Enhancing Communication in Lab-based Organisations

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Jean Wineman
Georgia Institute of Technology, Atlanta, United States of America

Margaret Serrato
Georgia Institute of Technology and Lord, Aeck, Sargent, Architects

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0 Abstract

Communication is essential to effective performance in office settings. In research and development laboratories, for example, communication among technical professionals has been shown to be a significant determinant of technical performance and the productivity of project teams. This research examines the interrelationships of spatial layout and configuration in two laboratory-based research organizations to face-to-face communication outcomes.

Data was collected on face-to-face interactions for the members of three research groups in each of two organizations, located in the Atlanta area (Georgia, USA). This data, collected over a period of four weeks, represents randomly selected real-time logs of interactions documented on hand-held mini-recorders. During the data collection period, group members were randomly paged approximately ten times per day. For each page, participants recorded their location, and, if engaged in an interaction, with whom they were talking.

Spatial analyses included both convex and axial syntax analysis and the analysis of visual fields. Results of the research explore interrelationships between spatial measures and the occurrence, location, and participant involvement (workgroup versus non-workgroup) of face-to-face communications. Results indicate that the organization with the more integrated overall spatial layout demonstrated a significantly higher number of face-to-face communications. In both organizations, face-to-face communications occurred primarily in office spaces, and most often involved the group head. In circulation/common areas, as expected, more interactions (among group and non-group members) occurred in more integrated spaces. The occupants of more integrated office spaces and those with greater visual fields, were involved in greater numbers of conversations. Further conclusions relate to the relationships among communication outcomes and the locations of workgroup offices, the location of laboratory space, and the overall configuration of workspace. Implications are discussed for the design and layout of laboratory-based office space.

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Jean Wineman
College of Architecture
Georgia Institute of Technology
Atlanta, Georgia, 30332-0155,
United States
tel: (1) 404 894-3476
fax: (1) 404 894-1629
e-mail: jean.wineman@arch.gatech.edu

1 Background

It was more than ten years ago that Tom Peters, in his book In Search of Excellence, extolled the virtues of organizing office workers into largely self-managing teams, and went on to suggest that many of the best ideas produced by these teams found their germination in unscheduled 'serendipitous' encounters with workers outside the team. Although it is now commonplace to find offices that are designed with 'teams' in mind, it is unclear what are the primary design ingredients for achieving successful workspace.

In June 1993, the New York Academy of Sciences conducted a workshop on Research Facilities of the Future. Much of the discussion focused on facility design that promotes interaction among diverse investigators, and the need for "fostering interdisciplinary communication...and alleviating the sense of isolation that has long been the lot of the researcher" (Kreeger, 1994).

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Architectural strategies that respond to the desire for interdisciplinary communication range from providing "break-out" spaces to organizing space into "neighbourhoods and main streets." For example, an article on planning interactive research facilities (Architecture, 1993) described The University of Georgia's new Biological Sciences Complex as having informal break-out spaces "woven into the normal work flow rather than tacked onto the ends of corridors in out-of-the-way places." According to the architect, the break-out spaces were "carefully placed conference areas to facilitate both scheduled and casual discussions."

Several studies have defined the role of corridors, and collection points such as elevator lobbies and support services, in promoting casual communication (Finrow, 1970; Moleski, 1974; Perin, 1970). Allen (1977), in his work on the performance of research teams, demonstrated that the patterns of circulation in the building affect the communication patterns of the workers by promoting chance encounters and aiding in the accomplishment of intended contacts. He advocates locating support facilities so that they are shared by workers whose physical separation might otherwise inhibit communication.

In their article, Visible Colleges, Hillier and Penn (1991) propose that buildings, as organizers of space, can set in place conditions for either the generation or conservation of knowledge. To the extent that spatial conditions maintain status, social relations, and social practice, tradition is maintained. In the case of the generative model, spatial conditions continually create "new relational patterns by maximizing the randomness of encounter through spatial proximity and movement" (p. 26). Space functions to facilitate and extend opportunities for encounter. This is particularly true, as the article goes on to say, for building types where patterns of space use and movement are not highly structured by the building program; in such cases, "movement is defined less by the program and more by the structure of the layout itself" (p. 35). The article questions the traditional assumptions of the benefits of emphasizing localized zones, suggesting this often leads to fragmentation and a lack of natural movement. Within a localized spatial zone, the social and spatial behaviour of individuals may, in fact, be intended to minimize the spatial pressure to establish social relationships. Thus, the authors propose, opportunities for 'serendipitous' encounters, in particular, those that may develop into a relationship of shared ideas, are more dependent on the global pattern of movement within an organization than on local spatial layout. To establish this fertile ground, they go on to suggest, the overall spatial system should be one that creates global integration.

In research laboratories, as Hillier and Penn discuss, the organizational program tends toward separation by knowledge area. The question that arises, for this building type, in particular, where the organizational goal is production of knowledge, is to what extent does the building spatial layout reinforce this 'localism' or create a generative integrated system?

A number of subordinate questions are also raised by this earlier work: Do face-to-face conversations occur more often along the more travelled, and presumably more integrated, circulation routes? Are these 'serendipitous' or unscheduled interactions? Are these unscheduled conversations more frequent in proximity to support spaces, such as the break room or coffee bar, or support services, such as the mail room or xerox machine?

2 Comparative Study of Labs

The present study examines communication patterns of researchers in two research facilities in relation to spatial layout. Both facilities are located in the Atlanta (Georgia, US) area, and are engaged in lab based research. The first organization, Lab A, is a research and development division of an international pharmaceutical products company; the second, Lab B, is a research and development division of an international ophthalmic products company. In both organizations, the research and development division was one of several divisions housed in different buildings in campus-like settings. For this project, we focused on one division (housed in one building) within each organization. In Lab A, a division of about 64 employees, we collected data on the communication patterns of three (out of the 4) research groups. In Lab B, with about 42 employees, we sampled communication patterns from both of the two research groups.

In the case of both of these organizations, and typical of research laboratories in general, the organization is subdivided according to knowledge areas, with relatively few layers of managerial hierarchy, and an array of hierarchically equivalent research groups each focused in a particularly defined area of knowledge. Thus, in both cases, the organization creates a set of boundaries of knowledge.

Lab B, however, had recently experienced a reorganization around a particular project effort. Although organizationally the workers were subdivided by knowledge area into two groups, there was a concerted effort on the part of management to merge the efforts of these individuals. These objectives had spatial implications, as we will discuss further.

3 Methods and Procedures

Participant Data. The primary data set consists of 2367 recorded events for 25 participants at Lab A, and 2212 recorded events for 22 participants at Lab B. Over a total data collection period of four weeks, participants carried a pager (vibration, not sound activated) and microrecorder during business hours. They responded to ten random pages per day by recording their location; activity; and, if they are engaged in face-to-face interaction, with whom they are speaking (i.e. group or non-group colleague, administrative personnel, outside consultant or sales representative). During the data collect for Lab B, data was also collected on whether the interaction was 'scheduled' (planned prior to the interaction) or 'unscheduled'.

Physical Descriptors. Description of the physical setting was based on analysis of floor plans and site visits. Syntax analysis was applied using the Axman analysis program developed at the University of London. Syntax analysis is a technique for the analysis of form based on spatial characteristics (more specifically topologic relationships).

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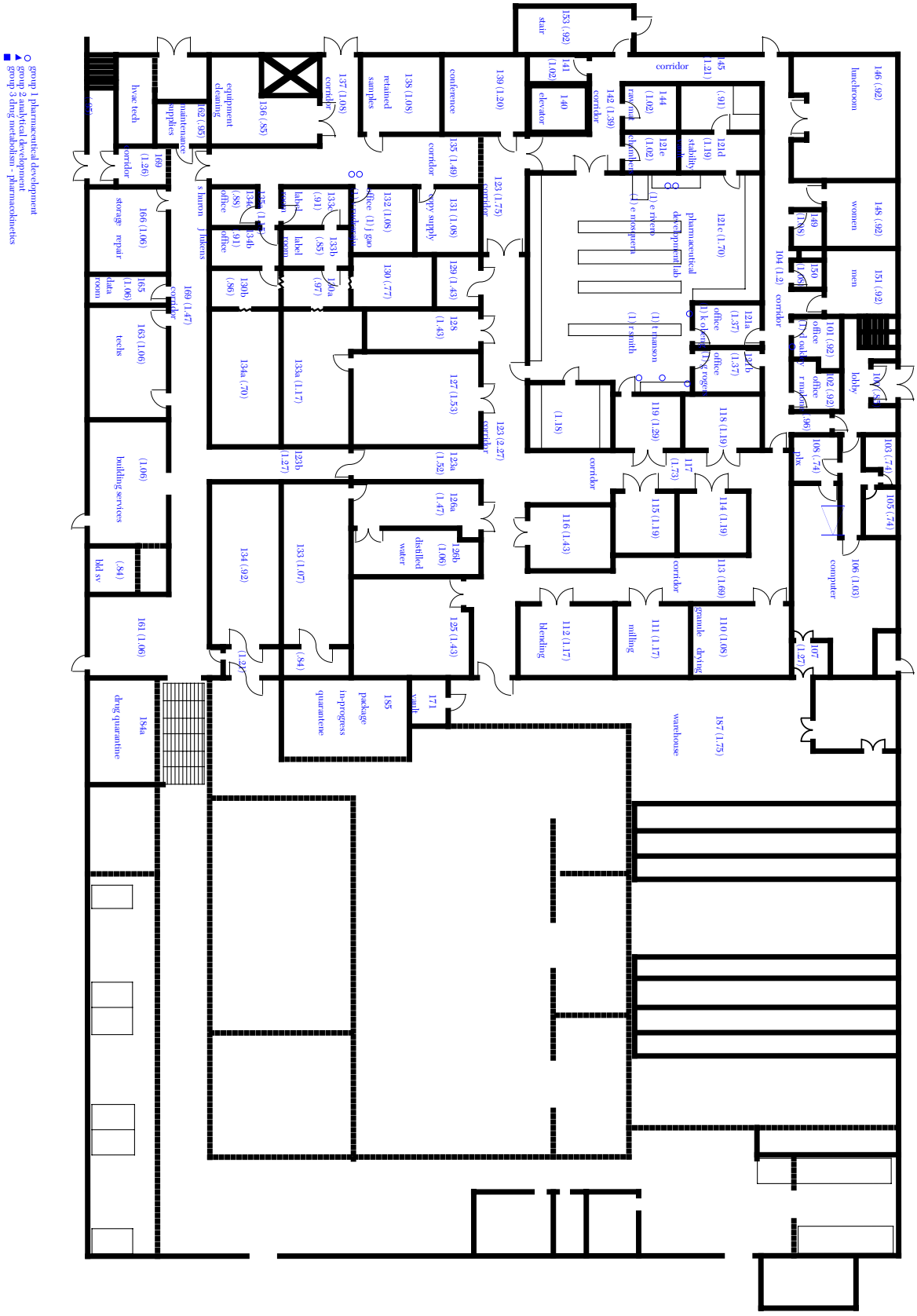

Figure 1. Lab. A.

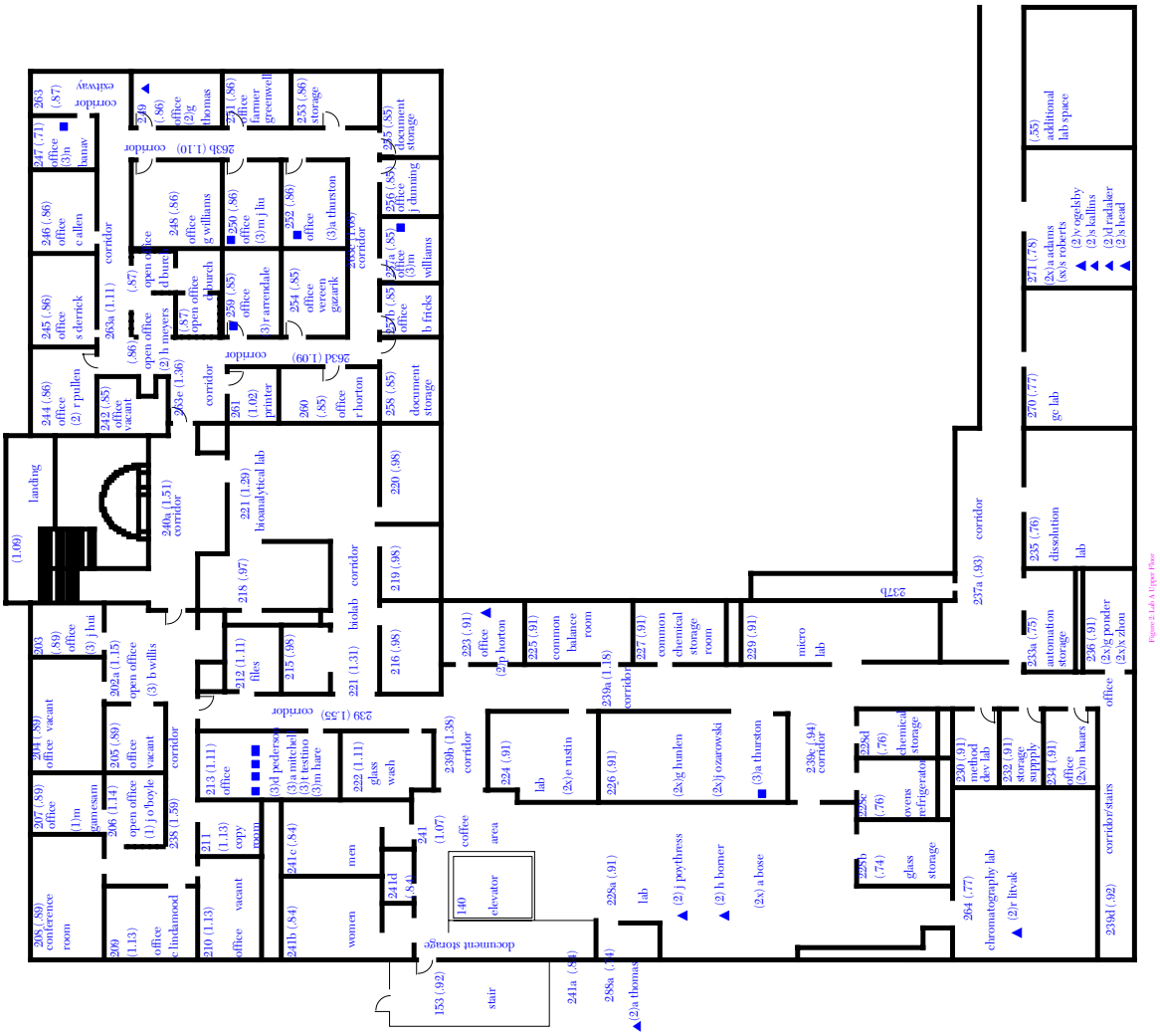

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Figure 2. Lab. B.

This technique has been found to be highly predictive of movement patterns in buildings. Its predictive strength is based on characteristics of space, irrespective of function (Hillier and Hanson, 1984).

Syntax analysis looks at the relationship of a space to every other space in a total system of spaces. Through syntax analysis, the Real Relative Asymmetry (RRA) can be calculated for particular spaces (convex analysis) or lines through space (axial analysis). These values indicate the spaces/lines that are the most integrated (those that are predicted to have the highest movement) and those that are the most segregated (those that are predicted to have the lowest movement) for the global (entire) system of spaces. It is also possible to look at the spatial layout of the system at a more local level. The calculation of Real Relative Asymmetry 3 (RRA3) indicates the relationship of each space to those spaces that are three spaces away. In contrast to RRA which indicates the extent to which the system of spaces is integrated as an entire system, RRA3 suggests the extent to which the system consists of more localized regions. Syntax analysis permits comparisons across systems.

4 Results

4.1 Lab A

Communication Data. At Lab A, 25% of all responses were TALKING. Of these, the largest portion, or 47% occurred in private offices. Of those in offices, nearly half occurred in the offices of the group leaders or lab directors. 23% of all TALKING occurred in the labs, followed by 5% of TALKING in the hallways. The remainder of the data identified as WORKING (not talking), was generally located in the labs or private offices.

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Physical Data. As illustrated in Figure 1, the staff that were surveyed at Lab A are located in labs and offices on two floors of their R&D building. All walls are full-height and every office and lab has a traditional, full height door. There are numerous doors located within the hallway system, although most have some glazing. Due to the maze-like nature of the plan, there is very limited visibility down corridors, into labs, or between offices. With the exception of one coffee station, the corridors do not contain any support services; they act merely as circulation conduits. There are three sets of stairs and an elevator that connect the two floors. Each floor has a conference room, and the breakroom is located downstairs.

4.2 Lab B

Communication Data. At Lab B, 47% of all responses where identified as TALKING. 3% of the responses where identified as E-MAIL with the remaining 50% WORKING. Of the TALKING responses, the largest portion, or 55% occurred in private offices. While TALKING occurs in every office, there is a concentration in several offices in one part of the building. The offices in this area include those of the lab director the division heads, and division managers. 6% of TALKING occurred in the hallways.

Physical Data. As illustrated in Figure 2, the participants at Lab B are located in labs and offices on one floor of their R&D building. The offices are located together in one half of the building, and the labs in the other half. The halves are connected by two hallways. Offices around the perimeter of the building are traditional, enclosed spaces with full height doors and side light. The majority of the office spaces are in a cluster of open workstations with standing-height walls. The whole office space is arranged in a fairly strict grid pattern, with major and minor paths. Support services, such as mailboxes, coffee station, copy machines and printers are located in and along the major path which encircles the main workstation zone.

One of the strengths of this research is that we have, in essence, a time sampling of activity over the course of several days. Clearly most activity takes place in participants' workspaces. In Lab A, given the location of many of the workspaces within the lab, there is quite a high level of activity in the lab, as well as in the offices. In Lab B, with no one located in the lab, activity is concentrated in the offices. A small proportion of time is spent in the hallways of both facilities (3 percent of events in Lab A and 4 percent of events in Lab B).

In Lab A, respondents are engaged in face-to-face communication about 25 percent of the time. These events are generally either in the workspace of the respondent (lab or office) or someone else's workspace. 14 percent of talking is in the conference rooms. Respondents are talking close to twice as often in Lab B (47 percent of events are talking). These interactions take place generally in the workspace of the respondent or someone else's workspace. A large percentage of communication (33%) takes place in the conference rooms.

In Lab B, we had the opportunity to look at scheduled as compared to unscheduled interactions. We found that, as one would expect, the talking that occurs in the hallway is almost entirely unscheduled. We found also that, as one might expect, the major proportion of talking that occurs in the conference room is scheduled (96%).

In order to look more closely at the relationship between unscheduled face-to-face interaction and characteristics of spatial layout, we conducted an axial analysis on the data for talking using the axial map covering only the major circulation spaces. For this and the subsequent analysis, in order to better reflect unscheduled interactions, all conference rooms were removed from the analysis for both Labs A and B. (For Lab B, almost all interactions in the conference rooms were scheduled, our assumption was that the same holds true for Lab A.) For both Labs A and B, there was no relation between the integration of the corridor (RRA) and interaction (see figures 6 and 10). When we looked at local integration (RRA3) there was also no relationship in either lab (see figures 7 and 11).

Since interaction was more frequent in the office spaces in both facilities, we examined interactions that occurred not only along the corridor but also in spaces that were linked to the corridor, one space away. For both Labs we found a more suggestive relationship between the integration of the corridor (RRA) and this linked measure of interaction (see figures 8 and 12). The relationship improves if we look at the local integration (RRA3) (see figures 9 and 13).

5 Conclusions

The spatial layout of the two research units in this study are fundamentally different. In Lab A, the spatial layout reflects a correspondence to the organizational description. Working groups, defined by knowledge area, are distributed throughout the building generally in local clusters of office space in proximity to labs or actually in the lab space (about half of the respondents occupied desks located in a lab). Lab B, in contrast, is an example of non-correspondence. The organizational description defines two working groups, reflecting two knowledge areas. These groups, however, are spatially co-located, and even within the local area, workers from the two groups are interspersed. The labs are quite separate from the offices, linked to the office area through two hallways.

The question that is raised is to what extent these apparent spatial differences lead to differences in patterns of space use and communication? Clearly there is more talking occurring in Lab B. However, this could simply be due to the concentration of workers in one portion of the building. If our focus is on unplanned interactions, the 'serendipitous' encounters of Tom Peter's book, the data analysis reveals some

interesting differences. Although most talking occurs in offices, and movement is only a small percentage of all events (3 percent of events in Lab A and 4 percent of events in Lab B), 40 percent of events in the hallway at Lab A were talking, and 72 percent in the hallways at Lab B were talking.

Axial analysis results for interactions in hallways suggest that interactions are not well correlated with integration or even with local integration. However, if one considers interactions that occur in spaces that are linked to the corridor, one space away, the results are more suggestive, and the strength of this relationship increases for local integration. Strong local links among a set of offices enhance opportunities for interaction.

For both labs, spatial layout supports localization. The major difference occurs in the composition of the groups that are 'localized'. At Lab A the localization reflects the pattern of subdivision by knowledge area. In this organization, knowledge groups are 'localized' in relatively close proximity to the lab space. In this sense, the interface between the place of 'practical activity' and the place of 'contemplation' (as described by Hillier and Penn, 1991) is enhanced, but kept separate from the global system of the organization as a whole. At Lab B the localization mixes knowledge areas, creating conditions for generative production of knowledge. Yet this localization is separate from the places of practical activity, the labs. Separation from the laboratory may also reflect an evolution of activity in research-based organizations to a greater reliance on computer-based models for the initial testing of ideas (casual observations in both facilities suggests a high level of computer use). The spatial dynamic with practical activity may be displaced from the laboratory, and occur, at least initially, entirely within the office areas.

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