



2013

Italian piazze: models for public outdoor space in sustainable communities

Mark K. (Mark Kevan) Pederson
Western Washington University

Follow this and additional works at: <https://cedar.wwu.edu/wwuet>



Part of the [Geography Commons](#)

Recommended Citation

Pederson, Mark K. (Mark Kevan), "Italian piazze: models for public outdoor space in sustainable communities" (2013). *WWU Graduate School Collection*. 266.
<https://cedar.wwu.edu/wwuet/266>

This Masters Thesis is brought to you for free and open access by the WWU Graduate and Undergraduate Scholarship at Western CEDAR. It has been accepted for inclusion in WWU Graduate School Collection by an authorized administrator of Western CEDAR. For more information, please contact westerncedar@wwu.edu.

Italian Piazzas: Models for Public Outdoor Space in Sustainable Communities

By

Mark K. Pederson

Accepted in Partial Completion
Of the Requirements for the Degree
Master of Science

Kathleen L. Kitto, Dean of the Graduate School

ADVISORY COMMITTEE

Chair, Dr. Nicholas C. Zaferatos

Dr. Gigi Berardi

Dr. Paul A. Stangl

MASTER'S THESIS

In presenting this thesis in partial fulfillment of the requirements for a master's degree at Western Washington University, I grant to Western Washington University the non-exclusive royalty-free right to archive, reproduce, distribute, and display the thesis in any and all forms, including electronic format, via any digital library mechanisms maintained by WWU.

I represent and warrant this is my original work, and does not infringe or violate any rights of others. I warrant that I have obtained written permissions from the owner of any third party copyrighted material included in these files.

I acknowledge that I retain ownership rights to the copyright of this work, including but not limited to the right to use all or part of this work in future works, such as articles or books.

Library users are granted permission for individual, research and non-commercial reproduction of this work for educational purposes only. Any further digital posting of this document requires specific permission from the author.

Any copying or publication of this thesis for commercial purposes, or for financial gain, is not allowed without my written permission.

Mark K. Pederson

February 15, 2013

Italian Piazzas: Models for Public Outdoor Space in Sustainable Communities

A Thesis
Presented to
The Faculty of
Western Washington University

In Partial Fulfillment
Of the Requirements for the Degree
Master of Science

by
Mark K. Pederson
15 February, 2013

Abstract

Fundamental to the design of sustainable neighborhood spatial units, is an understanding of the relationship between sustainability, public outdoor space, and the production of social capital. Thoughtful and purposefully designed public outdoor space can act as a venue for the production of social capital essential for resilient and sustainable communities. The morphology of a public outdoor space plays a critical role in its success as effective infrastructure for the development of community social capital. This research is concerned with urban public outdoor space and the identification and analysis of the spatial and morphological features which maximize the social utility of that space. These design variables are examined through the physical analysis of a regional group of exemplary Italian piazze. In this study, the U. S. Green Building Council's *L.E.E.D. for Neighborhood Development Rating System* is critically examined and suggestions are made for modifications to its treatment of public outdoor spaces. Preliminarily, the underlying structure of the LEED ND, in regard to the criteria's typology of public outdoor space, is examined and suggestions made for its strengthening. With that typology in place, a systematically selected sample of Italian piazze is used as prototypical of those physical characteristics seen as fundamental to effective public outdoor space. This research focuses on the criticality of planar dimension as a basis for operative public outdoor space design. Also important to a comprehensive understanding of spatial design is the inclusion of other morphological features that contribute to effective public outdoor space. These additional attributes, corner morphology, sectional proportion and planar area, are also examined and evaluated. Specific recommendations are made for improvements in the LEED ND criteria based on the developed typology and the analysis of the shared physical features of the selected piazze. Particular attention is given to those elements in the morphology of effective public outdoor space directly related to the human perceptual experience.

Table of Contents

Abstract	iv
Research Problem	1
Research Methodology	8
Social Capital and Public Outdoor Space	12
The LEED N. D. Rating System and Public Outdoor Space	15
The Concept of Public Outdoor Space through History	21
The History of the Theory of Proportion and Dimension	31
A Modern Theory of Public Outdoor Space Design	43
The Italian Piazze	47
The Theoretical Framework	69
Planar Area	71
Planar Proportion	75
Planar Dimension	79
Corner Morphology	85
Sectional Proportion	90
Theoretical Conclusions	96
Recommendations for Modifications to the LEED ND Criteria	99
Bibliography	107
Figure Attributions	114

List of Maps

Italy Piazzes Locations	01
Italy Piazzes Locations Detail	02

List of Piazzes Planar Drawing and Data Sheets

Piazza Drawings and Data	01-09
--------------------------------	-------

List of Tables

Initial Piazzes List	01
Piazzes Final Study Selections Notations and Geographic Data	02
Piazzes Citation Sources	03
Piazzes Rank Planar Area	04
Planar Area Frequency	05
Piazzes Rank Planar Proportion	06
Planar Proportion Frequency	07
Piazzes Rank Planar Width	08
Planar Width Dimension Frequency	09
Piazzes Corner Morphology	10
Piazzes Sectional Proportion	11
Suggested Public Outdoor Space Typology	12

List of Figures

The Operative Role of Italian Piazzes	01
Ancient Greek Athenian Agora	02
Ancient Roman Forum	03
Cardo and Decumanus	04
Cover, <i>De Architectura</i>	05
Siena, Tuscany	06
Alberti, <i>De re edificatoria</i>	07
Sabbioneta, Lombardy	08
Piazza del Popolo, Rome	09

List of Figures... (cont'd)

.....

Sitte, plans of urban squares in Europe, 1889	10
Aristotle teaching Alexander the Great	11
Vitruvius presents design of the Basilica at Faro	12
Leon Batista Alberti, <i>De pictura</i>	13
Human Eye and Optics	14
Human Cone of Vision and Building Height	15
Sitte's Italian Piazze Diagrams	16
Positive Outdoor Space Diagram	17
Urbino: Piazza Rinascimento	18
Planar Area, Width and Proportion Frequency Histograms	19
Rome: Piazza Mattei	20
Venice: Campo S. Stephano	21
Planar Area Frequency Histogram	22
Pavia: Piazza della Vittoria	23
Lodi: Piazza della Vittoria	24
Planar Proportion Frequency Histogram	25
Equal Areas at Different Proportions	26
Equal Width at Different Proportions	27
Planar Width Dimension Frequency Histogram	28
Sabbioneta: Piazza Ducale	29
Vigevano: Piazza Ducale	30
Todi: Piazza del Popolo e Garibaldi	31
Assisi: Piazza del Commune	32
Four Corner types on a piazza.....	33
Imola: Piazza Vittorio Emanuele (Matteotti)	34
Siena: Piazza Salimbeni	35
Degree of Enclosure	36
Angle of Vision Diagrams	37
Sense of Enclosure Diagrams	38
Determination of Sectional Proportion	39
Attributes of fixed Planar Areas	40
Attributes of fixed Planar Width Dimension	41
Street Penetrations at Corner Locations	42

Research Problem

As increasing population pressures drive an apparent need for continual expansion of the built-environment, a contemporary awareness of the effects of that growth has consequentially increased in our culture. Limited resources, along with the environmental impacts of increasing rates of development and land consumption, are making that expansion prohibitively expensive¹ and unsustainable. In response to this demand for development there is increasing interest in Green infrastructure and building, New Urbanism, and Smart Growth. These emerging principles of urban planning, building, and development have become an important force in an emergent global culture of, what has come to be termed, sustainable planning and architecture.

Sustainability, in a modern context, characterizes a culture's model for development and operation which, in its decision making, utilizes a balance between the elemental competing social, economic and environmental forces shaping its ultimate durability and long-term viability. Several cultures in history have followed this model, albeit perhaps unintentionally. Modern attempts at transforming a culture's character towards a more sustainable model involve deliberate and concerted efforts at changing existing frameworks of decision making. These new paradigms are constructed to accommodate a more enlightened and informed foundation and process for long-term planning based on a more holistic view of cost accounting and resulting impacts. Concepts of sustainability contribute to a broader perspective on a culture, its long-term prospects and its ultimate durability. These new perspectives include factors such as socio-economic equity, economic feasibility which properly accounts for environmental costs and benefits, as well as quality-of-life measures which weigh both social and environmental factors.

Progressing beyond a focus on architecture and individual buildings alone, the current sustainability movement in our culture has now concerned itself with the larger scale urban

¹ Expensive when considered within a framework requiring that all externalized costs be accurately accounted for.

elements shaping the built-environment. With this shift in scope from discrete buildings to neighborhood spatial units, the new *L.E.E.D. for Neighborhood Development Rating System* recognizes public outdoor space (p.o.s.) as an essential element in the creation of sustainable communities. This new set of criteria includes recommendations for the design of these spaces as essential settings for the production of social capital in neighborhoods. In what appears to be an effort to provide a concise set of design guidelines, much potentially useful common knowledge in the theory and practice of architecture and urban design is disregarded.

The purpose of this study is to inform further development of more effective public outdoor space design criteria. The research proposes an approach more representative of the multi-faceted nature of the human experience in the built-environment grounded on the analysis of historic examples. The purpose of public outdoor space in neighborhoods is integral to the important role the production of social capital plays in facilitating the collective behaviors essential to the goals of sustainability in an urban context. Those concepts will be briefly explored as a foundation for the relationship between Italian Piazza morphology and the LEED ND program's approach to the design of p.o.s.

An examination of the *L.E.E.D. for Neighborhood Development Rating System* design criteria provides the initial framework for a discussion of planar proportion and dimension as components in the design of public outdoor space. That criteria uses the morphological characteristic of planar proportion as the singular basis for recommended public outdoor space design. This research will propose that there are other, more significant, physical characteristics of p.o.s. which contribute more consistently to the ability of the space to facilitate the human use and comfort in an outdoor-room.²

By comparing a large number of example Italian piazze and analyzing their morphology, the study demonstrates and explains the importance of planar dimension, as well as corner

² Outdoor rooms are exterior space clearly defined by the surrounding built environment with a strong sense of enclosure.

conditions and sectional proportion³, as more operationally significant than mere planar proportion in the formulation of effective⁴ public outdoor space.

For the purposes of this research, public outdoor space will be considered effective, if it operates as a sociopetal⁵ and comfortable environment for human use and as an inviting venue for human activity. Through these characteristics, the space should be operative as a stage for the production of social capital⁶ thereby contributing to the public health of the neighborhood or community at large.

In order that the analysis be well grounded in the discourse of urban design, a history of the concept of public outdoor space, and the theory of dimension and proportion, as design determinants, are then explored. With that foundation of history, theory, and standards of contemporary practice (LEED ND criteria) in place, an analysis of the dimensional, proportional, and morphological characteristics associated with a selected group of Italian piazze is then presented. Through examination of the common physical characteristics of these piazze models, some understanding of the as-built implications of the theoretical metric recommendations is developed. From the data, some insight into the comparative importance of, and the relationships between, the morphological characteristics is pursued.

The history of the built-environment serves as a source of inspiration to contemporary designers and provides models of effective design which underlie the principals and standards of the theory and practice of architecture and urban design. Italian piazze have

³ Sectional proportion is the proportional relationship between the planar dimension which is perpendicular to a façade and the height of that façade which faces an enclosed outdoor space.

⁴Effective p.o.s. is supportive of the development of community-based social relationships leading to individual behaviors enabling to collective sustainable neighborhood initiatives.

⁵ Sociopetal p.o.s. is designed to encourage socialization through opportunities for interaction among occupants, antonym –sociofugal.

⁶ Social capital being the theoretical value of social relationships produced in a community, the production of which is useful in the facilitation of cooperative and collective action promoting the welfare of the community and individuals within it.
"Social Capital: social networks and the norms of trust and reciprocity that flourish through these networks." (Sander 2006)

served as prototypes for urban outdoor space since the work of Sitte (1889) and through the discourse of the last 100 years, most recently including: Lynch (1979), Krier (1979), and the New Urbanists. The continuous popular use of piazze as archetypes validates the piazze as credible models for urban public outdoor space design.

This research looks to the historical prototypes of Italian piazze as a resource to inform a more complete spatial design analysis of public outdoor space. A large group of piazze was selected based on their ubiquity in the literature of urban design in the Modern period. The study identifies those piazze most frequently mentioned by theoreticians of urban design as models for operative p.o.s. design. This group of prototypical piazze is the basis for the development of a series of measures objectifying dimension, proportion, and morphology in the built-environment.

It is clear from an analysis of piazze that the basis for operative outdoor public space is not one-dimensional but rather a complex formula with several variables. Architects and urban designers have learned, by both example and experience, that culture, dimension, building morphology, and human perceptual experience, as well as proportion, all play an operative role in the design and use of any space by humans. Planar proportion is only one of many necessary, but not sufficient, conditions for useful and popular public outdoor space.

The human experience in these outdoor spaces is perceived and limited by the sensory collectors of the human body and shaped by the parameters of those physiological systems. For example, the maximum visual acuity distance associated with the recognition of another human face might be related to a feeling of comfort and sanctuary in a public outdoor space. From this perspective it may be theorized that, rather than planar proportion, the actual planar⁷ dimensions are critical elements in the formulation of appropriate space attractive to human habitation.

⁷ Planar space being two dimensional space as related to the ground plane.

Additionally, details of a space's building typology and morphology⁸, the analysis of its formal physical properties, are critical elements in the design and performance of public outdoor space as outdoor-rooms. In the case of Italian piazze, the morphological conditions at the piazza corners are critical in the creation of a sense-of-enclosure. Sectional proportion⁹ also plays a significant role in the strength of the enclosure created by the piazza's physiognomy. The relationship between the height of the surrounding buildings and the piazza's planar dimensions can be critical in shaping the human perception of enclosure.

The individual building components, as well, play a role in the character and public use of spaces. Public outdoor space is dependent on frequent intensive human occupancy for its success and this can be encouraged by a mixed-use building typology. Most of the model piazze have specific plan and sectional characteristics which encourage intense mixed-use and the juxtaposition of building facades with significantly differing heights. Any standard imposing a single standardized planar proportion on a space implies uniformity not usually associated with lively human-scaled design. More typically, a space created to serve its occupants is, to some extent, a reflection of the particularities of the program-specific situation.

Expanding the formula for public outdoor space, from a singular concern with planar proportion to the inclusion of several other morphological characteristics, creates a more complex and accurate design model. Human experience in the space can then be understood as a result of the synergy of all the attributes. As a dynamic model, this paradigm would likely result in a more robust and resilient prototype, improving the subject space's performance as an outdoor-room, and facilitating the production of social capital.

⁸ Characteristics of the formation and transformation of urban form and structure are termed morphology and are often analyzed using figure-ground drawings.

⁹ The geometric relationship between the horizontal planar dimension and the apparent vertical height dimension of an enclosed space is identified as sectional proportion.

Before the principles of public outdoor space derived from the study of piazze can be applied to the *LEED ND Rating System*, a clear and consistent typology of p.o.s. needs to be formulated, providing a credible structure for the rating system and its criteria. The criteria, as they now read, are not taxonomically rational, with much confusion on the types of p.o.s. This needs correction before integration of any further design insight will be meaningful.

There is a need for a more critically informed basis for design standards regarding public outdoor space. The LEED ND criteria may benefit from a more thoughtful foundation for its recommendations. This research intends to collect a set of data from which some useful conclusions might be drawn concerning the most significant operative elements in the morphology of sociopetal p.o.s. The purpose of this effort is to facilitate more useful criteria for the design of p.o.s., with particular reference to the LEED ND program.

The following schematic diagram (figure 01) and suppositions represent the basis for the arguments put forth by this thesis:

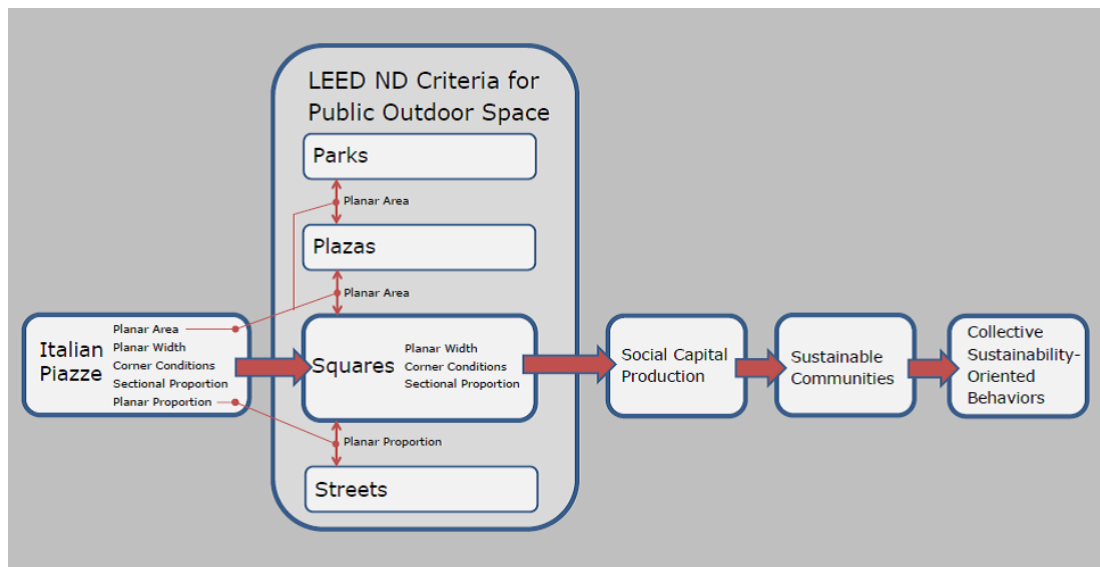


Figure 01. The Operative Role of Italian Piazze in the Development of Collective Sustainability-Oriented Behaviors

- The world is facing a dual crisis of depleted resources and changes in climate, both of which demand transitions to more sustainable, resilient and community-based collective behaviors.

- The design of communities can respond to the current environmental crises by creating morphologies more supportive of individual behaviors which are, in the context of the community, more collective and sustainable as well as resilient.
- One component in the potential sustainability of a community is its production of social capital, as a means to the development of collective behaviors.
- One of the most effective venues for social capital production is community public outdoor space. Sociopetal p.o.s. design facilitates the human interactions instrumental in the development of community-based relationships.
- The LEED Neighborhood Development criteria are a constructive tool for the implementation of the goals related to community resilience and sustainability. The rating system recognizes public outdoor space as a component in its overall systematic approach to encouraging a substantial progressive change in the design of neighborhood spatial units.
- Through the clarification of the taxonomy underlying the LEED ND criteria of public outdoor space, a typology should be developed distinguishing Squares from Streets, Parks, and Plazas. Through the use of this typology, improvements can be made in the relevance and applicability of the specific portions of the rating system.
- Italian Piazze have, historically been prototypes for public outdoor space design of the Square typology. By analyzing a large sample of prototypical piazza, knowledge applicable to the design of p.o.s. may be incorporated into the LEED ND criteria for p.o.s.

Research Methodology

This research is both qualitative and quantitative in type, with the two approaches respectively utilized to investigate both the subjective and objective aspects of the topic. Issues related to design methodology, history, and theory of public outdoor space and their relationship to concerns of sustainability and social capital, are investigated as appropriate to the character of the variable. This methodology allows for a more complete insight into the multifaceted challenges of urban design in the context of historical theory and precedent, as well as resilience and sustainability. Underlying the research are theories related to human visual acuity as acultural determinants of the effectiveness of p.o.s. design. The dual-approach seeks to find a merging of the complementary disciplines involved in the successful conceptualization and design of p.o.s.

As a basis for investigating the characteristics of effective public outdoor space, this work is grounded on a thorough survey, cataloging, and spatial evaluation of a large group of Italian piazze. The study will review and analyze the planar proportional and dimensional measures for the sample piazze and then examine the more subjective morphological factors contributing to the multifaceted nature of effective p.o.s. The research aims to clarify the theoretical issue of dimension versus proportion as a fundamental element in spatial design of piazze. Also examined is the operational interaction of these and other features of spatial design in existing built environments and their contexts.

The presented data of the study will focus on a set of four criteria developed to reveal each particular piazza's qualities contributing to a sense-of-enclosure and strength of performance as an outdoor-room, both important to the development of social capital. Because the selected piazza are extremely diverse in their dates of origin, functional and economic genesis, current use, and intermittent change in physical form, as well as functional purpose, they are somewhat operationally uncomparable at this point in time. By limiting the inquiry to easily quantifiable physical characteristics, it is intended that some

common, basic, and enduring morphological characteristics of these outdoor venues for human social interaction can be discovered.

In pursuit of a morphological understanding of the piazze, figure-ground drawings were prepared using scaled aerial photos and a computer illustration application. Planar scaled diagrams of each piazza were then prepared, again utilizing aerial photos imported into a computer modeling application with dimensional data extracted from those diagrams. The dimensional accuracy of these diagrams was verified by making actual on-site measurements of five sample piazze on-site in Italy utilizing a laser measuring device. Measurements were taken from the diagrams and sorted for rank order and frequency for each of the 50 piazze as related to:

- Planar area of the enclosed piazza space,
- Planar length and width (narrow) dimension of that area of enclosed space,
- Ratio or proportion of the planar length to width dimensions,
- Ratio or proportion of the least dimension of the enclosed space (width) to the height (in some cases an approximate subjective mean dimension),
- Strength of the corner morphology determined using a rating system for typical conditions at the corners.

The study has two components, first, a review and analysis of the planar proportional and dimensional data for the selected piazze, and secondly, a study analysis of certain morphological characteristics comprising the multifaceted nature of effective public outdoor space. The analysis focuses on either verifying the validity of planar proportion as the critical feature of operative public outdoor space design or revealing that a particular range of dimension is a more consistent characteristic of successful piazze as containers and facilitators of human activity.

Of particular interest is how the strength of some features can compensate for weakness in others in the production of well-designed p.o.s. (public outdoor space), and how some

components are necessary but not sufficient while others may be unnecessary but contributing as variables in this complex formula for piazzas. The study examines the theoretical issue of dimension versus proportion as necessary elements in spatial design of piazzas. This research looks in detail at how these and other features of space design interact in an actual existing three dimensional constructed environment and its context.

The characteristics of spatial perception common to the human visual capability provide the basis for the analysis. An attempt is made to explain the phenomenon of human comfort in the piazza through an understanding of the common physiological attributes and limits of human vision and that particular sensory experience. The relationship between outdoor public space morphology and human visual acuity is examined both qualitatively and quantitatively in the research. Being pursued here is some universal, acultural, human basis of participation in the sensory experience of being comfortable in a p.o.s.

This research will examine the perceptual issues in more detail and will incorporate specific examples from the piazza prototypes to test and illustrate the theory. As a basis for determining a range of planar dimensions fundamental to sociopetal public outdoor space, this research relies on the work of Hans Blumenfeld and Hermann Maertens. Some of these issues are introduced in a cursory manner in the groundbreaking work on design of the built-environmental, *A Pattern Language* (Alexander et al, 1977). Their theories concerning human visual acuity, and the recognition of human facial features as a basis for human spatial comfort, have been briefly mentioned by Alexander as a basis for dimensions of outdoor space. Through an analysis of the planar dimensions of the example piazzas, this research investigates the validity of the dimensions postulated by Blumenfeld and Maertens and as applied to the design of p.o.s. by Alexander.

While more difficult to objectify, quantify, and regulate, cultural determinants of spatial frameworks for human behavior in p.o.s. also need to be considered in any comprehensive

view of the design parameters involved. Additionally, local climatological¹⁰ factors clearly play a major part in the human use of any space, particularly in outdoor locations. These factors, while outside the morphological focus of this study, play an important role in the human enjoyment and use of any p.o.s. and certainly merit further research.

¹⁰ Climatological factors are conditions related to weather characteristics typical to a region or specific site and accounted for over a long time period.

Social Capital and Public Outdoor Space

As a response to the rapidly developing challenges of the sustainability movement, the increasingly apparent impacts of fossil fuel consumption on public health, as well as the emerging issues of global climate change, the role of collective community-based behaviors is receiving increasing recognition. One conceptual tool in understanding the operative nature of community responses to these issues is the socio-economic concept of social capital enhancement or production:

Social Capital refers to the norms and networks that enable collective action. It encompasses institutions, relationships, and customs that shape the quality and quantity of a society's social interactions. Increasing evidence shows that social capital is critical for societies to prosper economically and for development to be sustainable. (Resources)

The production of social capital, as an essential component in the broader landscape of solutions to these pressing environmental problems, is the subject of a current nexus of research in the disciplines of economics, sociology, urban design, and anthropology. The research into social capital, as a heretofore unrecognized factor in the operative social development and evolution of communities within this culture, is focused on the quality of social interactions within a societal unit.

In his analysis of the phenomenon of social capital and its relationship to New Urbanism, Thomas Sander, Executive Director of the "Saguaro Seminar: Civic Engagement in America," at the John F. Kennedy School of Government at Harvard University, observes the dynamics of social capital and networks and how they enhance community well-being. "First, they facilitate mobilizing others . . . Second, they improve information flow . . . Third, the existence of trust avoids the necessity of a third-party mechanism (such as government or a lawyer) to reinforce pro-social cooperative behavior. Fourth, in a trusting community, residents engage less in unproductive defensive behavior . . ." (Sander 214).

Collective action by individuals within a community context, with an emphasis on cooperative and collaborative lifestyles and choices may be one valid basis for a sustainable and resilient response to current environmental challenges. A significant component in the institutionalized difficulty our culture has in effectively responding to large-scale hazards may be our isolated and individuated lifestyles. This lack of community-based identity may be engendered by our existing urban and suburban morphologies, lacking effective community venues for social capital formation.

Public outdoor space is the community stage for the social activity which is the foundation for creation of social capital. Clearly, one potential contribution of neighborhood and urban design to the resolution of sustainability issues is the fostering of social capital production through properly designed public outdoor space. In the paper "Does Public Space Create Social Capital?" by Dr. Akram M. Ijla, the concept is succinctly explained:

Designing urban spaces that encourage social activity establishes an image of collective (and not isolated) social life . . . Public spaces have the potential to bring people into contact with each other if the space is designed with a focus on beauty and activity. Urban space has to become a place where people enjoy spending their free time and sharing their common interests with others in that space. This interaction gives these public spaces the ethical and aesthetic power to build the social capital that underscores the stability of society . . . The issue for urban planners . . . is how to design the needed public spaces. (Ijla 49)

It would seem prudent that any new criteria for sustainable neighborhoods and communities would include a robust and comprehensive initiative to encourage effective community scaled public outdoor space design. Such spaces would need design features specifically intended to facilitate their human use, as a catalyst for the types of collective community-based behaviors associated with the production of social capital and sustainable communities. The *LEED Neighborhood Development Rating System* may be able to provide

effective design leadership, as was the case with the LEED efforts in regard to individual buildings. With some taxonomic restructuring and a more vigorous approach, inclusive of a more comprehensive range of morphological contributors to effective public outdoor space, LEED ND could set a modern standard for urban design. The LEED Neighborhood Development program might prove pivotal in reshaping our urban built-environment to be more amenable to, and supportive of, sustainable and resilient community behaviors based on effective production of social capital.

The LEED N. D. Rating System and Public Outdoor Space

The U.S. Green Building Council's recently created *L.E.E.D. Neighborhood Development Rating System* provides criteria to evaluate the sustainability of new development on the neighborhood spatial unit scale. As a part of this broader view of the built-environment, some of the spaces between buildings have now been included in the LEED rating system as designated public outdoor spaces. Discrete public outdoor spaces are now recognized as integral to sustainable neighborhood development.

While the recognition of the importance of public outdoor space is essential to any design criteria for sustainable communities, the LEED rating system includes p.o.s. in a somewhat unmethodical manner. Two sections of the LEED ND system are written to encourage p.o.s. Under the "Neighborhood Pattern and Design Prerequisites," there is some language concerning public outdoor space as related to the design of a "street, square, park, paseo, or plaza" ¹¹ (USGBC 41). Further, in the "Access to Civic and Public Space" provisions, criteria are outlined for any "square, park, or plaza" (USGBC 41). There is considerable confusion within and between these two sections of the LEED ND Standard in regard to the distinction between the five¹² mentioned types of p.o.s.

A very clear differentiation is usually made by urban designers between streets and squares or plazas, not only in their morphology but also in their functional dynamics and performance. They work in completely different ways as successful as urban spaces. Conceptually, streets are designed to facilitate movement, piazzas or squares are intended to encourage pause. Morphologically, streets are typically linear and open-ended, squares

¹¹ Design and build the *project* to achieve all of the following:
a. For 90% of new building frontage, a principal *functional entry* on the front façade faces a public space, such as a street, square, park, paseo, or plaza, but not a parking lot, and is connected to sidewalks or equivalent provisions for walking. The square, park, or plaza must be at least 50 feet wide at a point perpendicular to each entry. (USGBC, 2009, 41)

¹² Types including: square, park, street, paseo, and plaza.

are usually nodal and enclosed. The typologies are functionally distinct and merit separate treatment in any prescriptive consideration.

There is also a lack of taxonomic clarity between and within the types of public outdoor space in the LEED standard. The "Neighborhood Pattern and Design" section specifically includes under the criteria for "Walkable Streets" (Prerequisite 1):

. . . general recreational spaces, intended to promote transportation efficiency, including reduced *vehicle miles traveled* (VMT). To promote walking by providing safe, appealing, and comfortable *street* environments that support public health by reducing pedestrian injuries and encouraging daily physical activity. (USGBC 41)

While very important for the encouragement of urban design elements contributing to walkable and human scaled¹³ streets, these standards have very limited applicability to the typologically distinct case of enclosed public outdoor space.

The subsequent "Access to Civic and Public Space" (Credit 9) section of the LEED ND criteria includes those types conceived and designed to: ". . . improve physical and mental health and social capital by providing a variety of open spaces close to work and home to facilitate social networking, civic engagement, physical activity, and time spent outdoors" (USGBC 67). Additionally, the "Public Space" section includes not only squares and plazas but also, anomalously, parks. It is not clear that general recreation spaces have the same type of sustainability purpose as those devoted to more specific civic and social functions. Taxonomically, these uses may not exist in the same category of public outdoor spaces.

There seems to be some confusion in the standard between streets, squares, and parks, and their roles as public outdoor space in communities. It would seem that, in spite of the typologies commonly used for street, square, park, paseo, or plaza, the LEED ND criterion treat the types of public outdoor space as interchangeable and without specific meaning in

¹³ Human scaled elements of the built-environment are those which are defined by that set of physical characteristics related by dimensional quality to the [human](#) body and its sensory capabilities.

regard to morphology or function. This is an obvious problem when it comes to setting standards for the design of such spaces. There is a fundamental need to typologically define and categorically organize a limited set of p.o.s. types and use those types consistently in any standard.

Before examining the specifics of the LEED ND criteria in regard to morphology, these taxonomic vagaries will need clarification. The focus of this research will be only the "Neighborhood Pattern and Design, Credit 9, Access to Civic and Public Space" criteria of the LEED ND system and its inclusion of squares and plazas in their stated applicability "To improve physical and mental health and social capital . . . to facilitate social networking, civic engagement" (USGBC 67). The apparent taxonomic oversights aside, the stated functional characteristics of this type of p.o.s., as related to the production of social capital, might place it in the same subset of public outdoor spaces as Italian Piazza. The stated social intention of LEED ND in the "Access to Civic and Public Space" section is the concept of p.o.s. design contributing to the sustainability and resilience of neighborhoods.

Under the "Access to Civic and Public Space" provisions of the LEED document, a less than transparent system is used to set a standard of design for outdoor public space. The "LEED ND Neighborhood Pattern and Design Credit" exclusively recognizes issues of planar scale and proportion, albeit in a less than robust manner: "Spaces less than 1 acre must have a proportion no narrower than 1 unit of width to 4 units of length. AND For projects larger than 7 acres, locate and/or design the project such that the median size of civic or passive-use spaces within and/or contiguous to the project is at least 1/2 acre." (USGBC 67)

The LEED standard seems to overlook much common knowledge in the theory and practice of architecture and urban design regarding the design of public outdoor space. Operative p. o. s. may best implement sustainable community design principles if based, not only on location, size, and connectivity, but also on an awareness of the basic principles inherent in the design of space for human occupancy.

LEED ND and its specific metrics, under further scrutiny, reveal more dimensional prescriptive content than is obvious on first reading. All affected public outdoor space is required to be more than 1/6 of an acre (43,560 square feet/6 = 7,260 sf) in planar area and, if less than an acre, shall be proportioned in plan such that the narrowest dimension is greater than 25% of the longer dimension. Each p.o.s. is to be within a quarter mile walking distance of most development, in other words, each p.o.s., assuming minimum walking distances, has a catchment area of approximately (1/4 mile = 1,320 linear feet, $3.14 (1,320)^2 = 5,471,136 \text{ sf} / 43,560 =$) 125 acres. The intent here may be to provide network of p.o.s. scaled in its dispersion to a reasonable walking distance within a community at the neighborhood scale.

Furthermore, the median (middle number) size of public outdoor space is required to be at least 1/2 acre or 21,780 sf, if the development is larger than 7 acres. The operative usefulness of this criterion is not clear, since there is no requirement that would result in multiple p.o.s. locations in a single development of less than 125 acres and a single numerical value cannot have a median value. Since p.o.s. greater than 1 acre is exempt from the standard, it must be assumed that the LEED ND authors do not think that proportional standards are applicable at that scale. That assumption may be unfounded.

The range in planar area established for public outdoor space regulated for planar proportion is from 1/6 acre (7,260 sf) to 1 acre (43,560 sf), with some intermediate area standard of 1/2 acre (21,780 sf). The following values can be induced for the three cases:

L.E.E.D. N.D. Planar Dimension Standards			
Case	Area	Minimum Width	Maximum Width($\sqrt{\text{area}}$)
1	1/6 acre - 7,260 sf	42' (x 173')	85'
2	1/2 acre - 21,780 sf	74' (x 294')	148'
3	1 acre - 43,560 sf	104' (x 419')	209'

The possible range for the lesser dimension of public outdoor space, under the LEED ND criteria, is from 42' to 209'. That range is very broad, with the maximum value being five times larger than the minimum, and may be less than useful as an architectural dimensional standard related to human perception and use. The parameters of operational human perception are much more focused and specific than the metric would suggest. It seems that the only planar aspect of concern in the standard, that is, the 4:1 proportion, is somehow exclusively functional as a minimum for successful p.o.s. without regard to the scale of the dimensions. Furthermore, proportion is the only morphological attribute considered for p.o.s. design under the LEED ND criteria, with inattention to issues of specific preferable dimensional ranges and other more complex morphological features.

Upon a careful reading and analysis, several questions regarding the LEED ND criteria become apparent:

- Is 1/6 of an acre a valid minimum area for public outdoor space? Is 7 acres a meaningful project size to trigger additional requirements?
- Is 1/ 2 acre actually the optimal size for the most common p.o.s. meeting the standard?
- Is the exclusion of p.o.s. over 1 acre from the standard typologically correct?
- And, most importantly, is planar proportion, rather than dimension, the most important planar metric determining the quality of the human experience in p.o.s.? If that is the case, is 1:4 the appropriate proportion to specify as a minimum width related to length?

This research focuses on the last question, regarding proportion, dimension, and human use and perception of public outdoor space. The application of specific planar proportions, exclusive of dimensional character, as an isolated component in the design and evaluation of successful public outdoor space merits careful consideration. Before proportion can be validly incorporated into a design standard, there is a need to thoroughly examine other

contributors to successful exterior spaces which have been historically identified and analyzed. Ignoring all other factors, in what is surely a more complicated equation, may result in erroneous spatial design solutions and a uniform series of public outdoor spaces not effectively operating as inviting venues for human activity fostering the production of social capital.

The LEED standard, exclusively concerned with proportion without attention to other characteristics of the space, ignores much common knowledge in the theory and practice of architecture and urban design regarding the characteristics of public outdoor space. Operative p.o.s. will best implement sustainable community design principles if based, not only on location, size, and connectivity, but also on an awareness of the basic principles inherent in the design of space for human occupancy.

Finally, after navigating the LEED ND criteria for public outdoor space and meeting the requirements, a single point (out of a possible 100) is awarded to the project for compliance. In consideration of the significance of p.o.s. as a venue in neighborhoods for the production of social capital, this single point award seems incongruous with the broader goals of the rating system. Considering the important roll p.o.s. plays in the development of social capital and other adaptive collective community behaviors, a more significant award within the rating system for the inclusion of designated p.o.s. in neighborhood development would seem appropriate. The consideration of public outdoor space as a Prerequisite within the rating system, as well as an increase in the potential points awarded, seems warranted in light of the criteria's importance as a vehicle for meeting the current environmental crises through facilitation of collective community behaviors.

After an analysis of the LEED ND standard, and before reviewing the morphological characteristics of the Italian piazze, it is important to more comprehensively understand the concept of public outdoor space and its history.

The Concept of Public Outdoor Space through History

This thesis is concerned with some of the morphological characteristics of urban public outdoor space. As a foundation for this study of p. o. s. and Italian piazze, the origins and history of the concepts involved will first be examined. Attention to the “space between buildings” (Gehl 1987) has been a critical element in the morphology of the urban environment since the ancient Greeks built their cities. Exterior public space design has now again become a principal concern of architects and planners as essential to building sustainable neighborhoods and communities. There is much to learn from these earlier attempts at design of effective p.o.s. and the multitude of built examples which followed.

The history of Italian piazze and public outdoor space actually starts with the Ancient Greeks and their apparent origination of the formal concept. The Greek idea was expanded upon and given formal theoretical presence by the subsequent Roman Empire. During the medieval era in history, the piazza took on a very different physical form, while serving very similar functions as government and populations were dispersed from the Roman cities. With the Renaissance, much attention to the formal geometric qualities of piazze produced many ideal solutions to the spatial design aspect of p.o.s., as well as a theoretical discourse on the problem. The Baroque period generally turned from the design of discrete exterior space to the creation of larger scale urban sites. It is not until the 18th century and Camillo Sitte that the theoretical analysis of piazze is revisited and introduced into the modern discourse on urban design.

- Ancient Greece

The idea of an exterior space conceived, developed, constructed and maintained by a government for the exclusive use of its citizens, for common purposes, is thought to have been pursued early in ancient history and successfully executed in the 5th century B.C.E. Public outdoor space, as an identifiable phenomenon, occurring within the morphology of an urban built-environment, was probably first fully developed in Hellenistic period of Ancient

Greek planning history. For the most part, Greek town planning consisted of the disposition of individual buildings without particular regard to the creation of enclosed exterior spaces. The construction of an Acropolis within an urban context was predicated on the existing topographical features and, existing or historically significant or sacred, former structures. The positioning or design of buildings with the purpose of enclosing or enhancing a public outdoor space is not evident. The sacred nature of the Acropolis and its site precluded evolution of its morphology and creation of elements serving the developing human need for community market and social space. Paul Zucker discusses the Greek conception of outdoors pace in his analysis of outdoor space, *Town and Square: From the Agora to the Village Green*:

Space as such was neither felt aesthetically nor formed artistically from Archaic Greek times through the sixth century B. C. Generally the desire for shaping space developed only very slowly after 500 B.C., steadily increasing in Hellenistic times until its culmination in Roman architecture and town planning, when it becomes the aesthetically decisive factor (Zucker 28).

The conception, and the subsequent appearance of the Agora (figure 02), public space focused on the economic and political activity of the town separate from the Acropolis, appears later in Ancient Greek

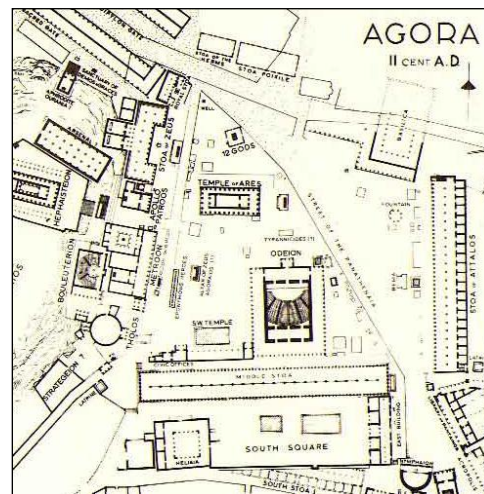


Figure 02, a & b.
Ancient Greek Athenian Agora

history. Agorae exist as an identifiable element in the archeologically reconstructed cities of the archaic period, occurring from the end of the 8th century to the beginning of the 5th century B.C.E. In contrast with the Acropolis, the Agora was a dynamic, functional outdoor space created and changed in continuous response to the needs of the polis.

By the time of 500 B.C.E., the Greek planner Hippodamus of Miletus was laying out towns and neighborhoods based on a geometric grid, thereby introducing the idea of comprehensive town planning. As one of the elements included in Greek planning, the Agora, and its form as a public outdoor space, is formalized as the economic and political heart of the planned town. A regular, rectangular, enclosed outdoor space as the focus of human activity began to become the standard for towns from the 5th century on. In contrast to Acropoleis and previous Agorae, individual buildings and sacred sites are not the focus of planning of space for public use. "The single structures surrounding it (the Agora) were architecturally subordinated to the idea of the enclosed space as a whole" (Zucker 36). "Essentially, though, it was the idea of massing buildings to form spatial enclosure that bound the parts into the whole" (Spreiregen 4).

Beginning with the first occurrence of the enclosed space for civic use by the Hellenistic Greek civilization, the physical existence of the phenomenon preceded its theoretical analysis and understanding. It was, perhaps, the Romans who first understood the power associated with the concept of a civic space shaped and controlled by the government and who first advanced theory on its design and use. One might say that while the Greek Agora occurred, the Roman Forum was designed.

- Ancient Rome

From the inclusion of public outdoor space, in the form of an Agora, in the master planning of Greek cities, the next significant development leading to the phenomena of the piazza is the Roman planning and design of the Forum (figure 03). The Romans took the Greek's idea of p.o.s. and gave it concrete existence,

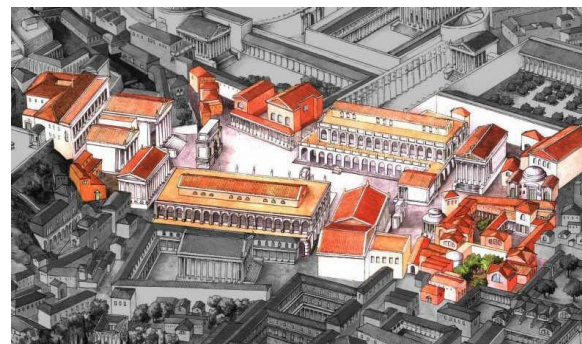


Figure 03. Ancient Roman Forum

consciously shaping the more amorphous Greek Agora into a discrete form which was as operationally significant as the buildings enclosing it. As Zucker points out, "The creation of

space, consciously handled and molded as such by three-dimensional design as the primary decisive task of the planner, was achieved by the Romans . . ." (Zucker 45)

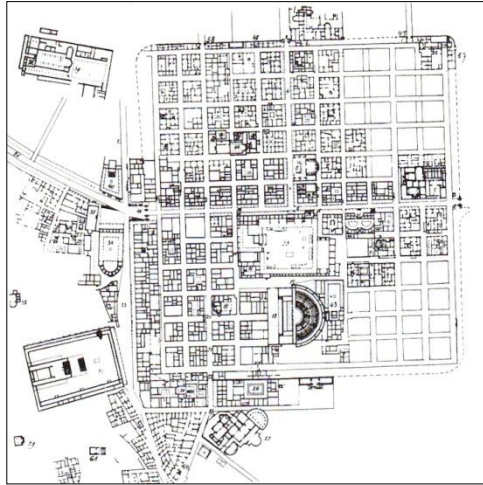


Figure 04. Cardo and Decumanus: the main north-south and east-west axes of a Roman city, Sofia

Towns which were planned and constructed by the Romans in Italy from the 5th century B.C.E. and later, included a cross axis of roads (cardo and decumanus) at the town center with a void at the axis location in the plat for a town square or forum (figure 04). In Italy many of these ancient Roman town layouts are still the basis for the existent town plan (Piacenza, Aosta, and Verona, for example).

These cases exemplify an integration of the design of the public space and the planning of the surrounding town. The town center or piazze and its form were a reflection of the contextual morphology of the surroundings and were intentionally planned for.

It was a Roman, Marcus Vitruvius Pollio (80 B.C.E. -15 B.C.E.), an architect-engineer and theorist who was the author of the books, *On Architecture* ("De Architectura"), "The Ten Books on Architecture". This work (figure 05) included the first theoretical works on architecture and urban design of which scholars have knowledge and which survive from classical time. Along with a diverse array of theory and observation on many subjects related to architecture, Vitruvius provides the first commentary and theory concerning the idea of public outdoor space. His most important theoretical constructs in the outdoor space aspect of architecture include the overarching relationship between the design characteristics of exterior space and the human occupation and use of that space. Additionally he initiates



Figure 05. Cover, De Architectura Marcus Vitruvius Pollio

the discourse, which continues today, on the planar proportions of outdoor space and the relationship between proportion and dimension.

- Medieval

With the waning of the Roman civilization, the theoretical foundation for the conception of public outdoor space, as exemplified by Vitruvius, expires and practical and ordinary functional considerations take precedence over broader issues of state image-building and engineering. Many medieval towns in Italy were expansions of existing Roman towns with the former plan geometries evident in the medieval morphologies while many were new developments at sites of existing churches or castles, as well as trading sites. As a result, there is a sharp contrast between the form of the p.o.s. sited on a former Roman grid and the more random and spontaneous spaces which grew incrementally on the new urban sites, with little or no long-term planning. The resulting examples are so diverse in the range of their morphological typologies that any formal analysis is difficult. It is clear that the singular Roman attention to exterior spatial design and intention to control human occupation and perception of p.o.s. is lacking in the instance of most medieval towns.

Nevertheless, many beautiful and socially functional spaces in which humans experience high levels of comfort are medieval in period. They may be a result of incorporation of cultural predispositions and a more vernacular approach to design as opposed to the predisposed Roman intent to control and shape outdoor space to serve a specific purpose. As these medieval spaces evolved over hundreds of years their formal qualities were often shaped by several intermittent instances of contribution to an overall design by individual new buildings or the remodeling of existing buildings to alter the experiential functioning of the piazza. These towns and their piazze are, by default, very human in scale and character with their relative lack of large-scale and long-term theoretical based planning or design.

In his survey of architectural urban design practice, *Urban Design: The Architecture of Towns and Cities* (1965), the modern architect and urban design theorist Paul Spreiregen, discusses and describes the urban spaces of medieval towns. "Intellectualized or abstract theories of urban design help little in understanding the medieval town. Geometric drawings scarcely portray them. These towns are too immediate, tangible, and personal." (Spreiregen 10)



Figure 06, a & b. Siena, Tuscany

Siena, Italy (figure 06), is often cited as a town most exemplifying the characteristics of medieval urban design; small local and larger main squares linked as a part of a system of minimally dimensioned streets following the topography of the site. Again, Spreiregen, characterizes the medieval town in his narrative describing Siena:

The variety of sights of the town is enormous, yet the overall impression is unified by the constant interplay of the basic themes: open space and closed space; narrow, winding streets lined with shops and opening into private courtyards; . . . the relatively small size of the town; the frequent and dazzling vistas into the surrounding countryside; and, not the least, the flow of familiar people everywhere. (Spreiregen 10).

- Renaissance

It was with the Renaissance that the design of public outdoor space returned to the Roman ideal of comprehensive consideration and creation of distinct space with purpose and

technique consciously at play in the creation of a definitive design. Theory is at the center of public outdoor space design, both in the purpose-built construction of new space or the remodeling and transformation of existing areas into examples of Renaissance civic design.

Much contemporaneous written theory accompanies drawn plans for large scale urban design projects. Foremost among design principles is a preoccupation with academic artistic order and formal discipline, very much in contrast with the irregular ad-hoc picturesque qualities of medieval urban design. Most of the theory underlying Renaissance urban design was based on a logical and rational frame for human perception and behavior. Spatial theory based on details of human behavior was subsidiary to a broader approach to the philosophical presuppositions of human existence.

During the Renaissance period, the theoretical work of architect Leon Battista Alberti appears (figure 07), *On the Art of Building or, after Vitruvius..., Ten Books of Architecture* (*De re edificatoria*). Alberti, as well as giving a thorough theoretical study of numerous buildings and their construction, provides some theoretical commentary on public outdoor space. His significant contribution to the historical discourse on the subject is his re-examination of the proportional standards put forth by Vitruvius and the extrapolation of the principles to the third dimension. The idea of human use and perception is set out as a basis for design by Alberti and, more importantly, he initiates the first discussion of the three dimensional aspect of outdoor-rooms and their enclosure.



Figure 07. Alberti, *De re edificatoria* (English: *On the Art of Building*)-Ten Books of Architecture

Paul Zucker, in his *Town and Square: From the Agora to the Village Green* succinctly discusses Renaissance design theory:

Renaissance rhetoricians and Renaissance artists believed firmly that human life

could be entirely rationalized by philosophical and logical schemes, and they embodied this belief in their plans for human habitation. It must therefore be emphasized that rational ideas primarily, and only secondarily a new spatial concept, were decisive for city planning ideas of the Renaissance. (Zucker 100)

Frequently analyzed as an example of Renaissance urban planning and public outdoor space is the ideal new-town of Sabbioneta (figure 08), Italy. Here, a carefully scaled grid is imposed as an organizing concept for the town. The main piazza is carefully placed with its sense-of-enclosure intentionally modulated with the treatment of intersecting streets. While a comfortable scale is achieved, absent are the more human elements of building and urban design, all appears regulated and



Figure 08, a & b. Sabbioneta, Lombardy

intentional without the variation and spontaneity of the medieval town. Sabbioneta is clearly the ideal creation of theoretically based human intent, designed and built at one point in time in response to a singular vision of the future, rather than an accretuous creation evolving over time as a response to site conditions and human use and need.

- Baroque

Following the Renaissance, the emphasis of urban design in Italy shifted from enclosed space to infinite space, from square to street (figure 09). Movement rather than proper proportion is the objective for Baroque urban design with limited concern for the theory of public outdoor space related to the

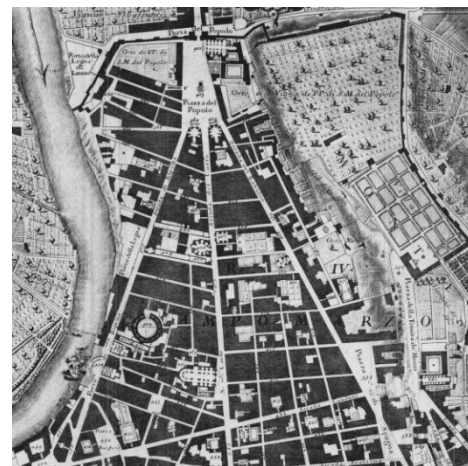


Figure 09. Piazza del Popolo, Rome

accomplishment of design attractive to human occupation. The individual p.o.s., or piazza, was not the focus of Baroque planning, which was more concerned with systems of movement, vistas, and their terminations and street design as opposed to singular spaces.

- Modern

The interest of modern urban design theoreticians in Italian piazze, from both Medieval and Renaissance periods, as models for the design of public outdoor space occurred long after the Baroque period. It was not until the 17th century that a renewed interest in piazze as examples of the concept of p.o.s. was evident.

In the 18th century, Camillo Sitte was the first urban design theorist to understand and postulate a multifaceted user-based perspective on the problem (figure 10). Sitte analyzed piazze based on their multiple physical characteristics and the complex

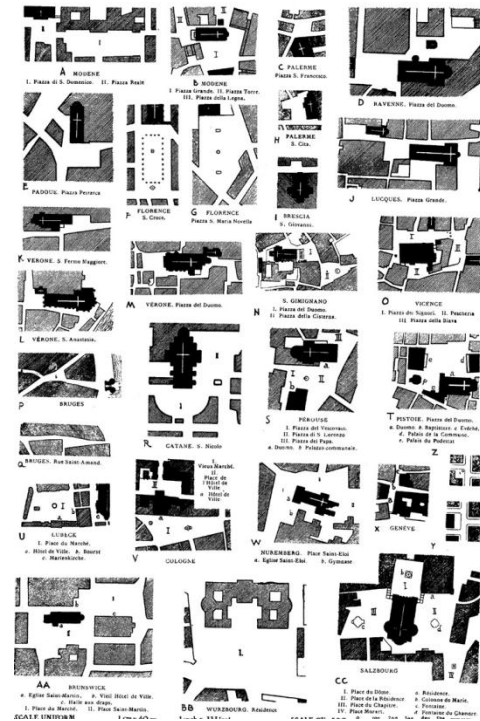


Figure 10. Sitte, plans of urban squares in Europe, 1889

combination of effects on the human occupants. His analysis is unrelated to the previous historical theories; rather he takes a real-time experiential approach to understanding the human experience in the spaces. His Modern approach to the subject has set the stage for most contemporary thought on public outdoor space design and the formulation of the modern conception of design based on an understanding of the experience of the individual human being. Sitte's methodology as applied to architecture, as well as urban design, involves evaluation of space design using human perceptual experience as the principal criteria. Theoretically, modern consideration of Sitte's work is based in the post-modern phenomenological¹⁴ analysis of architecture. The contemporary perspective of architectural

¹⁴ Phenomenology, in relation to the built-environment, is concerned with the user's direct experience as best understood from a human sensory perspective, independent of a scientific understanding.

phenomenology drives much of the movement to correct the obvious failures of modern attempts at humanly scaled and sociopetal p.o.s..

Theories of public outdoor space have evolved from the first appearance of a grouping of individual buildings, constituting the formation of exterior space by the Greeks, to the current process of intentionally designing a p.o.s. as a purpose-built outdoor-room. Exterior space created with the use, perception and comfort of the individual human occupants as the guiding criterion for overall dimension and proportion, as well as morphological and functional details, formulates a modern concept which guides much contemporary urban design. It is this modern sort of human sociopetal p.o.s. that fosters the production of social capital, so essential to the operative realization of sustainability in neighborhoods and communities.

The History of the Theory of Proportion and Dimension

- Aristotle

The consideration of proportion and dimension in the design of space, specifically outdoor space for public use, has been the subject of theoreticians since the time of the ancient Greeks. Looking back at the history of proportion and dimension as values in the tradition of the visual arts, Aristotle is usually seen as the first recognized expert on the subject (figure 11). In Part VII



Figure 11. Aristotle teaching Alexander the Great, Laplant, Famous Men of Greece

("Tragedy-Plot") of his philosophical treatise, *The Poetics*, Aristotle discusses the importance of the relative size of designated objects, saying that in order that an object be beautiful it should be neither too large nor too small; an object too large may lack comprehensible unity and completeness, and if too small, clarity of detail and distinguishability from context becomes an issue. As Aristotle explains the matter:

Again, a beautiful object, must not only have an orderly arrangement of parts, but must also be of a certain magnitude; for beauty depends on magnitude and order. Hence a very small animal organism cannot be beautiful; for the view of it is confused, the object being seen in an almost imperceptible moment of time. Nor, again, can one of vast size be beautiful; for as the eye cannot take it all in at once, the unity and sense of the whole is lost for the spectator. (Aristotle Part VII)

Aristotle sees scale and dimension, the components of proportion, as factors which contribute to the principles of beauty. Introduced in this Aristotelian idea is the critical relationship between the characteristics of human vision and the size of an object, that is, human scale of dimension. Beauty is seen as not solely inherent in the object but also dependent on the position of the observer or distance from the object. Dimension is postulated as a critical factor in the human spatial experience.

- Marcus Vitruvius

The actual formal documented analysis of public outdoor space and consideration of standards for its design probably begins with a first century Roman architect and author of



Figure 12. Vitruvius presents design of the Basilica at Faro to the Emperor Augustus

The Ten Books on Architecture, Marcus Vitruvius (figure 12). His treatise is seen as the oldest and, possibly, the most important book on architecture in all of history, strongly influencing the work of architects ever since his time. His discussion of p.o.s. begins with an historical account of ancient Greek forums or Agoras and their square planar proportions.

In his observations on Roman Forums in book V, Vitruvius goes on to make the profound observation that:

The size of a forum should be proportionate to the number of inhabitants, so that it may not be too small a space to be useful, nor look like a desert for lack of population. (too large) To determine its breadth, divide its length into three parts and assign two of them to the breadth. Its shape will then be oblong, and its ground plan conveniently suited to the conditions of the show. (Vitruvius 131)

Here in the First Century the basic wisdom of all space design is laid down for all who follow; the size and proportion of p.o.s. should be related to the human experience in that space. Vitruvius then, more practically, sets out a “proper” proportion of 2:3 based on the use of the Forum as a venue for gladiatorial shows, the contemporaneous civic use. The Vitruvian concept of scaling space to ceremony and spectacle rather than individual human perceptual experience is an important taxonomic distinction in the classification of p. o. s.

The point here seems to be a principal of basing the design of space first on dimension and then on proportion, both related to use, though not necessarily to human dimension.

- Leon Battista Alberti

It is not until the Renaissance that Western European civilization again takes a documented comprehensive approach to the design theory of public outdoor space with the

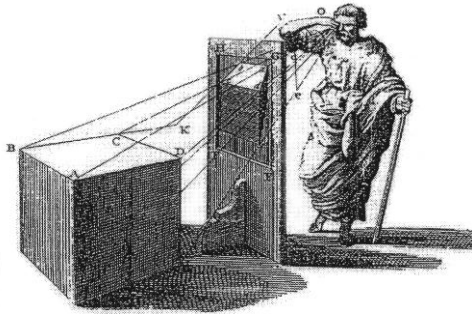


Figure 13.
Leone Battista Alberti, *De picture*

writings of Italian architect Leon Battista Alberti (figure 13), *Ten Books on Architecture* written in 1450 (Brunelleschi's Piazza Santissima Annunziata were started within a few years of the appearance of Alberti's *Ten Books*). In "Book VIII, Chap. VI.," Alberti follows the Vitruvian observations of the square planar geometry of Greek p.o.s. He then sets out a 3:4 proportion as typical for Roman Forums. He

goes on to give his own formulations for ideal planar proportions of 1:2 and then, most significantly, introduces the concept of proportional heights of enclosing buildings to the planar characteristics of a p.o.s. He correlates the heights of enclosure to the human perception of a space as either too large or too small: ". . . buildings about it should answer in some proportion to the open area in the middle, that it may not seem too large, by means of the lowness of the Buildings, nor too small, from their being too high" (Alberti 173).

Again, following Aristotle and Vitruvius, the idea of human use and perception is set out as a basis for design by Alberti and, more importantly, he initiates the first discussion of the three dimensional aspect of outdoor-rooms and their enclosure. To understand the basis of the Alberti observations on height of enclosure related to the human experience, some geometrical analysis related to the known characteristics of human vision is necessary.

It is postulated that human visual acuity occurs in a three dimensional cone of vision with an arc of about 60°. The cone of vision (figure 14) creates a right triangular with a 2:1

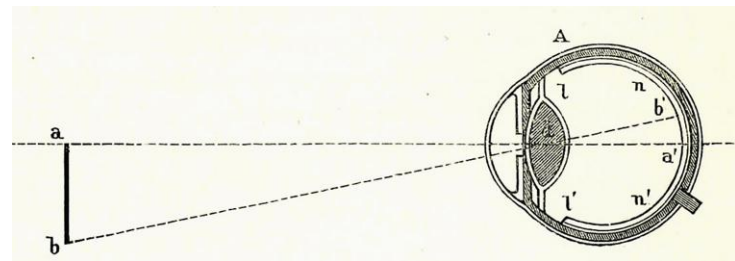


Figure 14. Human Eye and Optics

relationship between the distance from an object and the height of that object included in the cone of vision. Thus, for the enclosing buildings of an outdoor-room to be higher than the perceived cone of vision viewed from any point in the space, the distance from the

planar midpoint of the enclosed space cannot be more than twice the height of the enclosing buildings plus 5' of height of the eye of the viewer from the ground plane (figure 15). In other words, there exists a threshold vertical proportion of 4:1 (+5') of outdoor-room width to enclosing building height. With a ratio greater than 4:1, say 7:1, in Alberti's words, the public outdoor space will "seem too large, by means of the lowness of the Buildings."

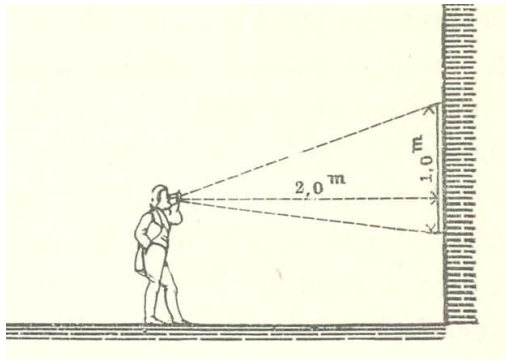


Figure 15. Human Cone of Vision and Building Height

If the typical location for perception of enclosure is closer to the edge of the square rather than the center, then the ratio is proportionally less, approaching 2:1 (+5'). The edge observation point also includes more of the enclosing building facades in the cone of vision. Alberti's spatial wisdom may have had some rational basis in the geometry of the characteristics of human vision.

- Camillo Sitte

The Late 19th century discussion of properly designed public outdoor space, in Camillo Sitte's *City Planning According to Artistic Principles*, includes aspects of proportion and dimension and a new element in the formulation of the design theory, corner morphology

(figure 16). In that chapter (III) of *City Planning According to Artistic Principles*, "That Public Squares Should Be Enclosed Entities," the characteristics of Public Squares are discussed as supporting the sense-of-enclosure of the outdoor-room. He designates "the enclosed character of a space" (Sitte, 32) as the main constituent in the creation of effective public outdoor space.

Figure 16, a, b, c, d & e. Sitte's Italian Piazza Diagrams

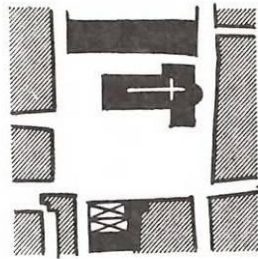


Fig. 16. Lucca: S. Michele.
[From Martin]

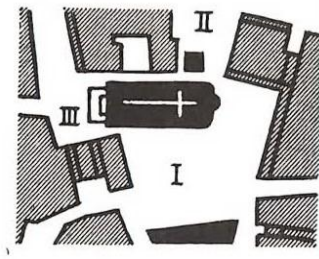


Fig. 41. Modena. I. Piazza Grande (Maggiore).—
II. Piazza della Torre.—
III. Piazza della Legna
(Piazzale Duomo).
[From Martin]

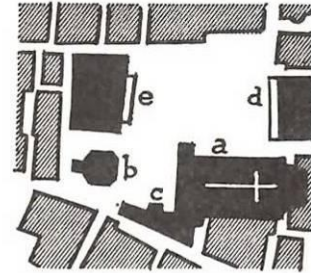


Fig. 23. Pistoia: Piazza del Duomo.—
a. Cathedral.—b. Baptistery.—c. Bish-
op's Palace.—d. Palazzo del Comune.
—e. Palazzo del Podesta. [From Martin]

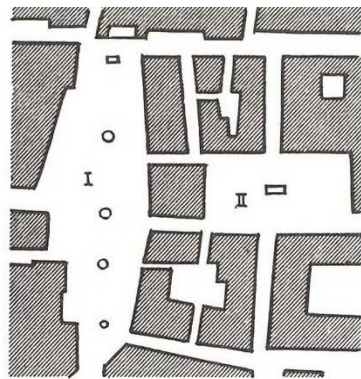


Fig. 34. Verona. I. Piazza Erbe.—II. Piazza dei Signori. [Cf. Pl. XXX-b]

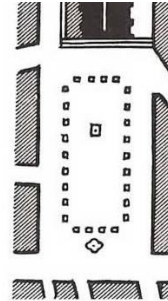


Fig. 28. Florence:
S. Croce.
[From Martin]

Sitte notes the "need for continuous enclosure by buildings" to fulfill the "main requirement" for public outdoor space. He then goes into some detail on the morphological characteristics of a space's corners and the street openings in the continuous enclosure of buildings. Finally, Sitte explains the advantages of "gateways" or portals as well as colonnades or loggias as contributing to the larger theme of enclosure (Sitte 33-38).

In the chapter devoted to "The Size and Shape of Plazas" (IV), Sitte deals with the issues of dimension and geometry and begins with a bifurcation of public outdoor space into two categories: "deep and wide." Here he reveals the phenomenological aspect of his analysis with the taxonomy based on the human perception of the directional quality of the space.

"Deep and wide" are dimensionally neutral perceptions which Sitte relates to "the position of the spectator and the direction in which he is looking." The shape, orientation, and size of the public outdoor space are seen as determined in relationship to the dominant building facing onto the space. Sitte's language seems to follow that of Vitruvius in cautioning against a p.o.s. that is too small or too large from a phenomenological perspective that is, based on human perception rather than mathematics or geometry. "In general, it is wrong to assume that the size effect of a public square as we perceive it increases in proportion to the actual size of the square" (Sitte 39-41).

Sitte then continues in this chapter (IV) to discuss corner morphology and, most significantly, his phenomenological approach to the analysis of the dimensional aspect of p.o.s. focusing on the point that "apparent size bears no relationship whatsoever to actual measurement" (Sitte 42). The design and context of space are seen by Sitte as the important factors determining "apparent" dimensions or size of a public outdoor space.

Finally, Sitte deals with proportional relationship between the height of dominant buildings facing onto a public outdoor space and the size of the space. Here, two ratios are mentioned: principal building height and minimum p.o.s. dimension-1:1 and principal building height and maximum p.o.s. dimension-1:2. On the subject of proportion of length and width of the planar dimensions of p.o.s., Sitte gives only one general rule, with substantial qualification, length to width should be less than 3:1.

Sitte is careful to point out the complexity of the planar proportion aspect of public outdoor space design: "the proper relation of the length of a plaza to its width is a very uncertain

matter" (Sitte 44). Once again he takes a phenomenological perspective, saying that the perception of the planar proportion aspect of the design is "dependent on the position of the observer" and "we can never become fully aware of the true relationship between breadth and depth in a plaza." He then speaks to the issue of taking a dimensional approach to the design of p.o.s.: "Setting up a norm would therefore be of little value since everything depends on the actual perspective effect and not at all on how the plaza appears in plan" (Sitte 44).

Sitte concludes his chapter "The Size and Shape of Plazas" with a brief mention of the importance of human comfort in a plaza as related to its size or proportions. Again he seems to be favoring a qualitative over a quantitative approach to understanding the effect of dimensions on a plaza's success as a container for human activity. For Sitte the problem is the p.o.s. which often seems too large to be comfortable for humans. As the dimensional aspect of a space is changed, made larger or smaller, the proper proportional relationships of the space also changes. What may be an appropriate proportion at one scale of dimensions may indeed not be so as they are increased or decreased proportionally. In Sitte's theory, universal fixed preferred proportions are meaningless, it is dimension which is most important and then proper proportion can be determined for each case.

- Kevin Lynch

Sitte's approach to the design of public outdoor space is taken up again by the important theorist on p.o.s. in the late 20th century, architect Kevin Lynch. In his extensive guide to the design of the exterior built-environment, *Site Planning*, first published in 1962, urban planning theorist and professor Lynch, discusses p.o.s. He succinctly summarizes, in agreement with other experts, the distances involved in the planning of p.o.s. as follows:

A few tentative quantities can be assigned to the size and proportion of comfortable external spaces. Developed empirically, these rules seem to derive from the characteristics of the human eye and from the size of the objects that are generally of

greatest interest to it, that is, other human beings. We can detect a man about 400 feet away, recognize a him at 80 feet, see his face clearly at 45 feet, and feel him to be in direct relation to us, whether pleasant or intrusive, at 3 – 10 feet. (Lynch 193)

Lynch goes on to identify the planar dimension of 450 feet to be the upper limit of the smaller dimension of most enclosed urban outdoor spaces of the past. He also discusses the proportion of an object's height and distance from the viewer, again agreeing with the previously cited theorist on detail object and context as related to viewing distance. He suggests that a ratio of between 1:2 and 1:4 between height of enclosing walls and a spaces least dimension is most "comfortable" with the sense of "enclosure" lost when the ratio is beyond 1:4 and if less than 1:1, the space is like a "pitch or trench" (Lynch 194). Lynch has incorporated some optical science into the previous phenomenological observations but seems to ignore Sitte's insight on the relationship between dimensional scale and proportion. His stipulation of preferred proportions independent of their dimension contradicts Sitte's observations.

- Christopher Alexander et al.

Closely following Lynch in time and theoretical approach were a group of researchers in the fields of architecture and planning led by Christopher Alexander. In 1977 they published a series of books "intended to provide a complete working alternative to our present ideas about architecture, building, and planning- an alternative which will . . . gradually replace current ideas and practices" (Alexander ii). *A Pattern Language* was the second of the series and presented a comprehensive compendium of knowledge concerning the architecture, building, and planning in a format of interrelated patterns applied to the decreasingly scaled: "towns, neighborhoods, houses, gardens and rooms." Much content of the patterns was based on common-knowledge design, indigenous building practices, and observed (inductive) rather than theorized (deductive) built-environment solutions.

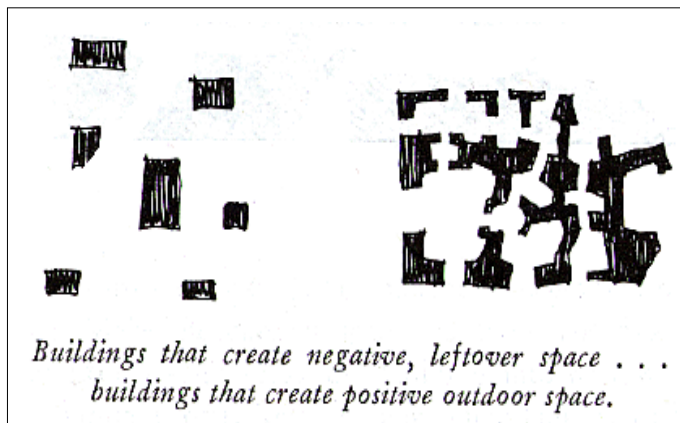


Figure 17. "Positive Outdoor Space" Diagram, (*A Pattern Language*)

In *A Pattern Language*, the narrative concerned with "Positive Outdoor Space, 106," the Language takes up the issue of comfort and the phenomenological aspect involved in the design of public outdoor space (figure 17). Sense of enclosure and its qualities are seen as the determinant of successful space which becomes "an

entity with a positive quality." The case is clearly stated thus: "People feel comfortable in spaces which are 'positive' and use these spaces . . ." (Alexander 519). The pattern then refers back to Camillo Sitte and his observations concerning enclosure related to the attractive qualities of p.o.s.

In "Pattern 61, Small Public Squares" the Language sets out some standards for p.o.s. with the initial caveat that "open places intended as public squares should be very small." The pattern goes on to stipulate a dimension of 60-70 feet as a maximum diameter or 300-400 square feet in area. Utilizing a spatial zone of about 150-300 square feet per person and an estimation that few places can attract more than 10-20 people on a consistent basis, and then the 300-400 square foot standard is thus derived. Furthermore, "Pattern 61" maintains that 70 feet is about the maximum distance that human visual and aural acuity allows for recognition of another person by face or voice. It is carefully noted that this dimensional standard need only be applied to one direction, the other being indeterminate under this pattern, with no discussion on the topic of proportion (Alexander 311).

"The Small Public Squares" Pattern, and its discussion, attempt to provide some meaningful basis for determination of dimensional characteristics of public outdoor space which might be associated with the more phenomenological observations of Vitruvius, Alberti, and Sitte.

Rather than the vague terms such as, too large or too small, Pattern 61 seeks to find some basis in the physiological limits of visual and aural acuity of the human occupants of the space. This use of optical science is a big advance in analyzing and making accessible some common understanding and quantification of the phenomenon of comfort in public outdoor space. It is Sitte's implication that proportion is indeterminate without considering dimension, thereby necessitating the stipulation of some base range of dimensions from which preferred proportions are derived. Alexander gives us the foundation for these base dimensions.

"Pattern 61," of Alexander's *A Pattern Language*, references a mid-20th century planning theorist, Hans Blumenfeld, who, in a paper delivered in 1953 at a conference at Yale University, outlined the details of the common theory underlying the visual acuity distances contained in the Pattern. Blumenfeld, in turn, references Hermann Maertens, a German architect who carefully utilizes the known physiological and optical aspects of human vision to construct a distance within which a human with normal visual acuity can recognize another human face.

In his book, *The Optical Scale: The Theory and Practice of Aesthetic Vision in the Arts on the Basis of the Science of Physiological Optics*, (1884) Maertens develops an explanation for the perception of scale based on the cone of vision. This cone is formed by the angle formed by radial lines theoretically drawn from our eyes to the limits of visual acuity, creating a three dimensional cone centered on the iris of the eye and encompassing our field of vision. He sets 27° as the interior angle of the cone measured from the line of perpendicular height. Within that cone, Maertens maintains, the smallest acknowledged discernible difference in perception is a single minute, making the greatest distance to a visible object a multiple of 3,450 (60 m/degree x [27°+27°]) times its size. The nose being the smallest recognizable feature of the human face, this physiological geometry sets the distance at which a human face can be recognized at about 70-80 feet, using the width of the nasal bone as a basis for the calculation. That is, using the nasal bone width times

3,450 produces the 70-80 foot dimension. Maertens also sets a distance of 48 feet for "portrait" face recognition or "intimate" human visual contact (Blumenfeld 35).

Using the 27° cone of vision, Maertens confirms the previously discussed ratio of 2:1 between the distance from an object and the objects height, if the object is not to be too large to be perceived in its Aristotelian "wholeness" of beauty. With a distance:height ratio of 3:1, he theorizes that an objects' context begin to play a part in construction of perception and at 4:1, the object is integrated into its context and loses its Aristotelian beauty through lack of detail.

Blumenfeld's paper and, by reference, Maerten's theory of scale based on the visual acuity of the observer, is incorporated into *The Pattern Language* theory of public outdoor space design, as well as being a common basis for much of 20th century urban design theory concerned with critical dimensions of space design.

- Jan Gehl

In 1980 a Danish architect and theorist, Jan Gehl, wrote a classic text on the significance of well-designed public outdoor space in the urban environment, *Life between Buildings: Using Public Space*. His research and writings are concerned with the needs of human users as the source of any guiding fundamentals for design of p.o.s. based on human activity in the space. As Gehl views the subject: "Familiarity with human senses – the way they function and the areas in which they function – is an important prerequisite for designing and dimensioning all forms of outdoor spaces and building layouts" (Gehl 65).

The work defines some essential components which facilitate the attraction to and use of p.o.s. by people. Included in the analysis is a heavy emphasis on human sensory experience, particularly visual acuity, as a basis for any defining metric applied to dimensioning of planar elements. Gehl discusses the proximity to other humans that "permits one to perceive other people as individuals" (Gehl 65). He continues on to set some actual dimensions:

At a distance of approximately 30 meters (100 ft.), facial features, hair style, and age can be seen and people met only infrequently can be recognized. When the distance is reduced to 20 to 25 meters (60 to 80 ft.), most people can perceive relatively clearly the feelings and moods of others. (Gehl 65)

Again, the dimensional range of 70 to 150 feet is a key element in setting a standard for human use and attraction to a public outdoor space. Additionally, it is interesting that proportion of space is not taken into consideration by Gehl or considered as an important component in his analysis. His consistent focus is on human activity and people's sensory experience as a foundation for operative sociopetal design.

Planar proportion, historically, has an intermittent and rather fluid position as a contributing element in the design of effective public outdoor space. It seems that even in classical times, beginning with Aristotle, the actual dimensions of our relationship to the material or built environment mattered most. Prescriptive planar proportions have no consistent basis, either in theory or in specific recommended ratios, as a significantly consistent source of guidance in urban design history. There has also been a consistent awareness of the human experience, and more specifically the characteristics of human perception, as the critical factor in the determination of the dimensional aspect of spaces. Planar proportions have historically been related to function or phenomenological human experience, rather than any recurrent fixed formula. However, the phenomenological facet of spatial design, the sense of comfort strived for in the design of a p.o.s., may actually have some objective causality in the common characteristics of human visual acuity and its physiological basis.

A Modern Theory of Public Outdoor Space Design

There has, historically, been a long discussion and empirical analysis in the discourse of architecture and urban design theory concerning the importance of some very specific dimensions as a condition for comfortable environments for human occupation. However, proportion has usually been considered a more nebulous, and phenomenological aspect of space design by theoreticians, with no clear agreement on the importance of any consistent values or conditions.

Paul Zuker in his seminal work, *Town and Square: From the Agora to the Village Green* (1969), sets out a basic theoretical approach to understanding the design of public outdoor space. In his discussion of the three elements of p.o.s., architectural frame, floor and ceiling Zucker explains:

The correlation of these principal elements that confine a square is based on the focal point of all architecture and city planning: the constant awareness of the human scale. As long as the size of the human body and the range of human vision are not recognized as the basic principles, any rules about absolute proportions, about design and composition of forms and motifs, about symmetrical and asymmetrical organization, etc., are meaningless. (Zucker 7)

For Zucker, and most other theoreticians, the human use of and sensory experience in public outdoor space are the only valid basis for the theory and practice of urban design. Making exterior space inviting, habitable, attractive, and comfortable for people is the challenge and the measure of effective p.o.s..

The history of architecture and urban design may be seen as a series of millions of individual experiments, conducted over the past $\pm 4,000$ years involving the relationship between the built-environment and human users. The results of these experiments have been incorporated into the common knowledge of the disciplines of architecture and urban

design. Architects have learned, by both example and experience, that culture, dimension, morphology, and human experience, as well as proportion, play an operative role in the perception and use of space by humans. Proportional considerations may not be the most ubiquitous characteristic of effective exterior spatial design. For example, the details of morphology are critical elements in the design of a space, the conditions of enclosure at the corners being critical in the creation of a sense-of-enclosure. Open corners act as less enclosing than "T" or completely closed conditions. Additionally, location-specific cultural characteristics and collective memory¹⁵ play a large role in the use of any space, particularly shared public space.

The human experience of being in these outdoor spaces is perceived and limited by the sensory collectors of the human body and shaped by the characteristics of those physiological systems. The visual acuity distance associated with the recognition of a human face can be associated with a feeling of comfort in an outdoor space. If the space is too large it might be uninviting due to the difficulty in recognizing other occupants of the space, too small and personal distance parameters are violated leading to discomfort. From this perspective the actual dimensions of the space are critical elements in the formulation of appropriate space, creating a condition of comfort necessary for human occupation.

A more complex paradigm for the understanding of operative public outdoor space, involving factors other than a singular reliance on planar proportion, most likely results in a more resilient and dynamic design solution. This framework likely creates a model more congruent with characteristics of human experience and a more comfortable exterior container for human experience, an outdoor-room.

From this survey of the history of the theoretical consideration of the issues involved in the public outdoor space, it can be understood that effective space is the result of the presence of several morphological characteristics, all necessary, but none sufficient, for an operative

¹⁵ Collective memory is that culturally constructed and commonly assumed historic information utilized by a group or culture.

outcome. Dimension based on human experience is the primary and most significant empirical starting point. Planar dimensional ranges for p.o.s. can be constructed from the characteristics of human visual acuity.

From an empirical point of view, a distance of 70-80 feet may be used a base dimension for the construction of a maximum planar width of public outdoor space of about 150 feet, within which a person might find some comfort in the recognition of most faces of most other occupants of the space as moving through the space. Additionally, this same knowledge of vision in humans allows us to set a minimum ratio between enclosing building height and p.o.s. width in order that, as Aristotle cautioned, the enclosing buildings not appear too large to be perceived as a whole with unity, as "beautiful."

Planar dimension, related to human visual acuity capabilities based on the width of the nasal bone, is the basis and primary determinant of the value of public outdoor space as a venue for the production of social capital. The dimensional limits of human visual recognition of other human beings is the major determinant of human comfort in, and the effectiveness of, p.o.s. as a platform for the development of sustainable communities.

Preferable vertical dimensions for surrounding structures can be derived from proportions related to the planar dimensions based on the same visual acuity model. Certain characteristics of the enclosing morphology of the built-environment can be identified as contributing to the phenomenon of human comfort in a public outdoor space. Only with these dimensional starting points can some preferred planar proportions then be constructed.

Finally, the importance of sense-of-enclosure as a phenomenon necessary for a perception of comfort in public outdoor space has been demonstrated. This perceptual sensation can be encouraged through a proper relationship between the height of buildings and the dimensions of the space they surround, as well as, details of corner morphology and extent of the positive enclosure in plan.

Looking at the Italian piazze selected for this study, the application of a theoretical understanding of the dynamics between planar dimension, planar proportion, and morphological features, such as sense-of-enclosure and sectional proportion, may be examined in situ. From these examples, two issues are clarified: first, the creation of operative public outdoor space is indeed a multifaceted design problem involving dimension, proportion, and morphology. Secondly, dimension based on the human experience in the p.o.s. is the primary physical characteristic around which the others are adjusted to achieve a comfortable and inviting container for human occupation.

The Italian Piazze

There are some well-established discrete public outdoor spaces which may be utilized as models for understanding the built-environment and its relationship to human behavior. As the topic of this research, the validity of the LEED ND prescriptive standards are examined in light of the most common historical model for the design of outdoor public space, the Italian piazza. The data's exclusive focus on Italian piazza has a valid basis in academic theory and common urban design practice.

The acknowledgement of Italian piazze as models for the design of public outdoor space has a long history. Piazze's canonization was perhaps initiated with the 17th century Grand Tour study-abroad tradition for the education of wealthy young British architect's apprentices. Several buildings and urban spaces in Italy were designated as models of good design for architects to emulate following visits to the sites.

Inigo Jones's 17th century design of Covent Garden Plaza in London has been popularly attributed to a specific visit to a piazza in Italy (Livorno) as a part of his travels. This tradition of travel for study of continental architectural (and planning) historical icons continued into the 20th century. The work of several key figures in the development of Modern Architecture including, among others, Alvar Aalto, can be seen to be greatly influenced by their travel to Italy and the piazze they visited. Aalto's Säynätsalo, Finland Town Hall may be understood as derivative of piazze he visited in a trip to Italy early in his career.

Italian piazze have been the modern subject of more formal and analytical study as prototypes of urban design since the work of Camillo Sitte in the late 19th century. His *City Planning According to Artistic Principles* (1889) identified and analyzed the physical components in the plans of a large group of selected public outdoor spaces in Western Europe, including several in Italy. His criteria for judging the success of these spaces has

survived into this century as a part of a picturesque¹⁶ tradition in urban design. His method includes the deconstruction of the built urban form and identification of recurring fractional morphologies as discrete characteristic physical aspects of an urban design.

Sitte's initial selection of Italian sites has been expanded by subsequent authors and theorists into a popular list of 20-25 piazze, somewhat limited in its scope and infrequently refreshed in content. Several piazze identified early in the literature generate later re-analysis with few new examples added. This focus on a limited group of piazze by urban design theoreticians has carried through in several 20th century works (Braunfels, 1990; De Wolfe, 1966; Gibberd, 1953; Webb, 1990 and Zucker, 1959) leading to the more current writings (Lynch, 1971; Rob Krier, 1979; Thiis-Evensen, 1987; and the New Urbanists, Duany and Plater-Zyberk, 2003).

In spite of the significant role these sites have taken on in the history and narrative of our conception of urban space, no thorough survey and analysis of Italian piazze has been undertaken since the early 20th century (Chambers, 1926). Her work was published before the piazze's eventual impact on contemporary urban design discourse and practice was fully realized. Review of the post-Sitte literature reveals a set of narrowly focused typological analyses focused on only a few repeated examples. A review of urban design literature confirms Italian piazze's firm establishment as archetypes of ideal urban public outdoor space, as well as useful models for the testing and analysis of the spatial design criteria proposed in LEED ND.

The subject piazze include both those most ubiquitous in the past written analyses. A review of a wide range of current and historical literature was conducted, noting the Italian piazza used as examples of effective outdoor public space design worthy of analysis and emulation. In all, twenty four of the most influential pieces of literature (table 3), related to the Italian piazza as an example of significant urban design, were reviewed and

¹⁶ Picturesque urban design is that which is primarily concerned with a nostalgic fixation on idealized appearances and often criticized for its alleged marginalization of the functional.

instances of reference to a particular piazza noted for a total of 236 notations of specific model piazza sites.

The piazze chosen for this study included those frequently mentioned in the literature of theoretical experts in the field of urban design, as shown in the Initial Piazze List (table 1), along with a few unmentioned but significant known examples. The initial unedited list of piazze considered for study included 194 examples.

Table 1 Initial Piazze List

Town	Piazza
Amalfi	del Duomo
Arezzo	Grande
Ascoli Piceno	del Popolo
Assisi	del Comune
Assisi	di San Francesco
Bagnaia	XX September
Bari	Mercantile e Ferrarese
Bergamo	Vecchia e del Duomo
Bologna	Galileo
Bologna	Maggiore e Netuna e di Re Enzo (Grande)
Brescia	del Foro
Brescia	del Duomo
Brescia	della Loggia
Caprarola	S. Teresa
Capri	Umberto I
Catania	degli Studi
Catania	Duomo
Catania	San Filippo
Catania	Dante
Cefalu	Piazza del Duomo
Cortona	repubblica
Cortona	Signorelli
Cremona	del Comune
Faenza	del Popolo
Faenza	S. Domenico
Ferrara	Trento Trieste
Ferrara	Duomo Et Mercato (Cattederal)

Ferrara	Torquato Tasso e Savonarola
Figline Val a'rno	Marsilio
Firenze	S. Spirito
Firenze	dei Cimatori
Firenze	di Danti
Firenze	Duomo
Firenze	S. Croce
Firenze	Vittor Emanuele (Repubblica)
Firenze	S. Maria Novella
Firenze	della Santissima Annunziata
Firenze	della Signoria
Gattinara	
Genova	de Ferrari
Genova	Strada Nuova
Gubbio	della Signoria
Imolia	Vittorio Emanuele
Lecce	del Duomo
Livorno	Vittorio Emanuele
Lodi	della Vittoria
Loreto	della Casa Santa
Lucca	Bernardini
Lucca	Grande (Napoleone), del Giglio, S. Giovanni, S. Martino e Antelminelli
Lucca	S. Michele In Foro
Lucca	dell'anfiteatro (Vettovaglie, Mercato)
Mantova	San Pietro
Mantova	delle Erbe
Mantova	Sodello (San Pietro)
Massa Marittima	del Duomo

Table 1 Initial Piazze List (cont'd)

Town	Piazza
Milano	della Scala
Milano	del Duomo
Modena	Reale (Roma) e S. Domenico
Modena	Legna e Grande (Maggiore) e Enzo (Torre)
Montepulciano	Piazza Grande
Monza	del Duomo
Napoli	dei Martiri
Napoli	di Dante
Napoli	Gesu Nuovo
Napoli	il Mercato
Napoli	della Borsa
Napoli	del Plebiscito
Noto	Piazza Municipio
Orvieto	Indipendenza (XXIX Marzo)
Orvieto	Maggiore (della Repubblica)
Orvieto	del Popolo
Orvieto	del Duomo
Padova	Eremitani
Padova	Petrarca (Carmine)
Padova	S. Giustina
Padova	del Duomo
Padova	Erbe e Frutta
Padova	Prato della Valle
Padova	Unita (Signori?)
Padova	del Santo Gattamelata (S. Antonio)
Palermo	del Duomo
Palermo	S. Cita
Palermo	S. Dominicco
Palermo	S. Francesco
Palermo	Pretoria
Palermo	Vigliena (Quattro Canti)
Parma	Garibaldi
Parma	della Steccata e Garibaldi
Parma	Duomo
Pavia	della Vitoria (Grande)
Perugia	della Repubblica e Italia
Perugia	Magiorre (IV Novembre)
Piacenza	del Duomo
Piacenza	dei Cavalli
Pienza	Pio II (Piccolomini)
Pisa	dei Cavalieri (degli Anziani)
Pisa	del Duomo
Pistoia	dello Spedale
Pistoia	del Duomo
Pitigliano	Piazza del Repubblica
Pompei	il Foro
Portofino Mare	Marinara
Ravenna	del Popolo
Ravenna	del Duomo
Roma	Venezia (Fora Italica)
Roma	Borghese
Roma	Campo di Ferro
Roma	Cancelleria
Roma	Collegio Romano
Roma	Colonna
Roma	della Maddalena
Roma	Mattei
Roma	Minerva
Roma	Pietra
Roma	Quirinale
Roma	S. Agostino
Roma	S. Carlo Alle Quattro Fontane
Roma	S. Giovanni En Laterno
Roma	S. Marcelo
Roma	Scossa Cavalli
Roma	Barberini
Roma	dell Orologio
Roma	della Rotunda
Roma	Farnese
Roma	Grazioli
Roma	S. Maria Maggiore Et Esquilino
Roma	S. Maria Trastevere
Roma	Trevi
Roma	Foro di Traiano
Roma	Campo dei Fiori
Roma	S. Maria della Pace
Roma	Fori Imperiali (Forum Romanum)
Roma	S. Ignazio
Roma	di Spagna
Roma	del Popolo
Roma	Navona
Roma	S. Pietro
Roma	Campidoglio
S. Gemignano	dell'Erbee
S. Gemignano	della Cisterna
S. Gemignano	del Duomo
S. Giorgio Morgeto	della Fontania
S. Giovanni V'al darno	Cavour
S. Severina	Campo

Table 1 Initial Piazze List (cont'd)

Town	Piazza
S. Vittorino	
Sabbioneta	Ducale (Garibaldi)
Siena	il Mercato
Siena	S. Maria di Provenzano
Siena	S. Pietro Alle Scale
Siena	del Duomo
Siena	S. Virgilio
Siena	Salimbeni
Siena	del Campo
Siracusa	del Duomo e Minerva
Spoleto	del Duomo (Piazza della Signoria)
Taormina	IX Aprile
Todi	del Popolo (V.Emanuele) e Garibaldi
Torino	Mercato
Torino	Castello ?
Torino	Corso Re D'Italia?
Torino	San Lorenzo Nuovo
Torino	V.Veneto
Torino	San Carlo
Treviso	dei Signori
Udine	Piazza della Liberta
Urbino	Rinascimento
Urbino	Duca Federico
Venezia	(Campo) Ghetto Novo
Venezia	(Campo) Manin
Venezia	(Campo) S. Apostoli
Venezia	(Campo) S. Giacomo Da L'orio
Venezia	(Campo) S. Margherita
Venezia	(Campo) S. Maria Formosa
Venezia	(Campo) S. Maria Nova
Venezia	(Campo) S. Giacopo di Rialto (dei Mercanti)
Venezia	(Campo) S. Polo
Venezia	(Campo) S. Stefano
Venezia	(Campo) S. Giovanni e Paolo
Venezia	S. Marco
Vercelli	Cavour
Verona	S. Anastasia
Verona	delle Duomo
Verona	delle Erbe
Verona	dei Signori
Vicenza	del Duomo
Vicenza	dei Signori e delle Biade (Biavia) e
Vicenza	delle Erbe (Pescheria)
Vigevano	Ducale
Viterbo	Duomo (S. Lorenzo?)
Viterbo	della Rocca Et Fiorentina
Viterbo	Fontana Grande
Viterbo	Plebiscito
Volterra	del Battistero (S. Giovanni?)
Volterra	Maggiore (dei Priori?)

The majority of the noted examples were in Northern and Central Italy with only a few examples in Southern Italy and Sicily. In order that the geographically mutable influence of climatological and cultural factors be minimal, the piazze finally chosen for this study were in the Regions of Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marches, and Lazio. Thus, the subject piazze are all north of Rome, approximately 42 degrees latitude and south of 46 degrees, the approximate location of Milan. By taking a regional approach to sample selection, the significance of morphology may be less obfuscated by variation in other design determinants, such as climatological, cultural, or historical factors. The table of Piazza Study Selections Notations and Geographic Data shows the number of literature notations, Regione, town, piazza, latitude/longitude, and elevation (table 2).

This study is singularly concerned with one group of the several functional types of public outdoor space. Those included in the study were the piazze whose purpose is accommodation of the day-to-day activities of people using the spaces with, for example; shops, markets, cafes, pre- and post-function space for church or civic gatherings, and administrative and professional offices. This classification suggests a mixed-use¹⁷ paradigm for the p.o.s. and indeed that is a salient feature contributing to the effectiveness of many of the examples.

The original group of 194 was reduced to 62 piazze initially selected for more detailed evaluation. The piazze were surveyed with relevant characteristics catalogued and their spatial performance briefly evaluated based on the developed criteria. The large number of examples is seen as necessary to balance the idiosyncratic character of most piazze and to give a comprehensive overview of the sites, including many not previously documented. There is a need to provide a broad base of data representative of a few features from which to induce the conclusions, minimizing the number of variables involved. The full selection of 62 piazze is catalogued with photos, figure-ground drawings, planar figures, and summary data in Appendix A, plates 1-83.

Excluded from the study were those piazze in excess of 2 acres in planar area, for example, Piazza Maggiore in Bologna and Piazza del Campo in Siena. This sample narrowing is intended to eliminate from the study those piazze intended for military, ceremonial and monumental functions, intended as staging areas for ceremony and designed to intimidate or overwhelm users, rather than create a sense of comfort and shelter. This categorization is a common taxonomy used in the literature concerning piazze. This common bifurcation of piazze between the expansive, impressive, civic-scaled and the more intimate,

¹⁷ Urban real estate developments or structures which physically and functionally integrate multiple residential, commercial, cultural, institutional, or industrial uses are termed as the mixed-use type.

neighborhood, human-scaled becomes an important and obvious distinction as the discussion of dimension based on the scale of human physiology unfolds in this research.

An additional significance of the two acre upper limit on planar area is apparent if the planar geometry of urban outdoor space is considered. The literature and theory of urban form typically identify two main types of public outdoor space, though the variety of possible morphologies is numerous. The two hypothetical types may be defined as the dynamic street and the Static Square or piazza. These spatial characteristics have certain geometrical implications when the spaces are viewed as planar objects.

Streets, as a type, are generally perceived to exist when the space is proportionally elongated beyond a planar proportion of 1:6 with a dynamic emphasis along a single axis. Piazzes are generally considered as exterior space with a less extreme proportional ratio than streets in the planar aspect and a more static sense-of-enclosure. While the piazza is usually perceived as enclosed on all sides, a street may be seen as completely enclosed or may be open on the short dimension sides; however, the implied sense of movement created by the elongated proportions of the street type makes the sense-of-enclosure dependent only on the long sides and renders the contribution of the ends as minimal regardless of its morphology. In the case of the street type, the sense of movement becomes perceptually more significant than the sense-of-enclosure.

This research is particularly concerned with the sense-of-enclosure, outdoor-room qualities, of public outdoor space and will therefore not be concerned with those piazzas whose spatial identity is that of a street rather than a square or piazza. This typological narrowing of focus has some significant implications when the planar geometry and dimensions of the initial broad range of study selections are analyzed. Since this research is particularly focused on those public outdoor spaces whose narrow dimension is a critical factor in determining its social/petal functioning, it is important to predetermine the range of possible narrow dimension associated with certain planar area ranges.

In some cases, the area of a subject piazza may be such that, given a particular range of planar dimensions on the narrow sides, the resultant space would necessarily be a street type rather than a piazza type in planar proportion. That is to say, some piazze are so large in planar area that they would, by geometric necessity, become streets if their scale was to be related to dimensions normally considered as human by urban design theorists

For example the Piazza Rinascimento in Urbino (figure 18) has a planar area of 32,000 square feet or 0.7 acres, a length of 385 feet and an approximated perceived width of 70 feet. The length necessitated by the relatively narrow width, and associated area, creates a proportion of 1:5.5. This proportional relationship between planar width and planar area may, by way of geometric necessity, in all cases of certain planar areas create non-enclosing streets rather than piazze.



This study will only include those piazze with a planar are of less than 2 acres, or \pm 87,000 square feet, in order that the planar geometry has limited possibility for the proportions of a street rather than a piazza. For the purposes of this study, piazze with planar areas over 2 acres and a width dimension of human scale are categorically precluded from the typology of a piazze (1:6 or less) and is, of necessity, a morphological street type. The selected piazze will thus allow for either proportions or dimensions, within the



Figure 18, a & b.
Urbino: Piazza
Rinascimento

range of human comfort, to be a common characteristic of their planar morphologies. This upper limit on size eliminates extremes of dimension or proportion being the singular result of a large planar area forcing either characteristic beyond the limits of piazze scale.

Planar dimension and planar proportion emerge as the morphological characteristics with which the research will be most critically concerned. These features of spatial design are typically associated with rectilinear geometries in their quantification and analysis. For that reason, those piazze with a highly irregular shape, making any dimensional or proportional analysis difficult or misleading, were also eliminated from the analysis. An edited group of 50 piazze formed the final basis for study and are illustrated with planar figures and summary data (Piazze Drawing Sheets 1- 10).

The final 50 study selections are those which:

- Are mentioned in the literature of Italian piazze or commonly held in high regard
- Are located in the region of North-Central Italy
- Have a planar area of less than 2 acres (excluding streets in narrow geometries)
- Have a relatively regular planar geometry

Table 2 Piazze Final Study Selections- Notations and Geographic Data

Regione				
Notations	Town	Piazza	Latitude/Longitude	Elev
Lombardia				
06	Bergamo	Vecchia e del Duomo	45° 42' 00" N, 09° 40' 00" E	817'
03	Brescia	della Loggia	45° 32' 00" N, 10° 14' 00" E	492'
03	Cremona	del Comune (Duomo)	45° 08' 00" N, 10° 2' 00" E	154'
00	Lodi	della Vittoria	45° 19' 00" N, 9° 30' 00" E	285'
01	Monza	del Duomo	45° 35' 00" N, 09° 16' 00" E	531'
02	Pavia	della Vittoria (Grande)	45° 11' 00" N, 09° 09' 00" E	253'
04	Sabbioneta	Ducale (Garibaldi)	45° 00' 00" N, 10° 30' 00" E	59'
09	Vigevano	Ducale	45° 19' 00" N, 08° 52' 00" E	381'
Veneto				
03	Padova	Signori	45° 25' 00" N, 11° 52' 00" E	39'
02		Fruta		
03		Erbe		
01	Venezia	(Campo) S. Margherita	45° 26' 15" N, 12° 20' 09" E	0'
02		(Campo) S. Polo		
02		(Campo) S. Stefano		
08	Verona	delle Erbe	45° 26' 00" N, 10° 59' 00" E	194'
07		dei Signori		

Table 2 Piazze Final Study Selections- Notations and Geographic Data (cont'd)

Regione				
Notations	Town	Piazza	Latitude/Longitude	Elev
Emilia- Romagna				
01	Faenza	del Popolo	44° 17' 00" N, 11° 53' 00" E	112'
01	Imola	Vittorio Emanuele (Matteotti)	44° 21' 00" N, 11° 43' 00" E	154'
05	Modena	Legna e Grande (Maggiore) e Enzo (Torre)	44° 39' 00" N, 10° 56' 00" E	112'
02	Piacenza	dei Cavalli	45° 2' 52" N, 09° 42' 02" E	200'
00	Ravenna	del Popolo	44° 25' 00" N, 12° 12' 00" E	13'
Toscana				
05	Arezzo	Grande	43° 28' 24" N, 11° 52' 12" E	971'
01	Figline Val D'arno	Marsilio	43° 37' 00" N, 11° 28' 00" E	413'
10	Firenze	della Santissima Annunziata	43° 47' 00" N, 11° 15' 00" E	164'
00		S. Spirito		
04	Lucca	S. Michele In Foro	43° 51' 00" N, 10° 30' 00" E	62'
03	Montepulciano	Grande	43° 06' 00" N, 11° 47' 00" E	1,985'
11	Pienza	Pio II (Piccolomini)	43° 04' 43" N, 11° 40' 44" E	1,611'
07	Pistoia	del Duomo	43° 56' 00" N, 10° 55' 00" E	213'
01	Pitigliano	della Repubblica	42° 38' 00" N, 11° 40' 00" E	1,027'
03	S. Giovanni Val D'arno	Cavour	43° 33' 52" N, 11° 31' 58" E	440'
14	S. Gimignano	dell Erbe	43° 28' 00" N, 11° 03' 00" E	1,063'
16		del Duomo		
16		della Cisterna		
04	Siena	Salimbeni	43.19°N	1,056'
02	Volterra	Maggiore (dei Priori)	43° 24' 00" N, 10° 52' 00" E	1,742'
Umbria				
01	Assisi	del Comune	43° 04' 33" N, 12° 37' 03" E	1,391'
04	Gubbio	della Signoria	43° 21' 00" N, 12° 34' 00" E	1,713'
01	Orvieto	del Popolo	42° 43' 00" N, 12° 6' 00" E	1,066'
05	Todi	del Popolo (V.Emanuele) e Garibaldi	42° 47' 00" N, 12° 25' 00" E	1,345'
Marche				
05	Ascoli Piceno	del Popolo	42° 51' 00" N, 13° 35' 00" E	505'
04	Urbino	Duca Federico	43° 43' 00" N, 12° 38' 00" E	1,480'
03		Rinascimento		
Lazio				
01	Bagnaia	Xx September	42° 25' 33" N, 12° 09' 17" E	60'
04	Roma	(Campo) dei Fiori	41° 54' 00" N, 12° 30' 00" E	66'
02		Farnese		
01		Mattei		
01		Minerva		
02		S. Maria Trastevere		
01	Viterbo	Plebiscito	42° 25' 00" N, 12° 6' 00" E	1,070'

Table 3 Piazza Notation Sources (see Bibliography for complete citations)

Bacon, Edmund N. Design of Cities.
Benevolo, Leonardo. History of the City.
Braunfels, Wolfgang, and Kenneth J. Northcott. Urban Design in Western Europe.
Canniffe, Eamonn. The Politics of the Piazza: the History and Meaning of the Italian Square.
Chambers, Isobel M. "Piazzas of Italy.
Chambers, Isobel M. "Piazzas of Italy (Conclusion).
Feraboli, Maria Teresa., and Angela Arnone. City Squares of the World.
French, Jere Stuart. Urban Space: a Brief History of the City Square.
Fusch, Richard. "The piazza in Italian urban morphology.
Gatje, Robert F. Great Public Squares: an Architect's Selection.
Gehl, Jan. Life between Buildings: Using Public Space.
Gutkind, E. A. International History of City Development. London:
Holm, David. "Drawing on Drawing in Architectural Education
Hofmann, Paul. Cento Città: a Guide to the "hundred Cities & Towns" of Italy.
Janson, Alban, and Thorsten Burklin. Scenes: Studies of Architectural Space: the Campi of Venice.
Jenkins, Eric J. To Scale: One Hundred Urban Plans.
Katō, Akinori. Plazas of Southern Europe.
Kidder Smith, G. E. Italy Builds: Its Modern Architecture and Native Inheritance.
Krier, Rob. Urban Space = Stadtraum.
Lakeman, Sandra Davis. Natural Light and the Italian Piazza: Siena as a Case Study.
Mancuso, Franco, and Aurelio Natali. Piazze D'Italia.
Moughtin, Cliff. Urban Design: Street and Square. .
Site, Camillo. City Planning According to Artistic Principles. .
Webb, Michael. The City Square.
Zucker, Paul. Town and Square: From the Agora to the Village Green.



Map 01 Italy Piazze Locations



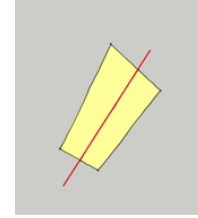
Map 02 Italy Piazze Locations Detail

Sheet 01 Piazza Drawings and Data

L o m b a r d i a

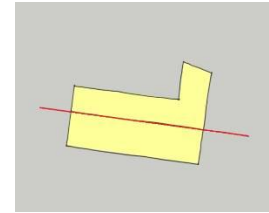
Bergamo: Piazza Vecchia

Plan orientation (clockwise from north): 33°
Plan area (square feet/ acres): 26,000/ 0.6
Plan length x width (feet)/ ratio: 115 x 225/ 1:2



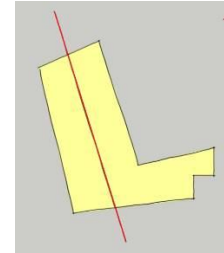
Brescia: Piazza della Loggia

Plan orientation (clockwise from north): 97°
Plan area (square feet/ acres): 42,000/ 1.0
Plan length x width (feet)/ ratio: 130 x 290/ 1:2.4



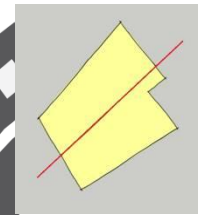
Cremona: Piazza del Comune

Plan orientation (clockwise from north): 166°
Plan area (square feet/ acres): 60,000/ 1.4
Plan length x width (feet)/ ratio: 145 x 350/ 1:2.4



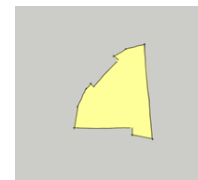
Lodi: Piazza della Vittoria

Plan orientation (clockwise from north): 47°
Plan area (square feet/ acres): 56,500/ 1.3
Plan length x width (feet)/ ratio: 215 x 280/ 1:1.3



Monza: Piazza del Duomo

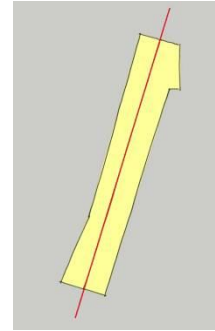
Plan orientation (clockwise from north): NA
Plan area (square feet/ acres): 30,000/ 0.7
Plan length x width (feet)/ ratio: 140 x 140/ 1.0



Sheet 02 Piazza Drawings and Data

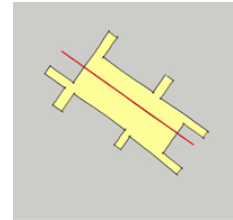
Pavia: Piazza della Vittoria (Grande)

Plan orientation (clockwise from north): 17°
Plan area (square feet/ acres): 52,000/ 1.2
Plan length x width (feet)/ ratio: 90 x 560/ 1:6.2



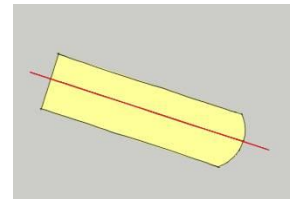
Sabbioneta: Piazza Ducale (Garibaldi)

Plan orientation (clockwise from north): 125°
Plan area (square feet/ acres): 23,500/ 0.5
Plan length x width (feet)/ ratio: 95 x 240/ 1:2.5



Vigevano: Piazza Ducale

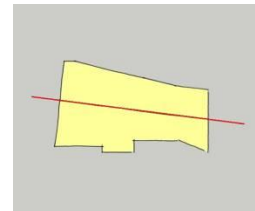
Plan orientation (clockwise from north): 108°
Plan area (square feet/ acres): 53,000/ 1.2
Plan length x width (feet)/ ratio: 125 x 415/ 1:3.3



V e n e t o

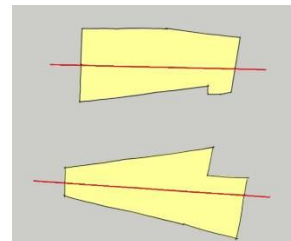
Padova: Piazza Signori

Plan orientation (clockwise from north): 97°
Plan area (square feet/ acres): 47,000/ 1.1
Plan length x width (feet)/ ratio: 140 x 315/ 1:2.3



Padova: Piazze Erbe

Plan orientation (clockwise from north): 91°
Plan area (square feet/ acres): 47,500/ 1.0
Plan length x width (feet)/ ratio: 130 x 390/ 1:3.0



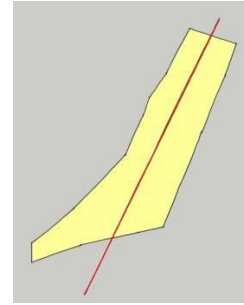
Padova: Piazze Frutta

Plan orientation (clockwise from north): 91°
Plan area (square feet/ acres): 45,000/ 1.0
Plan length x width (feet)/ ratio: 130 x 330/ 1:2.5

Sheet 03 Piazza Drawings and Data

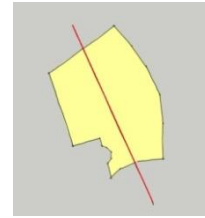
Venezia: Campo S. Margherita

Plan orientation (clockwise from north): 26°
Plan area (square feet/ acres): 70,000/ 1.6
Plan length x width (feet)/ ratio: 125 x 480/ 1:3.8



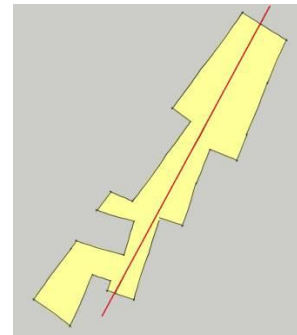
Venezia: Campo S. Polo

Plan orientation (clockwise from north): 155°
Plan area (square feet/ acres): 61,000/ 1.4
Plan length x width (feet)/ ratio: 210 x 300/ 1:1.4



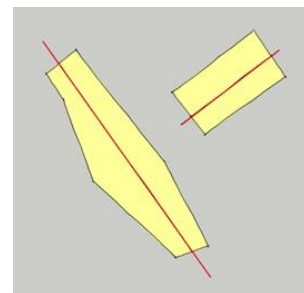
Venezia: Campo S. Stefano

Plan orientation (clockwise from north): 29°
Plan area (square feet/ acres): 87,500 / 2.0
Plan length x width (feet)/ ratio: 125 x 640/ 1:5.1



Verona: Piazza dei Signori

Plan orientation (clockwise from north): 55°
Plan area (square feet/ acres): 25,000/ 0.6
Plan length x width (feet)/ ratio: 115 x 225/ 1:2.0



Verona: Piazza delle Erbe

Plan orientation (clockwise from north): 145°
Plan area (square feet/ acres): 53,500/ 1.2
Plan length x width (feet)/ ratio: 110 x 490/ 1:4.5

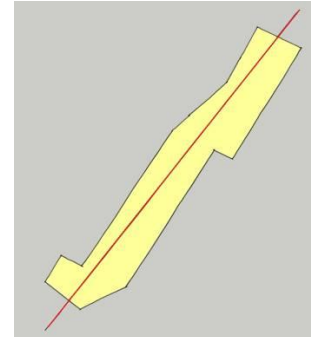


Sheet 04 Piazza Drawings and Data

E m i l i a - R o m a g n a

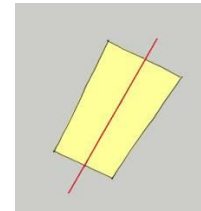
Faenza: Piazza del Popolo

Plan orientation (clockwise from north): 38°
Plan area (square feet/ acres): 75,500/ 1.7
Plan length x width (feet)/ ratio: 110 x 725/ 1:6.6



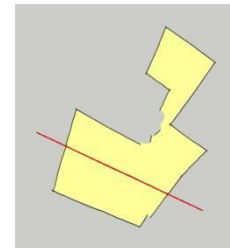
Imola: Piazza Victoria Emmanuelle (Matteotti)

Plan orientation (clockwise from north): 30°
Plan area (square feet/ acres): 42,500/ 1.0
Plan length x width (feet)/ ratio: 160 x 265/ 1:1.7



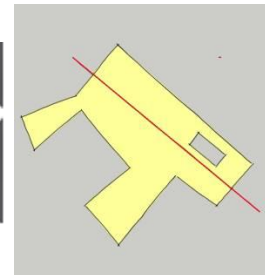
Modena: Piazza Legna & Grande (Maggiore) & Enzo (Torre)

Plan orientation (clockwise from north): 115° (25°)
Plan area (square feet/ acres): 60,000/ 1.4
Plan length x width (feet)/ ratio: 165 x 240/ 1:1.5



Piacenza: Piazza dei Cavalli

Plan orientation (clockwise from north): 130°
Plan area (square feet/ acres): 82,000/ 1.9
Plan length x width (feet)/ ratio: 175 x 390/ 1:2.2



Sheet 05 Piazza Drawings and Data

Ravenna: Piazza del Popolo

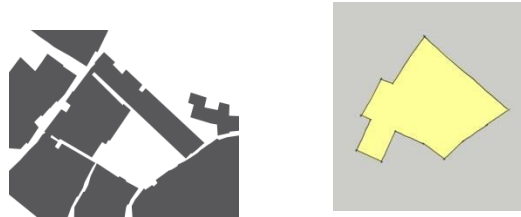
Plan orientation (clockwise from north): 79°
Plan area (square feet/ acres): 34,000/ 0.8
Plan length x width (feet)/ ratio: 105 x 320/ 1:3.0



T o s c a n a

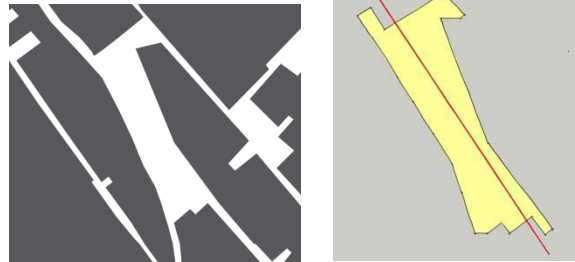
Arezzo: Piazza Grande

Plan orientation (clockwise from north): 50°
Plan area (square feet/ acres): 42,000/ 1.0
Plan length x width (feet)/ ratio: 185 x 210/ 1.1



Figline Val d'Arno: Piazza Marsilio Ficino

Plan orientation (clockwise from north): 146°
Plan area (square feet/ acres): 67,000/ 1.5
Plan length x width (feet)/ ratio: 125 x 515/ 1:4.1



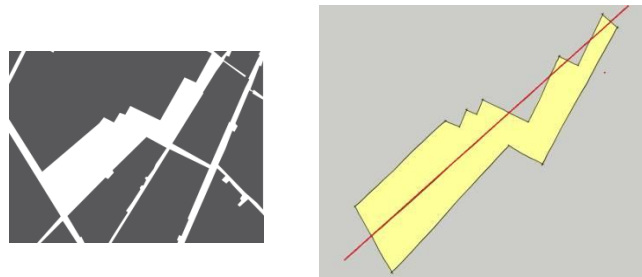
Firenze: Piazza della Santissima Annunziata

Plan orientation (clockwise from north): 42°
Plan area (square feet/ acres): 49,000/ 1.1
Plan length x width (feet)/ ratio: 190 x 255/ 1:1.3



Firenze: Piazza Santo Spirito

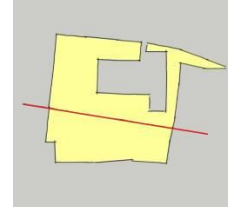
Plan orientation (clockwise from north): 48°
Plan area (square feet/ acres): 74,000/ 1.7
Plan length x width (feet)/ ratio: 145 x 400/ 1:2.8



Sheet 06 Piazza Drawings and Data

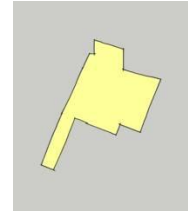
Lucca: Piazza S. Michele in Foro

Plan orientation (clockwise from north): 99° (09°)
Plan area (square feet/ acres): 56,500/ 1.3
Plan length x width (feet)/ ratio: 140 x 275/ 1:2.0



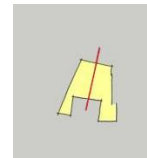
Montepulciano: Piazza Grande

Plan orientation (clockwise from north): 24°
Plan area (square feet/ acres): 27,500/ 0.6
Plan length x width (feet)/ ratio: 135 x 165/ 1:1.2



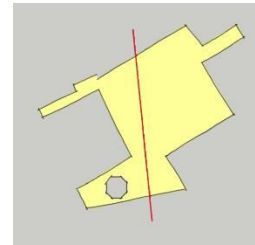
Pienza: Piazza Pio II (Piccolomini)

Plan orientation (clockwise from north): 12°
Plan area (square feet/ acres): 9,000/ 0.2
Plan length x width (feet)/ ratio: 80 x 85/ 1:1.1



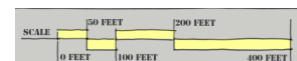
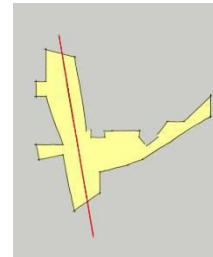
Pistoia: Piazza del Duomo

Plan orientation (clockwise from north): 58°
Plan area (square feet/ acres): 70,000/ 1.6
Plan length x width (feet)/ ratio: 230 x 300/ 1:1.3



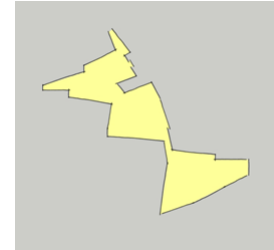
Pitigliano: Piazza della Repubblica

Plan orientation (clockwise from north): 170°
Plan area (square feet/ acres): 33,000/ 0.8
Plan length x width (feet)/ ratio: 70 x 325/ 1:4.6



Sheet 07 Piazza Drawings and Data

S. Gimignano: Piazza delle Erbe
 Plan orientation (clockwise from north): NA
 Plan area (square feet/ acres): 14,450/ 0.3
 Plan length x width (feet)/ ratio: 90 x 90/ NA

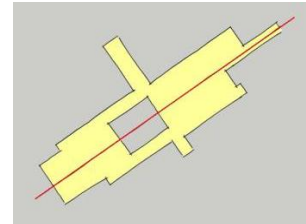


S. Gimignano: Piazza del Duomo
 Plan orientation (clockwise from north): NA
 Plan area (square feet/ acres): 14,400/ 0.3
 Plan length x width (feet)/ ratio: 110 x 110/ NA

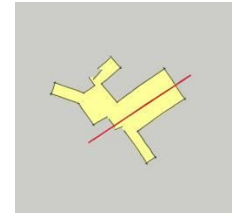


S. Gimignano: Piazza della Cisterna
 Plan orientation (clockwise from north): NA
 Plan area (square feet/ acres): 18,500/ 0.4
 Plan length x width (feet)/ ratio: 95 x 95/ NA

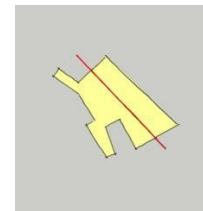
S. Giovanni Val d'Arno: Piazza Cavour
 Plan orientation (clockwise from north): 55°
 Plan area (square feet/ acres): 53,000/ 1.2
 Plan length x width (feet)/ ratio: 135 x 475/ 1:3.5



Siena: Piazza Salimbeni
 Plan orientation (clockwise from north): 56°
 Plan area (square feet/ acres): 14,000/ 0.3
 Plan length x width (feet)/ ratio: 80 x 160/ 1:2.0

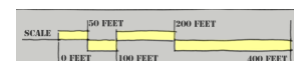
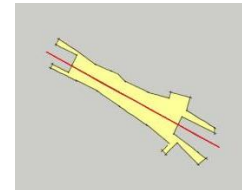


Volterra: Piazza Maggiore (dei Priori)
 Plan orientation (clockwise from north): 137°
 Plan area (square feet/ acres): 22,000/ 0.5
 Plan length x width (feet)/ ratio: 100 x 200/ 1:2.0



U m b r i a

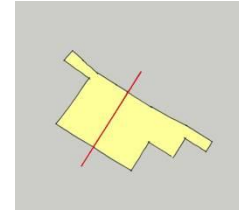
Assisi: Piazza del Comune
 Plan orientation (clockwise from north): 120°
 Plan area (square feet/ acres): 31,000/ 0.7
 Plan length x width (feet)/ ratio: 80 x 345/ 1:4.3



Sheet 08 Piazza Drawings and Data

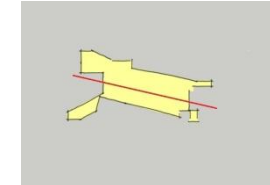
Gubbio: Piazza della Signoria

Plan orientation (clockwise from north): 32°
 Plan area (square feet/ acres): 32,000/ 0.7
 Plan length x width (feet)/ ratio: 150 x 200/ 1:1.3



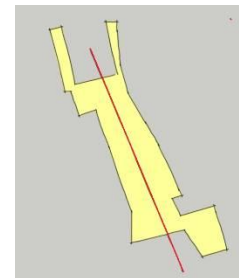
Orvieto: Piazza del Popolo

Plan orientation (clockwise from north): 101°
 Plan area (square feet/ acres): 18,850/ 0.4
 Plan length x width (feet)/ ratio: 75 x 180/ 1:2.4



Todi: Piazza del Popolo (V.Emanuele) & Garibaldi

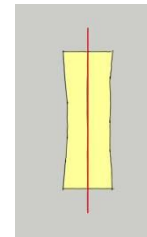
Plan orientation (clockwise from north): 157°
 Plan area (square feet/ acres): 39,000/ 0.9
 Plan length x width (feet)/ ratio: 100 x 360/ 1:3.6



M a r c h e

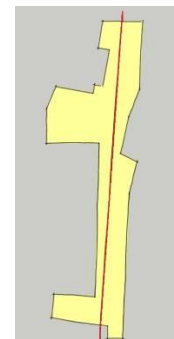
Ascoli Piceno: Piazza del Popolo

Plan orientation (clockwise from north): 00°
 Plan area (square feet/ acres): 28,000/ 0.6
 Plan length x width (feet)/ ratio: 95 x 295/ 3.1



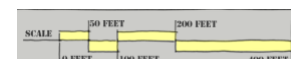
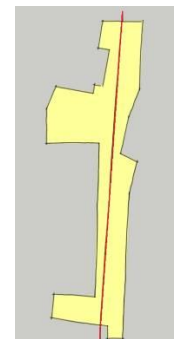
Urbino: Piazza Duca Federico

Plan orientation (clockwise from north): 04°
 Plan area (square feet/ acres): 33,500/ 0.8
 Plan length x width (feet)/ ratio: 175 x 250/ 1:1.4



Urbino: Piazza Rinascimento

Plan orientation (clockwise from north): 04°
 Plan area (square feet/ acres): 32,000/ 0.7
 Plan length x width (feet)/ ratio: 70 x 385/ 1:5.5

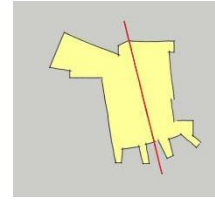


Sheet 09 Piazza Drawings and Data

L a z i o

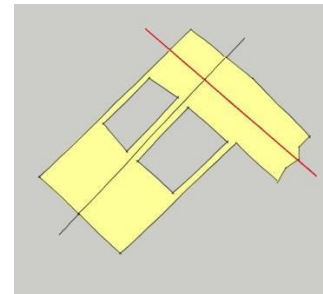
Bagnaia: Piazza XX September

Plan orientation (clockwise from north): 166°
Plan area (square feet/ acres): 41,000/ 0.9
Plan length x width (feet)/ ratio: 145 x 220/ 1:1.5



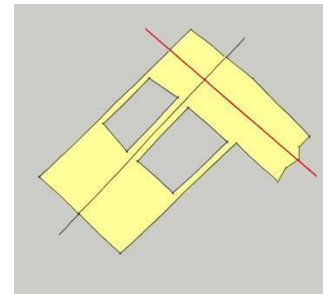
Roma: Campo dei Fiori

Plan orientation (clockwise from north): 130°
Plan area (square feet/ acres): 48,000/ 1.1
Plan length x width (feet)/ ratio: 125 x 365/ 1:2.9



Roma: Piazza Farnese

Plan orientation (clockwise from north): 40°
Plan area (square feet/ acres): 42,000/ 1.0
Plan length x width (feet)/ ratio: 170 x 240/ 1:1.4



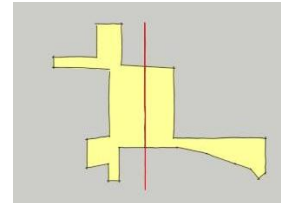
Roma: Piazza Mattei

Plan orientation (clockwise from north): 102°
Plan area (square feet/ acres): 7,000/ 0.2
Plan length x width (feet)/ ratio: 70 x 100/ 1:1.4



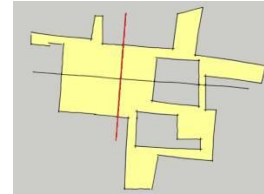
Roma: Piazza S. Maria della Minerva

Plan orientation (clockwise from north): 00°
Plan area (square feet/ acres): 25,000/ 0.6
Plan length x width (feet)/ ratio: 140 x 175/ 1:1.3



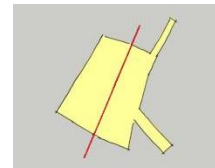
Roma: Piazza S. Maria Trastevere

Plan orientation (clockwise from north): 94°
Plan area (square feet/ acres): 32,000/ 0.7
Plan length x width (feet)/ ratio: 155 x 200/ 1:1.3



Viterbo: Piazza Plebiscito

Plan orientation (clockwise from north): 23°
Plan area (square feet/ acres): 30,000/ 0.7
Plan length x width (feet)/ ratio: 145 x 210/ 1:1.4



The Theoretical Framework

As the diagrams of planar characteristics are reviewed along with the data drawn from the scale drawings of each piazza, some patterns may emerge from the collected information. Data sets were collected and sorted for rank order and frequency for each of the piazze including the following categories of space design:

- Proportional Analysis-- The data concerning the planar proportion of the piazze should clarify whether effective public outdoor space is necessarily related to any specific planar proportion of the space, as suggested by the LEED ND criteria. The data should reveal any strong preference for the planar geometries respecting the 1:4 proportional limit, or any other, in the morphologies of the piazze. If too many exceptions to the 1:4 planar proportional ideal exist, the LEED criteria's basis may be in question.
- Dimensional Analysis-- Studying the piazze in the case of planar dimension, rather than proportion, should reveal any preference for certain dimensions. From the dimensions (length and width) and anecdotal examples, it should be possible to determine if planar dimension is a subordinate factor to planar proportion in the design of public outdoor space. It might also be concluded that the planar dimensions of a piazza play the most decisive role in the effective design of humanly-scaled p.o.s.
- Corner Morphology Analysis-- The Italian piazze included in the study are also analyzed for strength of sense-of-enclosure by identifying characteristics of corner morphology, including the rating of the piazze according to the typologies of corner conditions existing in each case. Each piazza is examined and values assigned for each corner as warranted by its likely morphology. These values are summed for each piazza and developed into a data table.
- Sectional Proportion Analysis-- The subject piazze are then evaluated for sectional proportion related to height of the enclosing built structures as compared to planar dimension. Using 360° panoramas, other photos and the scaled piazza diagrams,

subjective estimations are made of the sectional proportions of each piazza. Again, frequency will indicate any preferred proportional ratio.

For the planar area, proportion and dimensional data, frequency tables and histograms are constructed for each of these morphological characteristics. The profiles of the frequency histograms illustrate the unique distribution of metrics for each of the characteristics (figure 19). Planar Area shows, what is statistically termed, a normal distribution, Planar Dimension, a distribution with a precipitous natural break and Planar Proportion, a continuous declining slope. The comparison of those histograms suggests the importance of a specific range of dimensions, consistent with theory based on recognition distance and human visual acuity.

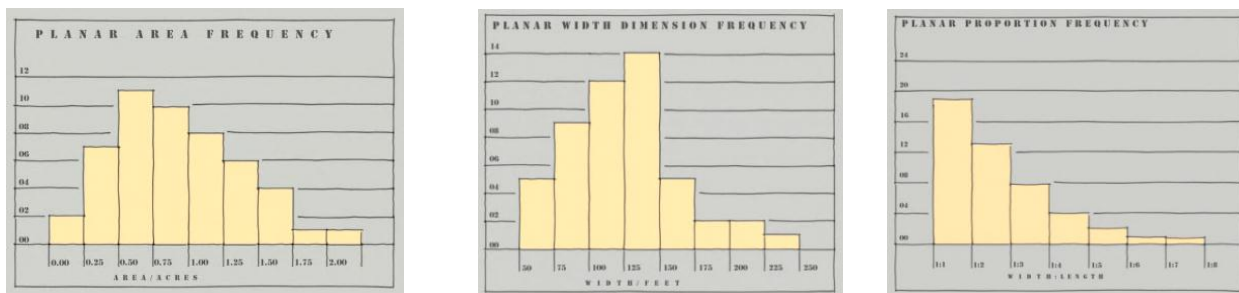


Figure 19 a, b, & c.. Planar Area, Width and Proportion Frequency Histograms

The analysis of sectional proportion reveals some effective ranges of planar width to surrounding building height for creation of a sense-of-enclosure. However, also obviated were the problems inherent in the simplistic quantification of a complex multifaceted characteristic, further complicated by case-specific morphological anomalies.

The examination of corner conditions as contributory to human comfort and enclosure of public outdoor space makes clear the dominant role these morphologies play in the multifaceted effectiveness of the subject piazza. A systematic method for rating p.o.s. is devised to objectify this aspect of urban design.

Planar Area

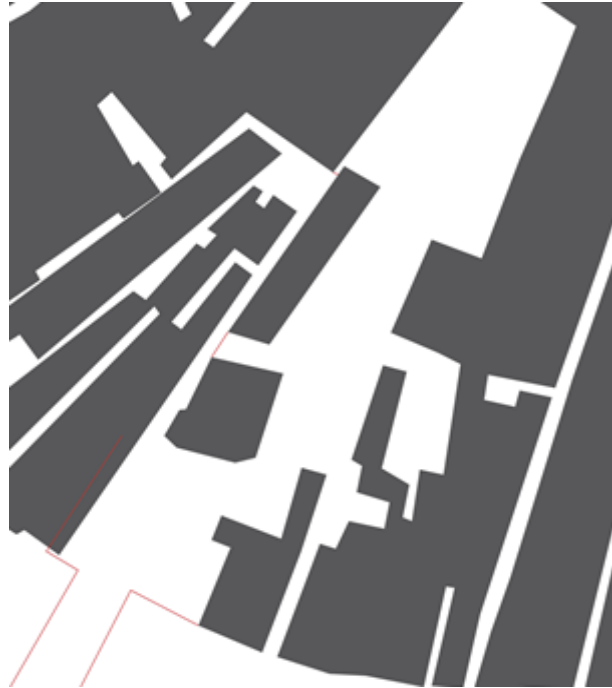
The data representing the planar area of the 50 subject piazze has a range of 7,000 to 87,500 square feet, or 0.2 to 2.0 acres. The largest piazza, Venice's Santo Stephano, is more than 10 times larger in planar area than the smallest, piazza Mattei in Rome. The frequency distribution of the 50 discrete piazze sizes is remarkably statistically normal, as shown in the frequency histogram. The most common areas are in the range of 20,000 to 50,000 square feet. Within that group, a 100 foot wide piazza would result in a planar proportion of between 1:2 and 1:5 and a 150 foot width would be associated with planar proportions between 1:1 and 1:2. For a given area, the wider planar dimensions of a piazza imply a more square (1:1) proportional geometry and less wide piazze are more elongated (1:5). Conversely, for a hypothetical piazze with a fixed width dimension, the larger its area, the more elongated it becomes. In this tripartite relationship between planar variables (area, dimension, and proportion), one can be specified as the criterion for design with the other two being adjusted to accommodate the desired spatial character.



Figure 20, a, b & c.
Rome: Piazza Mattei

The Piazza Mattei in Rome, at 7,000 square feet, is the smallest in area of the example piazze (Figure 20). It has a least width of only 70 feet and a length of just 100 feet. The resulting proportion is 1:1.4. This relatively small piazza with narrow width and strong sense-of-enclosure created by enclosing building height, façade characteristics, and corner morphology, exemplifies the issues of human scale with which this research is concerned.

In Venezia, the campo Santo Stephano is the largest of the 50 example piazze, at approximately 87,500 square feet or 2.0 acres (figure 21). With a conjectural width of only 125 feet, this piazza has an elongated planar proportion of approximately 1:5.1. This piazza demonstrates that point in the range of proportions where a public outdoor space makes the morphological transformation from a square to a street and the sense-of-enclosure begins to dissolve in favor of a sensation of movement.



The creation of a sociopetal space, in the case of piazza Mattei, is intrinsic in its size, at 7,000 square feet. The sense-of-enclosure and human scale of this public outdoor space are singularly obvious upon a visit, albeit not difficult to achieve considering the area metric. This piazza is an uncompromised example of an outdoor-room.



In contrast, S. Stephano is at the upper limit for area of an elongated piazza which can exist without becoming a street. The modulation of the footprint of the enclosing buildings creates sub-spaces within the total spatial experience. In spite of its vast size, by fragmenting the regularity of the enclosure and segmenting the elongated space, this piazza achieves a scale similar to that seen in the piazza Mattei.



Figure 21, a, b & c.
Venice: Campo S. Stephano

Table 4 Piazze Rank Planar Area

Town	Piazza	Area /	Square feet	Acres
Roma	Mattei		7,000	0.2
Pienza	Pio II (Piccolomini)		9,000	0.2
Siena	Salimbeni		14,000	0.3
S. Gimignano	del duomo		14,400	0.3
S. Gimignano	dell'erbe		14,450	0.3
Orvieto	del Popolo		18,850	0.4
S. Gimignano	della cisterna		18,500	0.4
Volterra	Maggiore (dei Priori)		22,000	0.5
Sabbioneta	Ducale (Garibaldi)		23,500	0.5
Verona	dei Signori		25,000	0.6
Roma	Minerva		25,000	0.6
Bergamo	Vecchia e del Duomo		26,000	0.6
Montepulciano	Grande		27,500	0.6
Ascoli Piceno	del Popolo		28,000	0.6
Monza	del Duomo		30,000	0.7
Viterbo	Plebiscito		30,000	0.7
Assisi	del Comune		31,000	0.7
Gubbio	della Signoria		32,000	0.7
Urbino	Rinascimento		32,000	0.7
Roma	S. Maria Trastevere		32,000	0.7
Pitigliano	della Repubblica		33,000	0.8
Urbino	Duca Federico		33,500	0.8
Ravenna	del Popolo		34,000	0.8
Todi	del Popolo (V. Emanuele) e Garibaldi		39,000	0.9
Bagnaia	XX September		41,000	0.9
Brescia	della Loggia		42,000	1.0
Arezzo	Grande		42,000	1.0
Roma	Farnese		42,000	1.0
Imola	Vittorio Emanuele (Matteotti)		42,500	1.0
Padova	Fruta		45,000	1.0
Padova	Signori		47,000	1.1
Padova	Erbe		47,500	1.1
Roma	(Campo) dei Fiori		48,000	1.1
Firenze	della Santissima Annunziata		49,000	1.1
Pavia	della Vittoria (Grande)		52,000	1.2
Vigevano	Ducale		53,000	1.2
S. Giovanni Val d'Arno	Cavour		53,000	1.2
Verona	delle Erbe		53,500	1.2
Lodi	della Vittoria		56,500	1.3
Lucca	S. Michele In Foro		56,500	1.3
Cremona	del Comune (Duomo)		60,000	1.4
Modena	Legna e Grande (Maggiore) e Enzo (Torre)		60,000	1.4
Venezia	(Campo) S. Polo		61,000	1.4
Figline Val d'Arno	Marsilio		67,000	1.5
Venezia	(Campo) S. Margherita		70,000	1.6
Pistoia	del Duomo		70,000	1.6
Firenze	S. Spirito		74,000	1.7
Faenza	del Popolo		75,500	1.7
Piacenza	dei Cavalli		82,000	1.9
Venezia	(Campo) S. Stefano		87,500	2.0

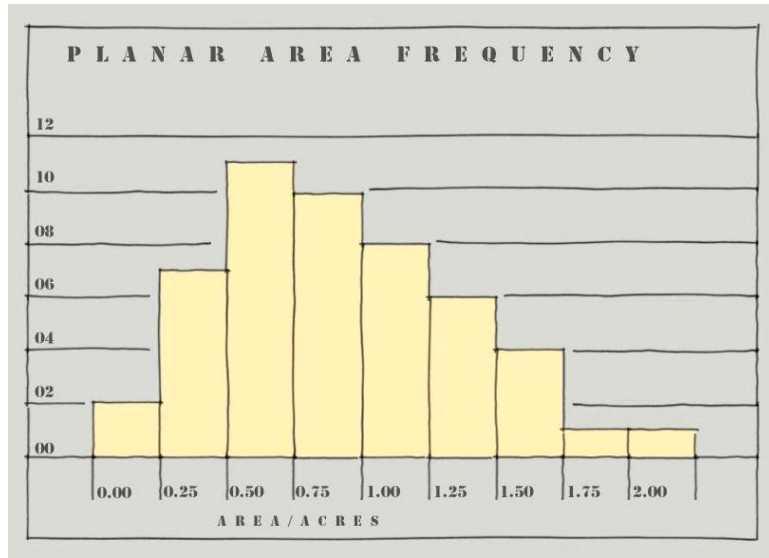


Figure 22. Planar Area Frequency Histogram

The histogram displaying the frequency characteristics of the data for planar areas of the subject piazze (figure 22) shows a statistically normal distribution for the data with a mean and median of .95 acres, negative skewness of .3402 and standard deviation of .4459. There being a direct mathematical relationship between planar

Table 5 Planar Area Frequency

Area/ Acres	Frequency	Percent	Cumulative Percent
0.00 -	02	04	04
0.25 -	07	14	18
0.50 -	11	22	40
0.75 -	10	20	60
1.00 -	08	16	76
1.25 -	06	12	88
1.50 -	04	08	96
1.75 -	01	02	98
2.0-	01	02	100
	50	100	

width, planar proportion and planar area, ($\text{Area} = \text{Width} \times \text{Length}$ and $\text{Proportion} = \text{Width} : \text{Length}$). Comparing the histograms and the frequency distribution of the three variables will reveal much concerning not only the distribution of the individual frequencies but also identify the unique attributes of each by the qualities of their distributions compared to the statistically normal planar area curve.

Planar Proportion

The data reveal no frequency among the piazza prototypes related to an upper limit on the planar proportions of 1:4 as prescribed by the *LEED ND Rating System*. In fact, the examples show a wide variation from that ratio ranging from the 1:5.6 proportion of the much admired Piazza della Vittoria in Pavia (figure 23) to the impressively scaled Piazza della Vittoria in Lodi (figure 24) with a ratio of width to length of 1:1.2. While the data do show a greater frequency of piazze with proportions approaching a square geometry, there is no underlying theoretically consistent basis supporting a preference for this proportion.



Figure 23, a & b.
Pavia: Piazza della Vittoria

It is most likely that the square shape is a consequence of planning realities of the dense urban locations and preexisting grid morphologies forcing the geometries of a certain percentage of the sample of fifty. Examination of the figure ground drawings associated with each of the geometrically square piazze reveals that preexisting grid morphologies may indeed be the circumstance. In any case, there seems little support for the choice of a 1:4 proportion as a limiting factor in the proportioning of public outdoor space. Examination of the data, along with the piazze plan drawings and figure ground



Figure 24, a & b.
Lodi: Piazza della Vittoria

drawings, does not suggest that effective p.o.s. is necessarily related to a 1:4 limit on the proportional relationship between the planar dimensions of the space. Too many exceptions, recognized as examples of good urban design tested over many hundreds of years, affirm the absence of theoretical agreement on preferred proportions.

Table 6 Piazze Rank Planar Proportion

Town	Piazza	Proportion
		Width : Length
Monza	del Duomo	1 : 1.0
Arezzo	Grande	1 : 1.1
Pienza	Pio II (Piccolomini)	1 : 1.1
Montepulciano	Grande	1 : 1.2
Volterra	Maggiore (dei Priori?)	1 : 1.2
Firenze	della Santissima Annunziata	1 : 1.3
Gubbio	della Signoria	1 : 1.3
Lodi	della Vittoria	1 : 1.3
Pistoia	del Duomo	1 : 1.3
Roma	Minerva	1 : 1.3
Roma	S. Maria Trastevere	1 : 1.3
Roma	Farnese	1 : 1.4
Roma	Mattei	1 : 1.4
Urbino	Duca Federico	1 : 1.4
Venezia	(Campo) S. Polo	1 : 1.4
Viterbo	Plebiscito	1 : 1.4
Bagnaia	Xx September	1 : 1.5
Modena	Legna e Grande (Maggiore) e Enzo (Torre)	1 : 1.5
Imola	Vittorio Emanuele (Matteotti)	1 : 1.7
Lucca	S. Michele In Foro	1 : 2.0
Verona	dei Signori	1 : 2.0
Bergamo	Vecchia e del Duomo	1 : 2.0
Siena	Salimbeni	1 : 2.0
Brescia	della Loggia	1 : 2.2
Padova	Signori	1 : 2.2
Piacenza	dei Cavalli	1 : 2.2
Cremona	del Comune (Duomo)	1 : 2.4
Orvieto	del Popolo	1 : 2.4
Padova	Fruta	1 : 2.5
Sabbioneta	Ducale (Garibaldi)	1 : 2.5
Firenze	S. Spirito	1 : 2.8
Roma	(Campo) dei Fiori	1 : 2.9
Padova	Erbe	1 : 3.0
Ravenna	del Popolo	1 : 3.0
Ascoli Piceno	del Popolo	1 : 3.1
Vigevano	Ducale	1 : 3.3
S. Giovanni Val D'arno	Cavour	1 : 3.5
Todi	del Popolo (V.Emanuele) e Garibaldi	1 : 3.6
Venezia	(Campo) S. Margherita	1 : 3.8
Figline Val D'arno	Marsilio	1 : 4.1
Assisi	del Comune	1 : 4.3
Verona	delle Erbe	1 : 4.5
Pitigliano	della Repubblica	1 : 4.6
Venezia	(Campo) S. Stefano	1 : 5.1
Urbino	Rinascimento	1 : 5.5
Pavia	della Vittoria (Grande)	1 : 6.2
Faenza	del Popolo	1 : 6.6
S. Gimignano	del Duomo	NA
S. Gimignano	della Cisterna	NA
S. Gimignano	delle Erbe	NA

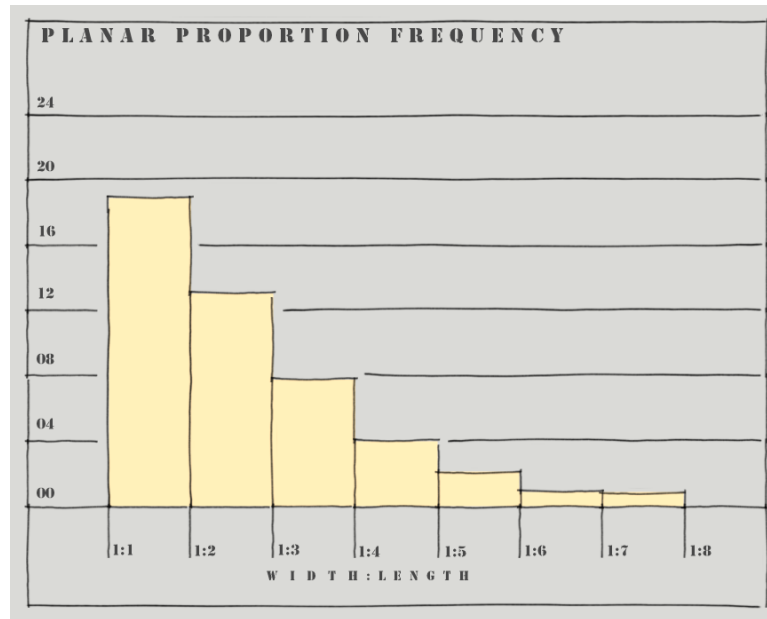


Figure 25. Planar Proportion Frequency Histogram

The histogram for “Planar Proportion Frequency” (figure 25) demonstrates the most common occurrence of piazze with planar proportions closest to a square geometry, with proportions between 1:1 and 1:2. As the proportions become more elongated, the frequency decreases regularly. This distribution

Table 7 Planar Proportion Frequency

Proportion Ratio	Frequency	Percent	Cumulative Percent
1:1.0 -	19	38	38
1:2.0 -	13	26	64
1:3.0 -	07	14	78
1:4.0 -	04	08	86
1:5.0 -	02	04	90
1:6.0 -	02	04	94
NA	03	06	100
	50	100	

is not comparable to the more statistically normal curve of the “Planar Area Frequency” histogram. The selection of a 1:4 proportion as significant, based on this data, seems somewhat arbitrary. It might be more useful to set a more inclusive benchmark at 1:5 or 1:6. By setting the limit on proportion at the more elongated rectilinear values, more instances of public outdoor space with large area values would be accommodated if a limit were to be set on the narrow planar dimension. The data for the three triangular piazze at S. Gimignano are listed as NA due to their uncomparable geometries.

The following diagrams, Figures 25 and 26, illustrate the relative shape and size of varying planar proportions when adjusted for fixed areas and fixed widths. The two figures have equal planar areas and proportions in the 1:3 cases.

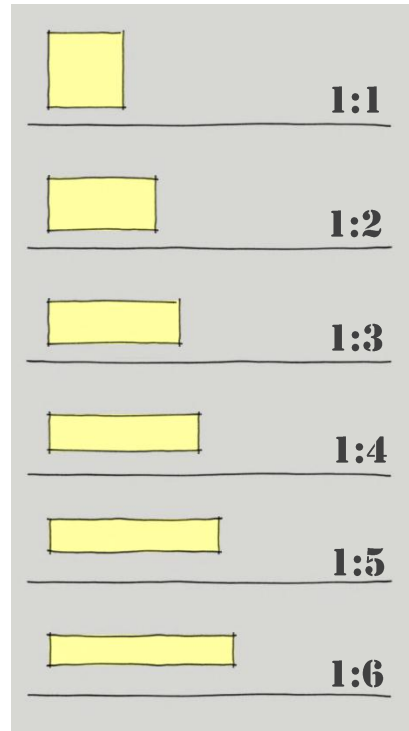


Figure 26. Equal Areas at Different Proportions of Width to Length

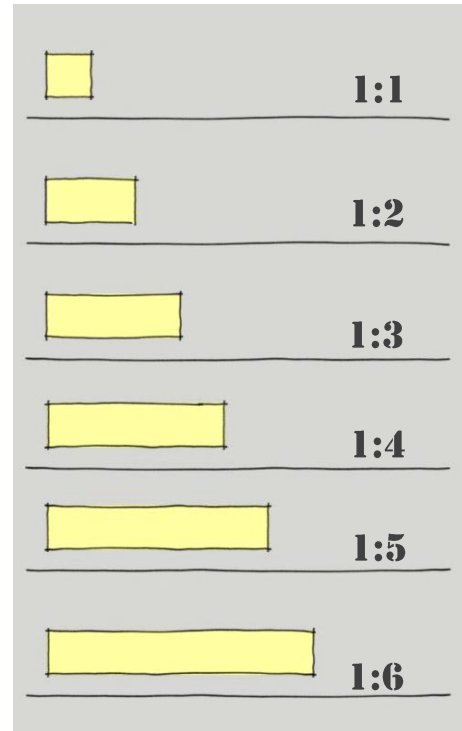


Figure 27. Equal Width at Different Proportions of Width to Length

The review of historical theory of public outdoor space design reveals no consistent preference for specific planar proportions related to human perception. Without a compelling theory that any proportion, 1:4 or otherwise, is a clear benchmark in the range of possible proportion seen in the example piazze, the more inclusive rule would seem most constructive. It is not clear what spatial purpose would be served by limiting the planar proportions of a square, other than differentiation from a street morphology. Streets are a different typology from Squares in the taxonomy of p.o.s. and there is a need to identify and characterize the two types for the purposes of urban design. A limit on the proportions of a square would serve this purpose without unnecessarily limiting the planar areas of those public outdoor spaces with an upper limit on their least dimension.

Planar Dimension

Studying the piazze in the case of planar dimension, rather than proportion, as the basis for effective design of humanly-scaled public outdoor space, yields a surprisingly focused range of dimensions. If the underlying dimensional parameter is the one previously discussed as related to visual acuity, then a dimensional range for the least width of the enclosed space would be based on a 70-80 foot horizontal range of vision centered on a person in the piazza. The general principle being that, at most locations in the space, a person should be able to see most of the other occupants in that portion of the piazza (70-80 feet away). Generally speaking, that would put the maximum dimension at ± 150 feet, assuming a person moving through the space and at the center is still able to recognize most faces in either direction. More conservatively, it could be construed that ± 75 feet would be the maximum allowing recognition at any location, including at the edges. A range of 75 – 150 feet could be accepted as a good basis for a maximum dimension for the enclosed p.o.s., allowing for recognition of most other human occupants at most locations with the subject moving through the piazza space.

Looking at the dimensions for width of enclosed space for the 50 examples, a significant group of the piazze fall within the discussed range of 75-150 feet, 35 of 50 piazze (70%). It seems, from this data, that a dimensional minimum of 75 feet and a maximum of 150 feet is critical to effective public outdoor space designed to attract human occupants to a venue for the production of social capital.

Table 8 Piazze Rank Planar Width

Town	Piazza	Width/feet
Pitigliano	della Repubblica	70
Roma	Mattei	70
Urbino	Rinascimento	70
Urbino	Duca Federico	70
Orvieto	del Popolo	75
Pienza	Pio II (Piccolomini)	80
Siena	Salimbeni	80
Assisi	del Comune	85
S. Gimignano	delle Erbe	90
Pavia	della Vittoria (Grande)	90
Ascoli Piceno	del Popolo	95
Sabbioneta	Ducale (Garibaldi)	95
S. Gimignano	della Cisterna	95
Todi	del Popolo (V.Emanuele) E Garibaldi	100
Ravenna	del Popolo	105
Faenza	del Popolo	110
S. Gimignano	del Duomo	110
Verona	delle Erbe	110
Volterra	Maggiore (dei Priori?)	115
Bergamo	Vecchia E del Duomo	115
Verona	dei Signori	115
Venezia	(Campo) S. Stefano	125
Figline Val d'Arno	Marsilio	125
Roma	(Campo) dei Fiori	125
Venezia	(Campo) S. Margherita	125
Vigevano	Ducale	125
Brescia	della Loggia	130
Padova	Erbe	130
Padova	Fruta	130
Montepulciano	Grande	135
S. Giovanni Val d'Arno	Cavour	135
Gubbio	della Signoria	140
Monza	del Duomo	140
Padova	Signori	140
Roma	Minerva	140
Lucca	S. Michele In Foro	140
Bagnaia	XX September	145
Cremona	del Comune (Duomo)	145
Firenze	S. Spirito	145
Viterbo	Plebiscito	145
Roma	S. Maria Trastevere	155
Imola	Vittorio Emanuele (Matteotti)	160
Modena	Legna E Grande (Maggiore) E Enzo (Torre)	165
Roma	Farnese	170
Piacenza	dei Cavalli	175
Arezzo	Grande	185
Firenze	della Santissima Annunziata	190
Venezia	(Campo) S. Polo	210
Lodi	della Vittoria	215
Pistoia	del Duomo	230

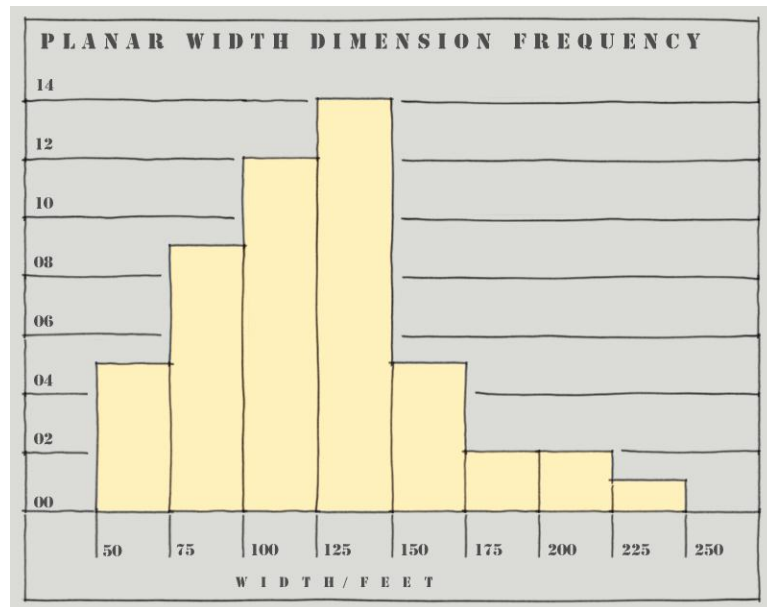


Figure 28. Planar Width Dimension Frequency Histogram

The histogram for “Planar Width Dimension Frequency” (figure 28) of the piazzes’ least dimension shows a precipitous drop in frequency as the width exceeds 150 feet with the significant majority of the values falling between 75 and 150 feet. This distribution is not one which reflects the more statistically normal qualities of the

Table 9 Planar Width Dimension Frequency

Width Feet	Frequency	Percent	Cumulative Percent
50- 75	5	10	10
75- 100	9	18	28
100- 125	12	24	52
125- 150	14	28	80
150- 175	5	10	90
175- 200	2	4	94
200- 225	2	4	98
225- 250	1	2	100
	50	100	

histogram showing the frequency of planar areas of the piazzes. If the piazzes prototypes are to be emulated, the data apparently support a critical range of dimensions, 75-150 feet, related to visual acuity and recognition of other occupants of the space by a human moving around or through the piazzes.

The Piazza Ducale in Sabbioneta, a 16th Century new-town in Lombardy, is an example of piazza with one dimension within the range which demonstrates the human scale associated with the 75 to 125 foot metric (figure 29). The Piazza Ducale is a particularly interesting case, being designed and built in the latter half of the 16th century as an ideal town based on theories of urban design current at its construction during the Renaissance. There were no existing physical constraints on the design of the town or the Piazza Ducale, no existing buildings or urban fabric to determine or influence the size or shape of the public outdoor space, as has so often been the case with other piazze. It might be assumed that the



Figure 29, a & b. Sabbioneta: Piazza Ducale

dimensions and proportions of this purpose-built piazza were based entirely on theoretical Renaissance concepts of p.o.s. morphology. The planar least dimension is 100 feet and the proportion of planar length to width is 1:2.5.

Another example of a purpose-built piazza is Piazza Ducale in Vigevano (figure 30), designed and constructed at the end of the 15th century in Lombardy as a major repurposing of a deteriorated residential quarter. Intended to serve as an exterior anteroom for the adjacent



castle of the Duke of Milan, the existing urban fabric was demolished and the Piazza Ducale was built in its place. The decisively dimensioned piazza is surrounded with arcades and a latter addition of a Baroque church façade at one end. The width of the space must be assumed to have been determined



Figure 30, a & b. Vigevano: Piazza Ducale

by theoretical rather than contextual considerations since the existing urban built-environment had been eliminated as necessary to make a site for construction of the designed space. Here the width dimension of 125 feet is, once again, within the suggested range. At Vigevano, a conscious decision was made, independent of context, to construct a public outdoor space at a dimension scaled to human experience.

An older example of a piazza demonstrating the dimensional range at issue here, is Piazza del Popolo (V.Emanuele) e Garibaldi in Todi, Umbria (figure 31). This example dates from the late 12th and early 13th century and has a less



theoretical basis for its design. Four major buildings which fixed the proportions and dimensions of the piazza were built within a 100 year time frame, albeit by different owners and designers. A collective concept of the planar layout of this piazza survived in the town's memory and resulted in subsequent reinforcement of the design concepts for hundreds of years.



Figure 31, a & b.
Todi: Piazza del Popolo
e Garibaldi

Here the reasoning underlying the selection of planar dimensions and the resulting proportion were probably more concerned with the practical considerations of design rather than ideal theory, as would have been consistent with contemporaneous practice. Again the dimensioning of the width of the piazza, 125 feet, has apparently been scaled to human occupation as postulated by this study. Remarkable, here at Todi, is not only the original dimensioning of the public outdoor space, but its survival and reinforcement over hundreds of years through a process of cultural memory.

Finally, as an example of a critical dimensional range existing in the context of an entirely non-theoretical based piazza shape and size, the Piazza del Comune in Assisi (figure 32), located in Umbría, demonstrates the recurrence of the critical dimensions in an entirely different context. This piazza has survived and evolved over one thousand years beginning in Roman times down through the Middle Ages and Renaissance with enclosing buildings from all periods. Once again, the width of the enclosed public outdoor space is in the range of 75 -150 feet, with much of the irregularly configured extended rectangle having a width of 75 feet.



Figure 32, a & b.
Assisi: Piazza del Comune

Assisi's piazze and its existence today is remarkable as an example of a p.o.s. taking on a collective identity and enduring over centuries of change of use and cultural context.

From the data and these anecdotal examples it would be possible to conclude that planar proportion is only a subordinate factor in the design of public outdoor space and in fact may be insignificant within such a very broad range of ratios. It could be theorized that the planar dimensions of the piazza play the most decisive role in determining the effectiveness of p.o.s. as a container for human activity or occupation. With that understanding in mind, then what other features of urban design are the major contributors to p.o.s. attractive to human use? In the literature associated with modern theory of urban design, from Sitte forward, sense-of-enclosure and the morphologies associated with it have a considerable position in the discourse. These morphological elements in the design of p.o.s. will be examined next.

Corner Morphology

The previously discussed emphasis on sense-of-enclosure put forward in *The Pattern Language* (Alexander et al, 1977) and discussed by Sitte (1889) has also been emphasized by other prominent theorists of outdoor public space morphology. In *Townscape* (1961), the heavily-illustrated urban design guide, Gordon Cullen discusses the art of intelligent city planning and creation of "townscapes." One of the basic ingredients he espouses is enclosure: "Enclosure or the outdoor room is, perhaps, the most powerful, the most obvious, of all the devices to instill this sense of position, of identity of the surroundings" (Cullen 290).

Hugh Moughtin, architect and Professor, examines the laws of architectural composition as applied to a detailed analysis of towns and cities in his work, *Urban design: Street and Square* (1992), one in a series of four books on the topic of urban design. Moughtin describes "enclosure" as "purist expression of a sense of place" where "order is created out of the undifferentiated chaos of the world beyond." He theorizes that the "square is an outdoor-room and with the room it shares the quality of enclosure" (Moughtin, 1992, 99). He then details a theory of "enclosure" related to corner morphology:

The key to enclosure in the square is the treatment of its corners. Generally speaking, the more open the corners of the square the less the sense-of-enclosure, the more built up or complete they are, the greater the feeling of being enclosed. Many recent urban spaces have two streets meeting at the corners; the space in this case disintegrates. (Moughtin 99)

Moughtin goes on to describe the corner conditions of single street opening (Walled) and completely closed corners as providing a stronger sense-of-enclosure than open or the above described situation of two intersecting streets (Intersect) conditions.

The Italian piazze included in the study were analyzed for strength of sense-of-enclosure by identifying characteristics of corner morphology and rating the piazze as to the typologies of corner conditions existing in each case. Corner conditions contributing to sense-of-enclosure were simplified into four increasingly enclosing morphological types (figure 33).

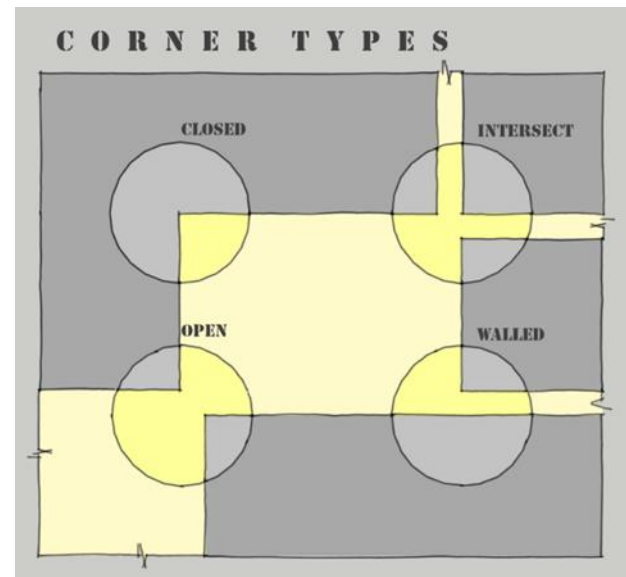


Figure 33. Four Corner Types on a Piazza

- Open- The lowest rated condition is an open corner with no structures closing the vista in any direction.
- Intersect- The second lowest rated enclosing condition is the situation created by two intersecting streets and the requisite buildings on.
- Walled- The third condition is a walled corner created by the continuation of one wall of the piazza as a street with buildings with no intersecting street.
- Closed- Finally, the highest rated corner condition is the completely closed corner with no opening at all.

By way of example, Piazza Vittorio Emanuele (Matteotti), in Imola (figure 34), has two corner types, an Intersect, at the Southeast corner and Walled at the Northeast and Southwest corners.



Figure 34, a & b. Imola: Piazza Vittorio Emanuele (Matteotti)

The Piazza Salimbeni (figure 35) in Siena demonstrates three of the hypothetical types: an open corner to the west, two closed corners to the north and east and a walled corner to the south.

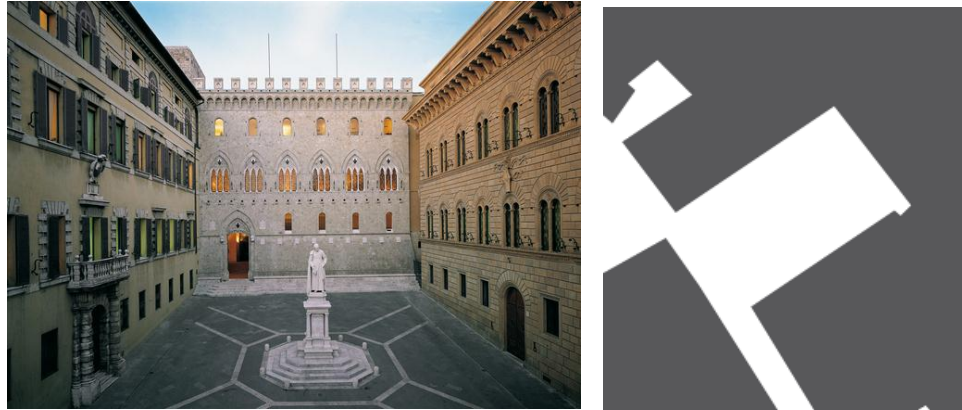


Figure 35, a & b. Siena: Piazza Salimbeni

Each piazza was examined and types assigned for each corner as warranted by its most likely morphology. Several of the piazza (NA) had such complex planar shapes and indeterminate ambiguous corner conditions, that any attempt at objectification would have been misleading. (table 10).

Table 10 Piazza Corner Morphology

Town	Piazza	Corner Morphology Types Frequency of Occurrence			
		Open	Intersect	Walled	Closed
Arezzo	Grande	0	1	3	0
Ascoli Piceno	del Popolo	0	2	2	0
Assisi	del Commune	0	1	3	0
Bagnaia	XX September	NA	NA	NA	NA
Bergamo	Vecchia e del Duomo	0	2	0	2
Brescia	della Loggia	1	2	1	0
Cremona	del Comune (Duomo)	1	0	2	1
Faenza	del Popolo	1	0	2	0
Figline Val d'Arno	Marsilio	0	0	4	0
Firenze	della Santissima Annunziata	0	0	3	1
Firenze	S. Spirito	1	1	1	0
Gubbio	della Signoria	NA	NA	NA	NA
Imola	Vittorio Emanuele (Matteotti)	0	1	3	0
Lodi	della Vittoria	0	2	2	0
Lucca	S. Michele in Foro	1	1	2	0
Modena	Legna e Grande (Maggiore) e Enzo (Torre)	1	1	2	0
Montepulciano	Grande	0	1	3	0
Monza	del Duomo	NA	NA	NA	NA
Orvieto	del Popolo	NA	NA	NA	NA
Padova	Erbe	0	0	3	1
Padova	Signori	0	1	2	0
Padova	Fruta	1	2	1	0
Pavia	della Vittoria (Grande)	1	0	1	0
Piacenza	dei Cavalli	1	1	2	0
Pienza	Pio II (Piccolomini)	0	0	4	0
Pistoia	del Duomo	1	2	0	1
Pitigliano	della Repubblica	NA	NA	NA	NA
Ravenna	del Popolo	0	1	1	2
Roma	S. Maria Trastevere	0	1	2	1
Roma	Farnese	0	2	2	0
Roma	Mattei	0	1	2	1
Roma	Minerva	2	0	1	1
Roma	(Campo) dei Fiori	1	3	0	0
S. Gimignano	delle Erbe	NA	NA	NA	NA
S. Gimignano	del Duomo	NA	NA	NA	NA
S. Gimignano	della Cisterna	NA	NA	NA	NA
S. Giovanni Val d'Arno	Cavour	0	0	1	3
Sabbioneta	Ducale (Garibaldi)	0	2	2	0
Siena	Salimbeni	1	0	1	2
Todi	del Popolo (V. Emanuele) e Garibaldi	1	1	2	0
Urbino	Rinascimento	NA	NA	NA	NA
Urbino	Duca Federico	NA	NA	NA	NA
Venezia	(Campo) S. Polo	0	0	3	1
Venezia	(Campo) S. Margherita	2	0	1	1
Venezia	(Campo) S. Stefano	NA	NA	NA	NA
Verona	dei Signori	0	0	2	2
Verona	delle Erbe	1	0	2	0
Vigevano	Ducale	0	0	2	2
Viterbo	Plebiscito	0	0	3	1
Volterra	Maggiore (dei Priori?)	0	0	2	2

This is a very basic and simplistic descriptive format, ignoring the relative differences in magnitude of effectiveness of the four corner typologies. The values could be refined by weighting the values assigned to the morphologies based on subjective contribution to sense-of-enclosure and expanding the types to include more variations on the four basic models.

The data show a very broad range of values for total strength of enclosure based on corner morphology. Indeed, upon visiting the piazze in person, the phenomenological experience of enclosure does correlate with the wide divergence in values. Corner morphology is a very strong element in the creation sense-of-enclosure and sense of comfort for the human occupants of public outdoor space. The perceivable variation in this sense-of-enclosure associated with particular corner morphologies is evident during site-visits to several of the ranked examples. This perceived correlation would seem to confirm the primary role corner morphology plays in creating a strong sense-of-enclosure for p.o.s.

Sectional Proportion

Also significantly contributing to the sense-of-enclosure of any outdoor-room is sectional proportion, the relationship of the height of enclosing structures to the ground plane dimension. Sectional proportion is a basically complex parameter, complicated by details of architectural design. From the history of the theory of planar, and sectional, proportion, it is evident that a wide range of opinion exists concerning the correct proportional relationship between the height of the enclosing buildings and the planar dimensions of a piazza. Alberti's recommendations, the first theoretical examination of the subject, from the *Ten Books on Architecture*, written in 1450, are somewhat broad. His ratio of height to planar dimension range from 1:3 to 1:6: "A proper height for the buildings about a square is one third of the breadth of the open area, or one sixth at the least" (Alberti 173). This is not a very decisive directive for modern urban design.

The mid-20th century contemporary urban design common knowledge is explained and illustrated by Paul Spreiregen in his survey of architectural urban design practice, *Urban Design: The Architecture of Towns and Cities* (1965). He sets a narrower range of ratios. Based on the angles of various lines of sight in an enclosed outdoor space (figure 36), a maximum ratio of 1:1 or 45° yields "full enclosure," a ratio of 1:2 or 30° results in "threshold of enclosure," a ratio of 1: 3 or 18° creates "minimum enclosure and with a ratio of 1:4 or 14° "loss of enclosure" occurs (Spreiregen 75).

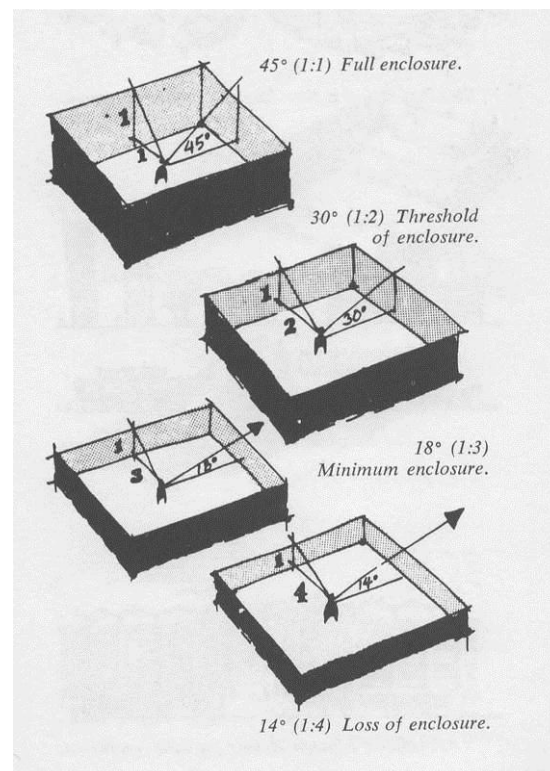


Figure 36.
Degree of Enclosure (Spreiregen, 1965)

As previously discussed, Kevin Lynch makes a case for a range of 1:1 to 1:4 (Lynch, 1971) with the 1:4 included in the acceptable range contrary to previous theory. Sitte was more conservative, advising that a ratio of 1:2 (Sitte, 1889) was preferable, and even that with much qualification. There does not seem to be firm agreement on these proportions from Alberti through Sitte down to Lynch.

All the aforementioned theories of sectional proportion are based on the science of optics, cone of vision, and angle of vision related to distance, allowing full view of buildings much as Aristotle theorized. Again, Spreiregen discusses (figure 37) the view based proportional theory and provides an illustration (Spreiregen 78).

In 1984 the American Planning Association published a guide to *The Fundamentals of Urban Design* authored by Richard Hedman and Andrew Jaszewski. They also presented an explanation of the theory behind the sectional proportional standards popular at the time for outdoor space. Here the amount of perceived sky as compared to area of wall included in the perception, or range of

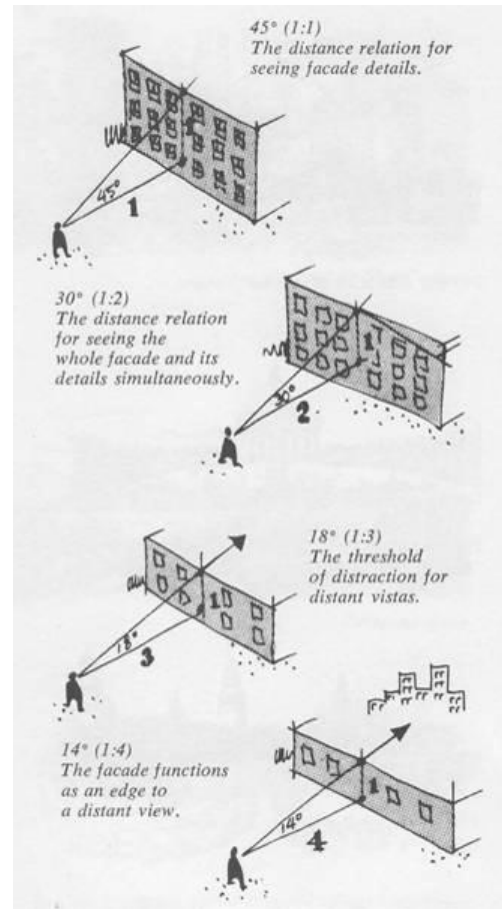


Figure 37.
Angle of Vision (Spreiregen, 1965)

vision, of the space is the seen as the critical factor in determining the sense-of-enclosure.

The ratio of 1:4 is described as having “three times as much sky as wall” and a “weak sense of space”. A 1:2 ratio gives “peripheral glimpses of sky equal [to] the amount of visual field devoted to the street wall.” This situation “provides sufficient spatial containment to permit the creation of intensely three-dimensional space,” a 1:1 ratio “severely limits any sky view” but allows for the possibility of “strong spatial definition.”

Finally, a unique instance of a ratio of 3:2 is introduced and described as claustrophobic to some and restrictive to the entry of sunlight into the space, with buildings cutting off peripheral vision of the sky and the tops of buildings (figure 38). While this standard is based, in principal, on the relationship of human occupants to the sky, no attention is given to the public outdoor space's solar orientation, an obvious additional parameter to the already complex formulation (Hedman and Jaszewski 18).

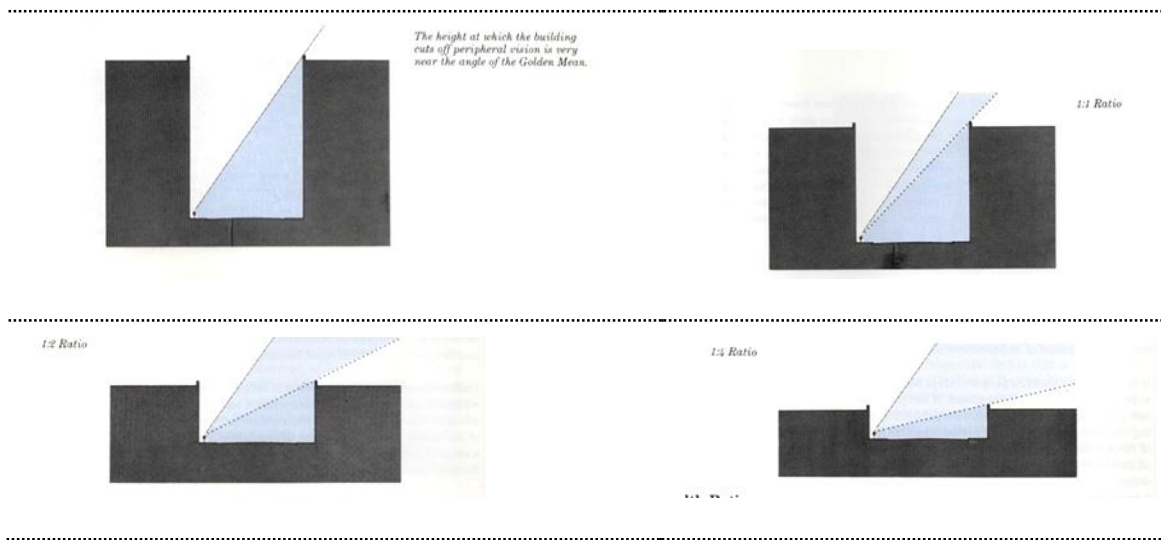


Figure 38 "Sense of Enclosure" diagrams. *The Fundamentals of Urban Design*

Additionally confusing, to any standard set of values associated with sectional proportion, is the degree of uniformity associated with the measurement of adjacent enclosing structures of variable heights. A variable building height calculation cannot be used interchangeably with a uniform building height measure of the same value. A mean of widely inconsistent building elevations is not equal in value to a set of buildings of uniform height. The two cases do not have the same proportional effects on the enclosed outdoor space. Applying a set ratio to the typical enclosed outdoor space with significant variations in the heights of the buildings surrounding the space would be quite a challenge, making the application of a standard difficult.

Any public outdoor space standard must necessarily be concerned, not only with the vertical proportion of structures surrounding the outdoor space, but also with the details of their building morphology. A building's detailed façade characteristics and scale can have as much influence on the sectional proportion as actual height.

Sectional proportion analysis, measurement, and calculation is a complex and somewhat indeterminate process. Its outcome is consequently a somewhat subjective factor in the sense-of-enclosure aspect of a subject public outdoor space. It is also the most subjective to apply to the widely varying existing morphologies, taking into consideration multiple enclosing building heights and façade characteristics influential in the human perceptual experience of the outdoor space.

Again it can be seen that proportion in the sectional as well as planar orientation is a difficult factor to intelligently include in the urban design equation of public outdoor space. With no clear definitive tradition of preferred values and considerable difficulties in creating a standard from the ideal case of uniform height to the practical realities of varying uses, details, and dimensions, sectional proportion is a complicated standard to implement on-the-ground.

With these caveats in mind, the subject piazze were evaluated for sectional proportion characteristics with subjective estimations being made of the meaningful line of height in those many cases with varying non-uniform sectional



Figure 39. Determination of Sectional Proportion method

characteristics (figure 39). The objectifying of the sectional proportion aspect of the piazze involved importing scaled images of the piazze into the *Sketchup* drawing computer application and subjectively judging the relationship between the enclosing buildings and

the planar dimensional characteristics of the outdoor space. Drawing a scaled rectangle on the imported image allowed for measurement of the spatial relationship as show in the example, Bergamo’s Piazza Vecchia, with an estimated sectional proportion of 1:2.6.

Additionally qualifying the data is the elimination of a significant number of example piazze due to indeterminate enclosing building height and/or anomalous façade characteristics. The process of determining sectional proportion is inherently subjective and in several cases that degree of conjectural and speculative evaluation reaches a point where the metric arrived at is misleading. The precision of the proportional ratio can, in these cases be deceptive with a distorted impression of accuracy, unrevealing of the actual subjective nature of the data.

Table 11 Piazze Sectional Proportion

Town	Piazza	Sectional Proportion Ratio
Verona	dei Signori	1 : 1.3
Imola	Vittorio Emanuele (Matteotti)	1 : 1.3
Todi	del Popolo (V.Emanuele) E Garibaldi	1 : 1.5
Pienza	Pio II (Piccolomini)	1 : 1.5-2.0
Pavia	della Vittoria (Grande)	1 : 1.6
Faenza	del Popolo	1 : 1.6
Assisi	del Commune	1 : 1.6
Urbino	Duca Federico	1 : 1.7
Urbino	Rinascimento	1 : 1.7
Orvieto	del Popolo	1 : 1.8
Viterbo	Plebiscito	1 : 1.8
Verona	delle Erbe	1 : 2.0
Volterra	Maggiore (dei Priori)	1 : 2.0
Roma	Farnese	1 : 2.0
Roma	Mattei	1 : 2.0
Roma	Minerva	1 : 2.0
Ravenna	del Popolo	1 : 2.0-3.0
Gubbio	della Signoria	1 : 2.2
Venezia	(Campo) S. Margherita	1 : 2.5
Figline Val d'Arno	Marsilio	1 : 2.5
Ascoli Piceno	del Popolo	1 : 2.5
Bergamo	Vecchia E del Duomo	1 : 2.6
Sabbioneta	Ducale (Garibaldi)	1 : 2.6
Brescia	della Loggia	1 : 2.7
Piacenza	dei Cavalli	1 : 2.8
Padova	Signori	1 : 3.0
Firenze	S. Spirito	1 : 3.0

Table 11 Piazze Sectional Proportion (cont'd)

Town	Piazza	Sectional Proportion Ratio
Lucca	S. Michele In Foro	1 : 3.0
S. Giovanni Val d'Arno	Cavour	1 : 3.0
Lodi	della Vittoria	1 : 3.3
Montepulciano	Grande	1 : 3.5
Pistoia	del Duomo	1 : 3.5
Vigevano	Ducale	1 : 4.0
Firenze	della Santissima Annunziata	1 : 4.0
Arezzo	Grande	NA
Bagnaiia	XX September	NA
Cremona	del Comune (Duomo)	NA
Modena	Legna E Grande (Maggiore) E Enzo (Torre)	NA
Monza	del Duomo	NA
Padova	Fruta	NA
Padova	Erbe	NA
Pitigliano	della Repubblica	NA
Roma	(Campo) dei Fiori	NA
Roma	S. Maria Trastevere	NA
S. Gimignano	delle Erbe	NA
S. Gimignano	del Duomo	NA
S. Gimignano	della Cisterna	NA
Siena	Salimbeni	NA
Venezia	(Campo) S. Polo	NA
Venezia	(Campo) S. Stefano	NA

While the data are significantly compromised by the conjectural nature of the determining elements, there is a conclusion evident. None of the piazze have a height to planar width ratio less than 1:1.3 and none greater than 1:4. There is a very even distribution of ratios within that range of 1:1.3 to 1:4 with no real dominant proportion. From this necessarily limited and subjective attempt at measuring the inherently ambiguous morphological characteristic of sectional proportion, it seems that the best rule-of-thumb would be that any proportion less than 1:4 does not detract from a positive sense-of-enclosure in public outdoor space. Nothing much more conclusive can be said after reviewing the data. With such a large group of examples with indeterminate sectional proportion ratios, the most significant finding of this aspect of the research may be the inherent difficulty associated with the use of sectional proportion in the criteria for the design of p.o.s. with a strong sense-of-enclosure.

Theoretical Conclusions

The data collected and analyzed in this study provide a new perspective on the morphological attributes necessary, but not necessarily sufficient, for the creation of effective sociopetal public outdoor space. The piazza examples demonstrate that:

- Specific planar dimensions, based on human visual acuity, are a salient and defining characteristic of these prototypical public outdoor spaces.
- Corner morphology and sectional proportion are secondarily important as contributors to a piazza or Square's sense-of-enclosure.
- Planar proportion seems most significant as an indicator for morphological differentiation of Squares from Streets, rather than a set of design criteria associated with human habitation and comfort in an outdoor space.
- Planar area has significance as a definitive attribute separating Squares from Plazas and Parks, particularly in relation to narrow width dimensions.

Two issues are brought forth for reconsideration. First, no single element of this complex set of morphological characteristics is sufficient for operative public outdoor space and planar proportion may not be the most significant. Additionally, it is suggested that the LEED ND criteria be based on a clear taxonomy and applicable typology of p.o.s. This underlying structure is now absent from the rating system.

The LEED ND standard is narrowly focused on the singular characteristic of planar proportion while ignoring dimension, as well as other morphological characteristics of public outdoor space. At the same time, the standard is somewhat inconsistently complex on the issue of the actual planar area of the regulated p.o.s. While disregarding other crucial factors, which could easily be quantified, the standard inexplicably focuses on a sole factor which may actually prove to be relatively insignificant as a component in the design of p.o.s.

Dimension related to the phenomenological human experience would seem to be the most important issue in the design of these spaces. Planar proportion is a necessary, but not sufficient factor in the consideration of space design; without a specific fixed dimensional range, the proper proportions for public outdoor space are indeterminate.

No mention in the LEED ND system is made of a more significant aspect of proportion, that is, the relationship between surrounding building height and the enclosed space dimension. As an element in the creation of the phenomenon of comfort, this height to planar width measure is probably more significant than planar proportion.

Finally, in the criteria, no attention is given to issues of sense-of-enclosure and comfort as generated and reinforced by the enclosing buildings, the space's characteristics as positive space and its corner morphology. These factors are more easily determined and implemented than the sectional proportion feature, considering the inherent operational conflict between the varying building typologies and heights of mixed-use and the strong role uniform heights of enclosing buildings play in the creation of sense-of-enclosure through sectional proportion.

If the LEED ND criterion are now reconsidered, by reexamining the dimensional outcomes of the application of the proportional prescription to the planar areas generated, it can be seen how the resulting size range is unrelated to issues of human scale and thus not obviously useful as an effective standard for public outdoor space.

L.E.E.D. N.D. Planar Dimension Standards			
Case	Area	Minimum Width	Maximum Width($\sqrt{\text{area}}$)
1	1/6 acre - 7,260 sf	42' (x 173')	85'
2	1/2 acre - 21,780 sf	74' (x 294')	148'
3	1 acre - 43,560 sf	104' (x 419')	209'

Looking again at the dimensional Area ranges and resulting Maximum Widths drawn from the LEED ND standards, only the maximum for Case 1, the minimum and maximum for Case 2 and the minimum for Case 3 have any relationship to the dimensions proposed by Maertens. The gross difference in scale between the Minimum and Maximum Widths clearly ignores the historically demonstrated importance of dimension in shaping human experience, both from an empirical and a phenomenological point of view. This wide range of planar areas is indicative of the lack of attention the LEED ND criteria pays to the concept of scale related to human experience and the phenomenon of human spatial comfort.

Additionally, the 1:4 planar proportional limit on the maximum lesser dimension of a public outdoor space, disallows many viable geometric possibilities related to actual dimensions (between 75 and 125 feet) which have been demonstrated as operative in past built examples. This aspect of the standard would allow the least effective range of proportions to be advocated as the 1:4 ratio approaches 1:1 or a square in plan, generally regarded by urban design theorists as the most undesirable geometry for space enclosure. Again, the criteria seem to be somewhat arbitrary, in light of a long history of theory and research contrary to the outcomes encouraged by application of its formulas.

In the course of critically examining the LEED ND criteria, certain inconsistencies and oversights related to the types of outdoor space mentioned in the narrative were pointed out. It seems that a more rigorous and robust approach to the taxonomy of public outdoor space would benefit the logical construction and application of the rating system. Parks and Squares are two distinct types of space and have completely different morphological systems of operation. Streets and Squares are also taxonomically and functionally different and merit separate standards. All five types¹⁸ need strict definition and design standards responsive to their purpose and morphologies.

¹⁸ LEED ND includes mentions of: squares, parks, streets, paseos, and plazas.

Recommendations for Modifications to the LEED ND Criteria

Taking into consideration both this study's observations on the LEED ND evaluation system and the data representing the morphological characteristics of the prototypical Italian piazza, some conclusions concerning the current LEED ND criteria might be justified. Specifically called into question by this research are the framework and structure of the rating system's public outdoor space taxonomic organization. Additionally, its specifics, in regard to the design of effective sociopetal p.o.s., are critically questioned.

Implicit in the following recommendations is recognition of the need for a theoretical foundation for the design criteria consistent with commonly-held concepts associated with the design of public outdoor space. These principles have been formulated throughout the history of urban design and architecture, from the ancient Greeks to modern theorists.

The proposed recommendations for revisions and additions to the LEED ND rating criteria are intended to accomplish these objectives:

- Create position and point awards within the rating system for public outdoor space, commensurate with its critical role in the development of social capital in neighborhood spatial units
- Establish a typology of public outdoor space based on a comprehensive and inclusive morphological and operative taxonomy of that aspect of urban design
- Differentiate the Square type of public outdoor space from the Street type through the imposition of a proportional limit on ratio of planar length to width, beyond which an elongated Square takes on the attributes and design parameters of Streets
- Further differentiate the typological category of Square from the Park and Plaza types, through the imposition of area limitations on the three types with Parks being the largest, Plazas intermediate in planar size and Squares being the smallest
- Establish minimum and maximum planar dimensional limits on the least width of Square types of p.o.s., with the intent of creating sociopetal space for human occupation

- Create a systematic method of accounting for and enabling corner morphology which contributes to the sense-of-enclosure of Squares
- Establish a simple and easily implemented criteria for the placement of limits on the upper and lower sectional proportions of Squares

The following recommendations for modifications to the rating system are offered in rank order of suggested implementation:

1. That public outdoor space be made a Prerequisite in the rating system, similar to the positioning of Walkable Streets. Additionally, that the point system be adjusted to include increased award points for the characteristics of p.o.s. which meet the herein suggested revised criterion for neighborhood developments. A significant range of points might be offered, as in the case of Walkable Streets, with increasing points awarded for higher levels of specific compliance.
2. That a limited strictly defined morphological and functional taxonomy, and associated typology, be established and clearly defined in the LEED Neighborhood Development criteria. Specifically, that the standards for public space, defined as related to Streets, be separate and distinct from those related to Parks or enclosed Squares, and that other extraneous types (plazas and paseos) either be dropped from the narrative or succinctly defined as useful additional types

Table 12 Suggested Public Outdoor Space Typology Based On Planar Area and Proportion

Type:	Planar Area:	Planar Proportion:	Purpose:
Park	>4.0 Acres	NA	General Recreation
Plaza	2.0 Acres – 4.0 Acres	1:1- 1:4	Ceremony, Inspiration
Square	<2.0 Acres	1:1- 1:6	Social Capital Production
Street	NA	1:5+	Movement, Circulation and Social Capital Production

3. That the primary standard be set for a planar dimension of no less than 75 feet and no greater than 150 feet for the least width of a Square type of public outdoor space.
4. That, secondarily, a 2.0 acre (\pm 87,000 sf) maximum planar area be established for the subject public outdoor space of the Square type.
5. That a limit on the planar proportion of Square type public outdoor space be established as 1:6, thereby differentiating, for example, a Square with a proportion of 1:5.5 from a Street with the proportions of 1:6.5.

These dimensional and proportional limits allow for the following alternative hypothetical configurations (figures 40 & 41):

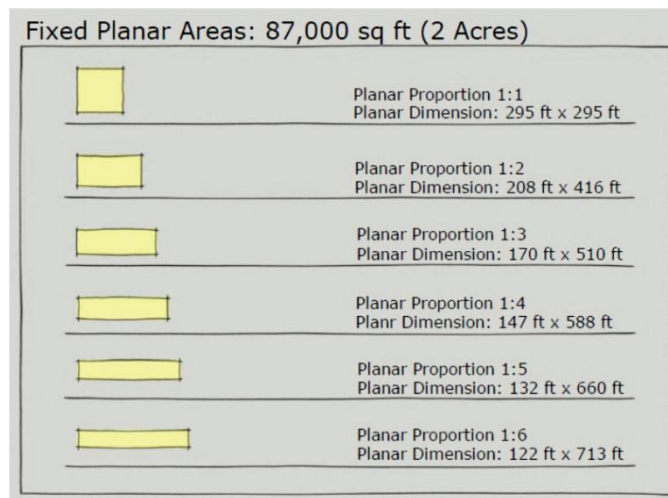


Figure 40. Attributes of fixed Planar Areas of varying Planar Proportions

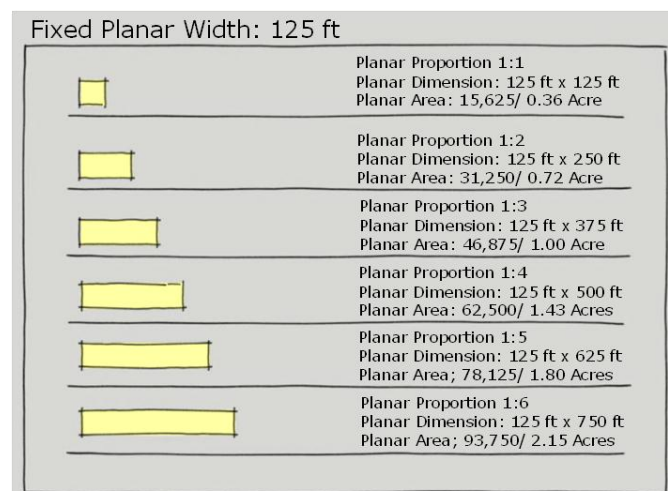


Figure 41. Attributes of fixed Planar Widths of varying Planar Proportions

6. That a maximum of five street penetrations, each in excess of ten feet in width, be allowed entering the subject Square at corner locations and that no more than two be allowed at non-corner locations (figure 42). (The number of streets counted is hypothetical: Closed=0, Walled=1, Intersect=2, and Open=3. An open corner configuration counts as having the same impact on the sense-of-enclosure as three proximate streets in a single location.)

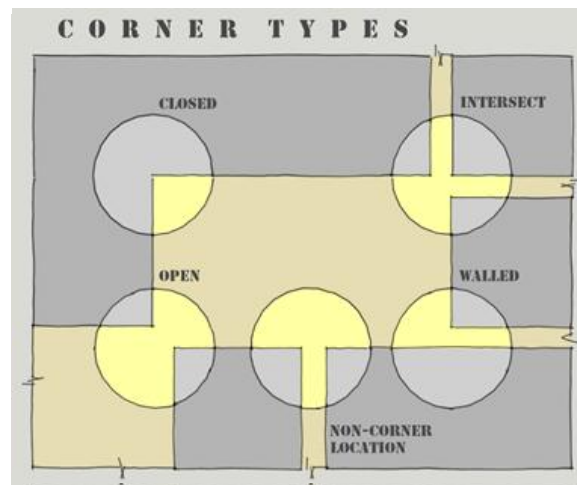


Figure 42. Street Penetrations at Corner Locations

7. That the height of all buildings surrounding and enclosing the Square type of public outdoor space be of a mean height no less than 2 times, and no more than 4 times, the least planar dimension with none counted for height in the calculation of the mean which is more than double the average height calculated without taking the taller building into consideration. Additionally, such taller buildings not considered shall not constitute more than some specific percentage, perhaps 25%, of the entire perimeter of the enclosing building frontage on the enclosed public outdoor space.

It may be necessary to develop a more complex system to manage the multifaceted nature of exterior architectural space design than that put forth in the LEED ND system. With the tools provided by this review of the history of theoretical analysis of the design of public outdoor space and analysis of Italian piazza prototypes, perhaps the criterion for successful outdoor-rooms as standardized by the LEED ND system could be redirected to include dimensional criteria, characteristics of enclosure, three dimensional proportion, and other attributes relevant to the human experience of comfort in these outdoor-rooms.

In regard to the public outdoor space portion of the LEED ND point system, close examination and analysis have revealed some aspects of the narrative which need improvement. A rational taxonomic-based typology is essential for a broad understanding of any subject matter and is missing in the *LEED ND Rating System*. This study provides a structured scheme to correct this perceived shortcoming. Secondly, much knowledge and understanding of the principles of urban design, as applicable to p.o.s., has been overlooked in the development of the LEED ND design criteria. This study attempts to provide some p.o.s. design guidelines based on historic theory and morphological analysis of some established prototypes.

The *LEED ND Rating System* is, strictly speaking, a set of design criteria, not a standard for design. While not intended to be an enforceable or compulsory prescriptive standard, the system's situation in the culture of sustainability gives it a position of significant influence in the practice of planning and urban design. The rating system is likely to take on significance beyond that of a point-based incentive for particular design outcomes. Considering the recent history of the LEED program as applicable to individual buildings, the LEED Neighborhood Development point system will probably take on the force of an informal standard for design. That being said, it is essential that this set of criteria be given adequate scrutiny to insure that LEED ND presents a logical, rational, and comprehensive approach to the challenges of neighborhood design responsive to contemporary circumstances.

This research is intended to provide a model for further analysis and critique of the laudable effort by the USGBC to develop a systematic approach to encouraging the design and implementation of neighborhood spatial units more responsive to the environmental challenges facing our society. Effective public outdoor space is an essential element in the constitution of sustainable communities as a venue for the production of social capital leading to adaptive collective community-based behaviors. While it is important that the details of LEED ND criteria be as effective as possible in fostering operationally sociopetal

spaces, also significant is the encouragement of the creation of public outdoor space as an essential component in neighborhood design. Supplemental to the minor point awards for specific design approaches and details discussed in this research, Prerequisite status and major point awards for the inclusion of any of the public outdoor space taxonomic types would seem essential to the success of any neighborhood spatial unit. With these modifications the *LEED ND Rating System* will be enabled as leading force in our culture to encourage public outdoor space responsive to the challenges of sustainability and resilience in our current environmental crisis.

Some aspects of the morphological characteristics, which are the subject of this research, merit further investigation. With the emphasis on the planar dimensional characteristics being based, in large part, on the optical theories of Maertens, it would be important that some research pursue the verification of the distance parameters suggested by these theories. This could be accomplished either by actual testing with human subjects or review of existing literature which documents any preexisting testing in this regard. It is significant whether the suggested face recognition distance is accurate and if there are other, possibly more significant, factors contributing to the recognition of other humans at specific distances.

The typology of public outdoor spaces suggested for the LEED ND rating system would benefit from a more robust investigation into the limits on each category and testing of the types using a broad range of existing public outdoor spaces. Through application of the taxonomic system, using the suggested typologies, to a large group of diverse examples, necessary adjustments in the typology might present themselves.

The corner morphology analysis would benefit from a value-weighted scoring system based on comparative evaluation of the several corner types. With these values a ranking of the piazzas could be developed and frequency analysis would be possible. It is clear, from the limited investigation conducted in this research, that the value of each corner type, as contributory to the sense of enclosure of a piazza, does not exist on an incrementally

regular scale. Discrete values for each type will need to be determined and evaluated so that total values of each piazza are comparable and consistent as representative of the total human perception of enclosure in that space.

Further research might also be concerned with the identification and analysis of the historic, functional, programmatic and process related features, as well as the physical characteristics, of successful durable existing urban public outdoor spaces. The proposed work would be an expansion of and shift in focus and scale from this investigation of Italian Piazzes. This research would expand the included sites from Italy to other countries and broaden the scope of the survey and cataloging to include process-related data.

The physical characteristics, which are the subject of this research, have included each piazza's corner morphology, features of enclosing building type and the dimensional and proportional aspects of spatial enclosure. Additionally, significant in consideration of the durability and feasibility of public outdoor space are the process oriented operational characteristics.

These non-morphological characteristics might be cataloged and analyzed and include:

- Paradigms of ownership, expected models involving, for example:
 - either private or public direct ownership of entire public space and enclosing buildings
 - lease and sublease arrangements for all or a portion of the structures and space
 - enclosing buildings held as separate property from the space and underlying lands
- Partis (schematic conceptual diagrams) as related to use and form
- Ongoing managerial schemes
- The physical origination or assemblage of public space and its development are also subject to variation, including:
 - demolition of selected existing buildings to create new space in an existing urban fabric,

- major remodeling of an existing urban public outdoor space creating a new spatial structure
- large-scale alteration of an existing urban fabric for the construction of new public outdoor space
- incremental assembly of a public outdoor space over some relatively long time period
- inclusion of a new public outdoor space as part of a single larger new development

The purpose of this additional research would be to understand how public outdoor space, of the Square type, takes a viable long-term place in neighborhoods and communities. By studying the operational characteristics of effective public outdoor space, an understanding of the factors which favor the economic and social durability of squares in this and other cultures, certain operationally necessary physical design features, unrelated to the human perceptual experience, might be discovered.

Because the Street type is the most common form of public outdoor space in the culture of the United States at this point in time, most research and design criteria are associated with the morphology and human use of streets. This is clear from this research's initial review of the *L.E.E.D. Neighborhood Development Rating System* and its obvious emphasis on Street design at the expense of the Square type of public outdoor space. Further research into the Square type will be necessary in order that a credible foundation, based on demonstrable theory and supporting data, be established and a sound case be made for the common inclusion of effective and durable Square type p.o.s. in sustainable neighborhoods included in the built-environment of this culture.

Bibliography

Alberti, Leon Battista, Cosimo Bartoli, and Giacomo Leoni. *The Ten Books of Architecture: the 1755 Leoni Edition*. New York: Dover Publications, 1986. Print.

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford UP, 1977. Print.

Aristotle and S. H. Butcher. *Poetics*. New York: Hill and Wang, 1961. Print.

Argan, Giulio C. *The Renaissance City: (planning and Cities)*. London: Studio Vista, 1969. Print.

Ashihara, Yoshinobu. *The Aesthetic Townscape*. Cambridge, MA: MIT, 1983. Print.

Bacon, Edmund N. *Design of Cities*. New York: Penguin, 1976. Print.

Baedeker, Karl. *Northern Italy: Including Leghorn, Florence, Ravenna, and Routes through Switzerland and Austria: Handbook for Travellers*. Leipsic [Leipzig: K. Baedeker, 1896]. Print.

Baedeker, Karl. *Central Italy and Rome: Handbook for Travellers*. Leipsic [Leipzig: K. Baedeker, 1897]. Print.

Benevolo, Leonardo. *History of Modern Architecture*. Cambridge Mass.: MIT, 1978. Print.

Benevolo, Leonardo. *History of the City*. Cambridge Mass.: MIT, 1980. Print.

Blumenfeld, Hans. "Scale in Civic Design." *Town Planning Review* 1st ser. 24.April (1953): 35. Print.

Braunfels, Wolfgang, and Kenneth J. Northcott. *Urban Design in Western Europe: Regime and Architecture, 900-1900*. Chicago: University of Chicago, 1990. Print.

Broadbent, Geoffrey. *Emerging Concepts in Urban Space Design*. London: E & FN Spon, 1996. Print.

Canniffe, Eamonn. *The Politics of the Piazza: The History and Meaning of the Italian Square*. Aldershot, England: Ashgate, 2008. Print.

Bibliography... (cont'd)

.....

Canniffe, Eamonn. "Mannerist Interventions: Three Sixteenth Century Italian Squares." *Urban Design Studies* 1 (1995): 57-74. Print.

Carver, Norman F. *Italian Hilltowns*. Kalamazoo, MI: Documan, 1979. Print.

Chambers, Isobel M. "Piazzas of Italy." *The Town Planning Review* 11.4 (February) (1926): 221-236. Print.

Chambers, Isobel M. "Piazzas of Italy (Conclusion)." *The Town Planning Review* 12.1 (May) (1926): 57-78. Print.

Crosby, Theo. *Architecture: City Sense*. London: Studio Vista, 1965. Print.

Cullen, Gordon. *Townscape*. London: Architectural, 1961. Print.

De Carlo Giancarlo. *Urbino; The History of a City and Plans for Its Development*. Cambridge, MA: M.I.T., 1970. Print.

De Wolfe Ivor. *The Italian Townscape*. New York: G. Braziller, 1966. Print.

Duany, Andres, Elizabeth Plater-Zyberk, and Robert Alminana. *The New Civic Art: Elements of Town Planning*. New York: Rizzoli, 2003. Print.

Feraboli, Maria Teresa and Angela Arnone. *City Squares of the World*. Vercelli, Italy: White Star Pub., 2007. Print.

French, Jere Stuart. *Urban Space: A Brief History of the City Square*. Dubuque, IA: Kendall/Hunt Pub., 1978. Print.

Fusch, Richard. "The piazza in Italian Urban Morphology." *Geographical Review* 84.4 (1994): 424. MasterFILE Premier. EBSCO. Web. 15 Dec. 2010.

Galantay, Ervin Y. *New Towns: Antiquity to the Present*. New York: G. Braziller, 1975. Print.

Gatje, Robert F. *Great Public Squares: an Architect's Selection*. New York: W.W. Norton &, 2010. Print.

Bibliography... (cont'd)

.....

Gehl, Jan. *Cities for People*. Washington, DC: Island, 2010. Print.

Gehl, Jan. *Life between Buildings: Using Public Space*. New York: Van Nostrand Reinhold, 1987. Print.

Gibberd, Frederick. *Town Design*. London: Architectural, 1953. Print.

Gutkind, E. A. *International History of City Development: Italy and Greece*. London: Collier-Macmillan, 1964. Print.

Hall, Edward T., and Mildred Reed. Hall. *Understanding Cultural Differences*. Yarmouth, Me.: Intercultural, 1990. Print.

Hall, Edward T. *Beyond Culture*. Garden City, NY: Anchor, 1977. Print.

Hall, Edward T. *The Hidden Dimension*. Garden City, NY: Anchor, 1969. Print.

Hedman, Richard, and Andrew Jaszewski. *Fundamentals of Urban Design*. Washington, D.C.: Planners, American Planning Association, 1984. Print.

Hertzberger, Herman. *Lessons for Students in Architecture*. Rotterdam: 010 Publ., 2006. Print.

Hertzberger, Herman. *Space and the Architect: Lessons in Architecture 2*. Rotterdam: 010, 2000. Print.

Holm, David. "Drawing on Drawing in Architectural Education | Architecture Insights." *Home | Architecture Insights*. Web. 07 May 2011. <<http://Architectureinsights.com.au/resources/drawing-on-drawing-in-architectural-education/>>.

Ijla, Akram M. "Does Public Space Create Social Capital?." *International Journal of Sociology and Anthropology* 4.2 (2012): 48-53.

Isaacs, Raymond. "The Urban Picturesque: An Aesthetic Experience of Urban Pedestrian Places." *Journal of Urban Design* 5.2 (2000): 145-80. Print.

Bibliography... (cont'd)

.....

Janson, Alban, and Thorsten Burklin. *Scenes: Studies of Architectural Space: The Campi of Venice*. Basel: Birkhauser Verlag, 2001. Print.

Jacobs, Allan B. *Great Streets*. Cambridge, MA: MIT, 1995. Print.

Jenkins, Eric J. *To Scale: One Hundred Urban Plans*. Abingdon, Oxon, England: Routledge, 2008. Print.

Katō, Akinori. *Plazas of Southern Europe*. 3rd ed. Tokyo, Japan: Process Architecture, 1990. Print.

Kidder Smith, G. E. *Italy Builds: Its Modern Architecture and Native Inheritance*. London: Architectural, 1954. Print.

Kirk, Terry. *The Architecture of Modern Italy*. New York: Princeton Architectural, 2005. Print.

Krier, Rob. *Urban Space = Stadtraum*. New York: Rizzoli International Publications, 1979. Print.

Lakeman, Sandra Davis. *Natural Light and the Italian Piazza: Siena as a Case Study*. San Luis Obispo: Natural Light, 1994. Print.

Lasansky, D. Medina. "Urban Editing, Historic Preservation, and Political Rhetoric: The Fascist Redesign of San Gimignano." *Journal of the Society of Architectural Historians* 63.3 (2004): 320-53. Print.

Lasansky, D. Medina. *The Renaissance Perfected: Architecture, Spectacle, and Tourism in Fascist Italy*. Pennsylvania: Pennsylvania State UP, 2004. Print.

Low, Setha M., and Denise Lawrence-Zúñiga. *The Anthropology of Space and Place: Locating Culture*. Malden, MA: Blackwell Pub., 2003. Print.

Lynch, Kevin. *Site Planning*. Cambridge: M.I.T., 1971. Print.

Lynch, Kevin. *The Image of the City*. Cambridge, MA: M.I.T., 1960. Print.

Bibliography... (cont'd)

.....

Low, Setha M., and Neil Smith. *The Politics of Public Space*. New York: Routledge, 2006. Print.

Mancuso, Franco, and Aurelio Natali. *Piazze D'Italia*. Milano: Touring Club Italiano, 1971. Print.

Maertens, Hermann. *The Optical Scale: The Theory and Practice of Aesthetic Vision in the Arts on the Basis of the Science of Physiological Optics*. Bonn, 1884. Print.

Moughtin, Cliff. *Urban Design: Street and Square*. Oxford: Butterworth Architecture, 1992. Print.

Norberg-Schulz, Christian. *Existence, Space & Architecture*. New York: Praeger, 1971.

Norberg-Schulz, Christian. *Genius Loci: Towards a Phenomenology of Architecture*. New York: Rizzoli, 1980. Print.

Pitkin, Donald S. "Italian Urbanscape: Intersection of Private and Public." *The Cultural Meaning of Urban Space*. Ed. Robert Louis Rotenberg and Gary W. McDonogh. Westport, CT: Bergin & Garvey, 1993. 95-103. Print.

Price, Edward. "Viterbo: Landscape Of An Italian City." *Annals of the Association of American Geographers* 54.2 (1964): 242-75. Print.

Rapoport, Amos. *History and Precedent in Environmental Design*. New York: Plenum, 1990. Print.

Rapoport, Amos. *Human Aspects of Urban Form: Towards a Man-environment Approach to Urban Form and Design*. Oxford: Pergamon, 1977. Print.

Rasmussen, Steen Eiler. *Towns and Buildings*. Cambridge, MA: M.I.T., 1969. Print.

"Resources." *Social Capital*. N.p., n.d. Web. 14 Nov. 2012. <<http://go.worldbank.org/C0QTRW4QF0>>.

Saalman, Howard. *Medieval Cities*. New York: Braziller, 1968. Print.

Bibliography... (cont'd)

.....
Sander, Thomas H. "Social Capital And New Urbanism: Leading A Civic Horse To Water?." *National Civic Review* 91.3 (2002): 213-234. Print

Sander, Thomas, and Kathleen Lowney. "Social capital building toolkit (version 1.2)." Saguaro Seminar: Civic engagement in America, Cambridge, Mass.: Harvard Kennedy School of Government, 2006. Print

Sitte, Camillo. *City Planning According to Artistic Principles*. New York: Random House, 1889 (1965). Print.

Spreiregen, Paul D. *Urban design: The Architecture of Towns and Cities*. New York: McGraw-Hill, 1965. Print

Tafuri, Manfredo. *History of Italian Architecture, 1944-1985*. Cambridge, MA: MIT, 1990. Print.

Thiis-Evensen, Thomas. *Archetypes in Architecture*. Oslo: Norwegian UP, 1987. Print.

Thiis-Evensen, Thomas, and Kolbjorn N. Nybo. *Archetypes of Urbanism: A Method for the Esthetic Design of Cities*. Oslo: Scandinavian University Press, 1999.

U.S. Green Building Council. *Green Neighborhood Development: L.E.E.D. Reference Guide for Neighborhood Development*. Washington, DC: U.S. Green Building Council, 2009. Print.

U.S. Green Building Council. *L.E.E.D. for Neighborhood Development Rating System*. Washington, DC: U.S. Green Building Council, 2009. Print.

Unwin, Simon. *Analysing Architecture*. London: Routledge, 1997. Print.

Vitruvius, Pollio, and M. H. Morgan. *The Ten Books on Architecture*. New York: Dover, 15 BC (1960). Print.

Ward-Perkins, J. B. *Cities of Ancient Greece and Italy: Planning in Classical Antiquity...* London: Sidgwick & Jackson, 1974. Print.

Webb, Michael. *The City Square*. London: Thames and Hudson, 1990. Print.

Bibliography... (cont'd)

.....

Whyte, William Hollingsworth. *The Social Life of Small Urban Spaces*. Washington, D.C.: Conservation Foundation, 1980. Print.

Woolcock, Michael, and Deepa Narayan. "Social Capital: Implications for Development Theory, Research, and Policy." *The World Bank Research Observer* 15.2 (2000): 225-249. Print.

Wurman, Richard Saul. *Cities--Comparisons of Form and Scale: Models of 50 Significant Towns and Cities to the Scale of 1:43,200 or 1"=3,600'*. Philadelphia: Joshua, 1974. Print.

Wycherley, R. E. *How the Greeks Built Cities*. New York: Norton, 1976. Print.

Zucker, Paul. *Town and Square: From the Agora to the Village Green*. New York: Columbia UP, 1959. Print.

Figure Attributions

1. The Operative Role of Italian Piazze
Mark K. Pederson (2012)
2. Ancient Greek Athenian Agora
 - a. University of Cincinnati, Department of Classics.
<http://classics.uc.edu/~johnson/libraries/pergamon%20images/agora.jpg>
 - b. Copyright © 2013 Picturesonlineorg.
<http://www.mitchellteachers.org/WorldHistory/AncientGreece/Images/EngravingAgoraTrans.jpg>
3. Ancient Roman Forum
MaItaly, Minnehaha Academy, Minneapolis Minnesota.
http://maitaly.files.wordpress.com/2011/04/forum-uitgelicht_a.jpg
4. Cardo and Decumanus
de+ge architects.
<http://www.de-ge.eu/files/dege-utopias-roman-city.jpg>
5. Cover, *De Architectura*
Netherlands Architecture Institute
http://static.nai.nl/nai_101/upload/images/97_f_txt.jpg
6. Siena, Tuscany
 - a. Pro Danza Italia/USA.
http://www.prodanzaitalia.com/images/location/051_siena_palio_square.jpg
 - b. Google Maps.
http://maps.google.com/maps?rlz=1C1CHFX_enUS389US389&um=1&ie=UTF-8&q=Piazza+del+Campo,+Siena,+Italy&fb=1&gl=us&hq=Piazza+del+Campo,+Siena,+Italy&cid=0,0,3235059140359458056&sa=X&ei=AFehUduwLsX1iQL954H4Cg&ved=0CKgBEPwSMAC
7. Alberti, *De re edificatoria*
Saint Louis Public Library.
<http://exhibits.slpl.org/scanned/pixel/ste00249.jpg>
8. Sabbioneta, Lombardy
 - a. Animated Web Srl.
http://www.animatedweb.it/imagestore/images/biking/sabbioneta_piazza_ducale1.jpg
 - b. BerensDotNetFoto.
<http://www.berens.net/wp-content/uploads/2012/05/sabbioneta.png>
9. Piazza del Popolo, Rome
Wikimedia.
http://upload.wikimedia.org/wikipedia/commons/f/f0/Map_of_northern_Rome,_Piazza_del_Popolo,_by_Nolli.jpg

Figure Attributions... (cont'd)

.....

10. Sitte, plans of urban squares in Europe, 1889
Department of Architecture, TU Delft.
http://www.tudelft-architecture.nl/system/work_images/11/medium/Claessens_image_PhD.jpg?1288716792
11. Aristotle teaching Alexander the Great
Public Domain Image.
12. Vitruvius presents design of the Basilica at Faro
Public Domain Image.
13. Leon Batista Alberti, De pictura
Public Domain Image.
14. Human Eye and Optics
Maertens (1884)
15. Human Cone of Vision and Building Height
Maertens (1884)
16. Sitte's Italian Piazze Diagrams
Sitte (1889)
17. Positive Outdoor Space Diagram
Alexander et al (1977)
18. Urbino: Piazza Rinascimento
 - a. Images Italy.
<http://www.fotoeweb.it/pesarourbino/FotoUrbino/Piazza%20Rinascimento%20e%20Via%20Puccinotti%20di%20Urbino.jpg>
 - b. Mark K. Pederson (2012)
19. Planar Area, Width and Proportion Frequency Histograms
a, b, & c. Mark K. Pederson (2012)
20. Rome: Piazza Mattei
 - a. Alvaro de Alvaris,
<http://www.flickr.com/photos/dealvaris/3674760383/>
21. Venice: Campo S. Stephano
 - a. Mark K. Pederson (2012)
 - b. Paradoxplace.
<http://www.paradoxplace.com/Perspectives/Venice%20&%20N%20Italy/Venice/Santo%20Stefano.htm>
 - c. Bing Maps.
<http://www.bing.com/maps/#JnE9LIZlBmljZSUyYiU3ZXNzdC4wJTdlcGcuMSZiYj00NS40NDA0NzYxODQ2Nzc4JTdlMTUuMzQ0MzgzMjM5NzQ2MSU3ZTQ1LjQyNTc3OTgzNjgxMSU3ZTEyLjMxNjcxNzQxOTQzMzY=>

Figure Attributions... (cont'd)

.....

22. Planar Area Frequency Histogram
Mark K. Pederson (2012)
23. Pavia: Piazza della Vittoria
 - a. © All Rights Reserved by Gianpiero Bacchetta.
<http://www.flickr.com/photos/gianpierobacchetta/7284809290/in/gallery-fotomie2009-72157629954740726/>
 - b. Mark K. Pederson (2012)
24. Lodi: Piazza della Vittoria
 - a. Sistema Turistico Po di Lombardia delle provincie di Pavia, Lodi, Cremona, Mantova.
<http://www.podilombardia.it/uploads/gallerie/4eb6ddc107a24f197f25e16d32200bf7.jpg>
 - b. Mark K. Pederson (2012)
25. Planar Proportion Frequency Histogram
Mark K. Pederson (2012)
26. Equal Areas at Different Proportions
Mark K. Pederson (2012)
27. Equal Width at Different Proportions
Mark K. Pederson (2012)
28. Planar Width Dimension Frequency Histogram
Mark K. Pederson (2012)
29. Sabbioneta: Piazza Ducale
 - a. Mark K. Pederson (2012)
 - b. © All Rights Reserved
by Claudio Pedrazzi.
<http://www.panoramio.com/photo/4481812>
30. Vigevano: Piazza Ducale
 - a. © All Rights Reserved • Autor: Drop83
http://estoesitalia.com/region523-42836/fotografia/img3338-3591423409_b8a575740f.html
 - b. Mark K. Pederson (2012)
31. Todi: Piazza del Popolo e Garibaldi
 - a. © All Rights Reserved umbriaonline.com.
<http://foto.umbriaonline.com/wp-content/uploads/2011/01/todi-piazza-del-popolo-e-cattedrale.jpg>
 - b. Mark K. Pederson (2012)
32. Assisi: Piazza del Comune
 - a. Informagiovani of Italy
http://www.informagiovani-italia.com/assisi_piazza_comune.jpg
 - b. Mark K. Pederson (2012)

Figure Attributions... (cont'd)

.....

33. Four Corner Types On a Piazza
Mark K. Pederson (2012)
34. Imola: Piazza Vittorio Emanuele (Matteotti)
 - a. Corso Bacchilega editore in Imola._
http://www.bacchilegaeditore.it/home_bacchilegaeditore.php?n=bacchilega&l=it
 - b. Mark K. Pederson (2012)
35. Siena: Piazza Salimbeni
 - a. Public Domain Image.
 - b. Mark K. Pederson (2012)
36. Degree of Enclosure
Spreiregen (1965)
37. Angle of Vision Diagrams
Spreiregen (1965)
38. Sense of Enclosure Diagrams
Spreiregen (1965)
39. Determination of Sectional Proportion
Mark K. Pederson (2012)
40. Attributes of fixed Planar Areas
Mark K. Pederson (2012)
41. Attributes of Fixed Planar Width Dimension
Mark K. Pederson (2012)
42. Street Penetrations at Corner Locations
Mark K. Pederson (2012)