

PREFERENCE OF DIRECTIONS IN 3-D SPACE

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In the course of research dealing with misconceptions in 3-D geometry basic concepts, I could clearly see that students tend to prefer particular and typical directions, and disregard other directions. These preferred directions are not necessarily the obvious ones – the horizontal and the vertical. They may be other directions, which are chosen relatively to the directions given in the problem.

For example:

- ❖ Given a line a situated in a plane P , the students are asked to place another line b , perpendicular to a . Most of them choose b to be perpendicular both to a and to the plane P .

For some of the students the preferred directions are their “first choice”, but they have no difficulties to see other directions as well. However, there are students who focus only on those preferred directions and are not able to see other options. For those students, awareness of their choices and of the possible reasons for these choices can improve considerably their visual ability and flexibility in 3-D space.

This study is an attempt to locate and to analyze those preferred directions among prospective teachers in a college of education. It is a part of broader research, which I presented last year in Japan: “Misconceptions in 3-D Geometry Basic Concepts”.

Over a period of 8 years, I watched most of the 272 students who participated in the research. During their discussions (some of which were video or audio taped), I noticed very clearly that they almost always choose typical and predictable directions when they illustrate interrelations in 3-D space. Then I interviewed some of them in order to try to analyze more carefully my assumptions about the preferred directions.

In general, we can see three types of preferences of directions:

1. Preference of gravitational directions: horizontal or vertical.
2. Preference of “convenient” directions, in which there are no conflicts between different concepts related to the same terms: “perpendicular”, “parallel” or “angle”. (For instance: in the example above, we can notice a choice of direction that avoids the conflict of being perpendicular to the line but not to the plane.)
3. Preference of directions which are perpendicular to one another (like the axes x , y , z), or directions which have a “balance” (internal or gravitational).

In the oral presentation some of the findings will be presented and analyzed, with examples of episodes that took place during the interviews or the discussions.