarten today instead of any other green space in Bonn? | |
| - easy accessibility | <i>totally disagree</i> |
| - proximity to my place of residence | <i>to totally agree</i> |
| - proximity to university | |
| - positive associations with this place | |
| - presence of many students | |
| 7. In your opinion, which role does the Hofgarten play for the image of and life at Bonn University? | |
| - Campus green is a fundamental element shaping the image of a university. | |
| - I consider the Hofgarten is as an identity-creating element of Bonn’s campus. | <i>totally disagree</i> |
| - The Hofgarten was a crucial pull factor for my decision to study in Bonn. | <i>to totally agree</i> |
| - The Hofgarten makes a considerable contribution towards improving my personal well-being on campus. | |
| - The Hofgarten is an important place for recovery during examination phases. | |
| 8. In your opinion, what characteristics make the Hofgarten unique? | <i>open question</i> |

II – Perceived well-being

- | | |
|---|--|
| 1. In general, how satisfied are you with your life? | <i>not at all to very much</i> |
| 2. My health is excellent.
I feel able-bodied.
I do not have enough energy for everyday life. | <i>totally disagree to totally agree</i> |
| 3. Please indicate how much the following areas of life contribute to your well-being. | |
| - school/ work | |
| - family | <i>not at all to very much</i> |
| - marriage/ relationship | |
| - living situation | |
| - financial situation | |
| - leisure activities | |

(continued on next page)

Appendix A (continued)

-
- stay in the Hofgarten
 - sports/physical activity
 - other
4. How often do you suffer from...
- ... tension (e.g. sleep disorder, sweating, cramps)?
 - ... impaired general condition (e.g. fatigue, poor appetite, dizziness, backache, weather sensitivity)?
 - ... time pressure? *rarely to*
 - ... inactivity? *very often*
 - ... a lacking ability to recover?
 - ... heavy course loads?
 - ... concentration difficulties?
 - ... uncertainties regarding your future career?
 - ... inner restlessness?
5. Please estimate your study-related stress level.
- in general *not at all to*
 - during examination phases *very much*
 - during this summer term
6. During this summer term, how often did you feel...
- ... full of energy?
 - ... nervous?
 - ... discouraged? *rarely to*
 - ... calm and relaxed? *very often*
 - ... annoyed?
 - ... exhausted?
 - ... happy?
 - ... lonely?
7. During your current stay in the Hofgarten, how much do you feel...
- ... full of energy?
 - ... nervous?
 - ... discouraged? *totally disagree*
 - ... calm and relaxed? *to totally agree*
 - ... annoyed?
 - ... exhausted?
 - ... happy?
 - ... lonely?
8. Please indicate how much you agree with the following statements.
- A stay in the Hofgarten provides me with the necessary energy for a successful graduation.
 - I have a bad conscience spending time in the Hofgarten instead of learning. *totally disagree*
 - I feel more satisfied and balanced after a stay in the Hofgarten. *to totally agree*
 - I can better concentrate after a break in the Hofgarten.
 - I feel bothered by the presence of other students in the Hofgarten.
 - The presence of other students in the Hofgarten creates a sense of belonging.
9. Please indicate how much you agree with the following statements.
- I have enough exercise on a normal working day.
 - I am satisfied with my level of physical activity. *totally disagree*
 - My level of physical activity positively influences my health. *to totally agree*
 - In my everyday life, I maintain a balance between fulfilling my duties and ensuring sufficient periods of rest.
 - I am able to cope with pressure in stressful situations without feeling weak afterwards.

(continued on next page)

Appendix A (continued)

-
10. Please indicate how satisfied you are with your present well-being in the Hofgarten. *not at all to very much*
11. What influence does the Hofgarten have on your...
 ... personal stress perception?
 ... physical well-being?
 ... academic achievement? *open questions*

III – Personal data

1. Your gender: *male*
female
other
2. Your age: *----- years*
3. Your relationship status: *single*
in a relationship
married
own children
4. Your faculty: *Catholic/ Protestant Theology*
Law and Economics
Medicine
Mathematics and Natural Sciences
Agriculture
Teaching
Other:
5. Your degree: *undergraduate*
graduate
state examination
PhD
6. In which borough do you live? *[map of Bonn to tick borough]*
7. Does your dwelling have a balcony? *yes*
no
8. Please estimate...
 ... how far it is from your dwelling to the closest green space. *< 100 m*
< 500 m
< 1 km
 ... how far you live away from the Hofgarten. *< 2 km*
> 2 km
9. Please estimate how many hours per week you spend ...
 ... in classes. *< 10 h*
11 – 15 h
 ... studying. *16 – 20 h*
 ... working. *21 – 25 h*
> 25 h
-

Appendix B

Sociodemographic and academic profile of survey participants.

<i>Sociodemographic and academic profile of survey participants (n = 100) in the Hofgarten, Bonn (2016).item</i>	n
<i>Gender</i>	
Female	62
Male	38
Total	100
<i>Age</i>	
Minimum	18
Maximum	34
Average	23
<i>Marital status</i>	
Single	52
In a relationship	45
Married	1
Single parent	2
Total	100
<i>Faculty</i>	
Arts	62
Law and Economics	15
Mathematics and Natural Sciences	12
Students of teaching	10
Agriculture	1
Total	100
<i>Distance of residence to Hofgarten</i>	
< 100 m	4
< 500 m	5
< 1 km	13
< 2 km	26
> 2 km	49
Total	97
<i>Academic degree</i>	
undergraduate students	48
graduate students	49
Ph.D. students	2
Total	99
<i>Average duration of stay in Hofgarten on weekdays</i>	
Never	5
≤ 1 h	45
1–2 h	41
up to 3 h	7
> 3 h	2
Total	100
<i>Average duration of stay in Hofgarten at the weekend</i>	
Never	36
≤ 1 h	41
1–2 h	13
up to 3 h	9
> 3 h	1
Total	100
<i>Distance to nearest green space in residential environment</i>	
< 100 m	53
< 500 m	31
< 1 km	10
< 2 km	4
Total	98

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