Tomsk Polytechnic University

DESCRIPTIVE GEOMETRY
ENGINEERING GRAPHICS

G.F.Vinokurova, R.G. Dolotova, S.P. Burkova

Lecture 1

PREFACE

PROJECTION METHOD

POINT

Plan

1. PREFACE
2. FROM THE HISTORY OF GRAPHIC REPRESENTATIONS
3. PROJECTION METHOD
4. POINT

PREFACE

Descriptive geometry

Engineering the GRAPHIC

Descriptive geometry-

Science about projective Images

Descriptive geometry-

considers:

- Methods of the image of spatial figures on a plane
- Properties of figures under their images

In section Engineering the GRAPHIC rules of performance and reading of drawings of separate details and assembly units are studied

The literature

From the history of graphic representations

The founder Descriptive Geometry-

Jasper Monge

Jasper Monge
(1746 -1818)

The first textbook on descriptive geometry It is published

In France In 1798 year

In 1810 y. Charles Potje Started to read lectures on Descriptive geometry In the Petersburg Institute Cases of engineers Means of communication

Since 1818 y. the lectures on descriptive geometry have been delivered by Professor Y.A.Sevostyanov (1796 - 1849)

In 1821 y. he published an original course named “Foundation of Descriptive Geometry”

It happened to be the first textbook on descriptive geometry in Russia in the Russian language

V. Jhons

28(16) October 900г.

Has read in Tomsk Polytechnic University the first lecture on descriptive geometry

PROJECTION METHOD

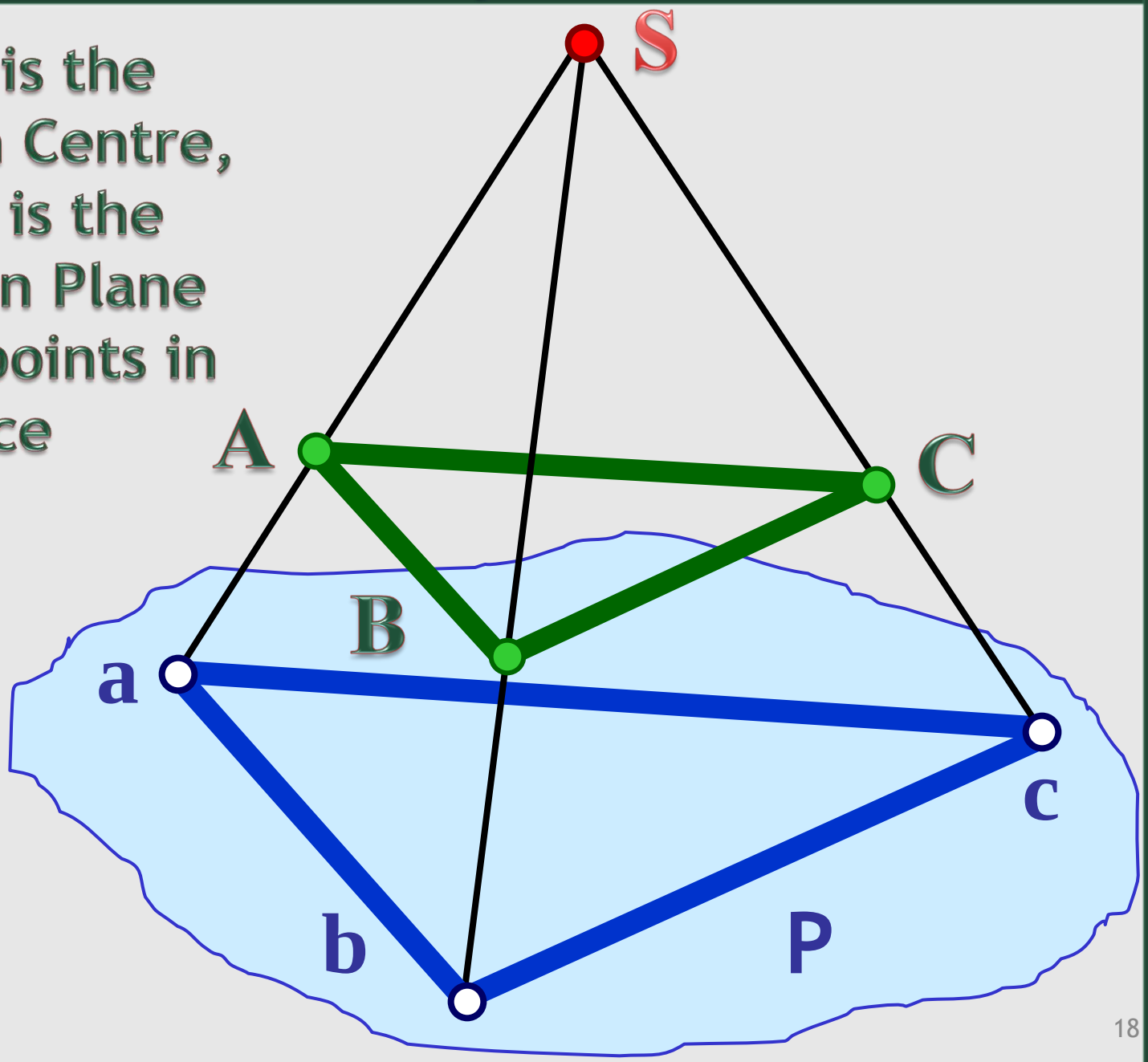
PROJECTION METHOD

Central Projection

Parallel Projection

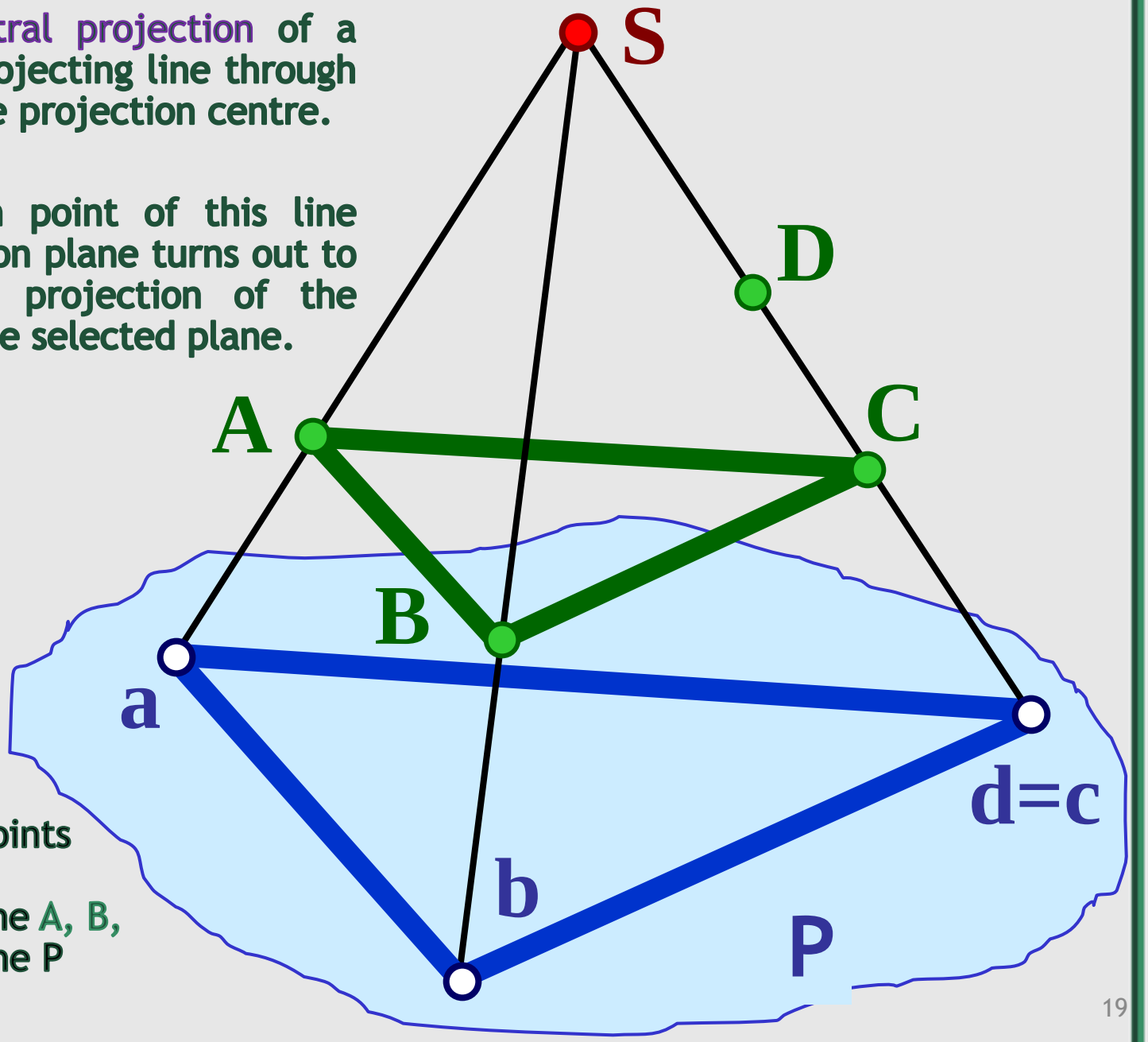
Central Projection

Point *S* is the Projection Centre, Plane *P* is the Projection Plane
A, *B*, *C* - points in space



To make a central projection of a point, draw a projecting line through the point and the projection centre.

The intersection point of this line and the projection plane turns out to be the central projection of the given point on the selected plane.



The a, b, c, d points are the central projections of the A, B, C, D points on the P plane.

The whole set of points of one projecting line has only one central projection if there is only one projection centre

So, on the given plane and given projection centre one point in space has one central projection.

But one central projection of a point does not allow us to determine the location of the point in space unambiguously, i.e. in central projecting there is no reversibility of drawing and additional conditions are required to provide drawing reversibility.

Properties of central projection:

I. Under central projection

a) a point projects to a point;

b) a line not passing through the projection center projects to a line (projecting line - to a point);

c) a plane (two-dimensional) figure not belonging to the projecting plane projects to a two-dimensional figure (figures belonging to the projecting plane project to straight lines);

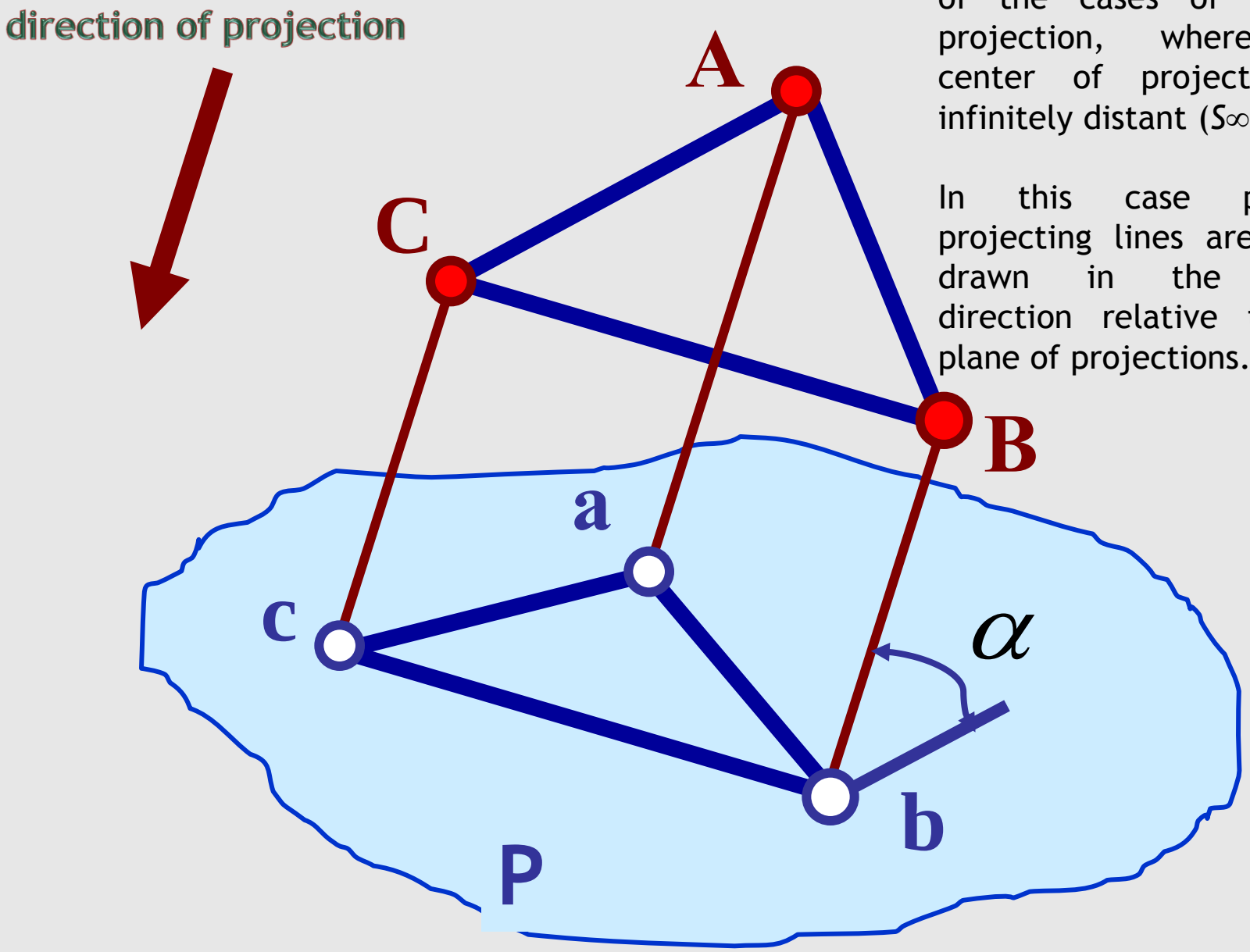
d) a three-dimensional figure projects to a two-dimensional one;

e) a central projection of figures keep mutual belonging, continuity and some other geometric properties

2. Under the given projection center figures of parallel planes are similar.

3. Central projection provides unambiguous similarity of the figure and its projection, for example, projection on a screen or a film.

Parallel Projection



Parallel projection is one of the cases of central projection, where the center of projection is infinitely distant (S∞).

In this case parallel projecting lines are used, drawn in the given direction relative to the plane of projections.

If the direction of projecting is perpendicular to the plane of projections, the last are called rectangular or orthogonal.

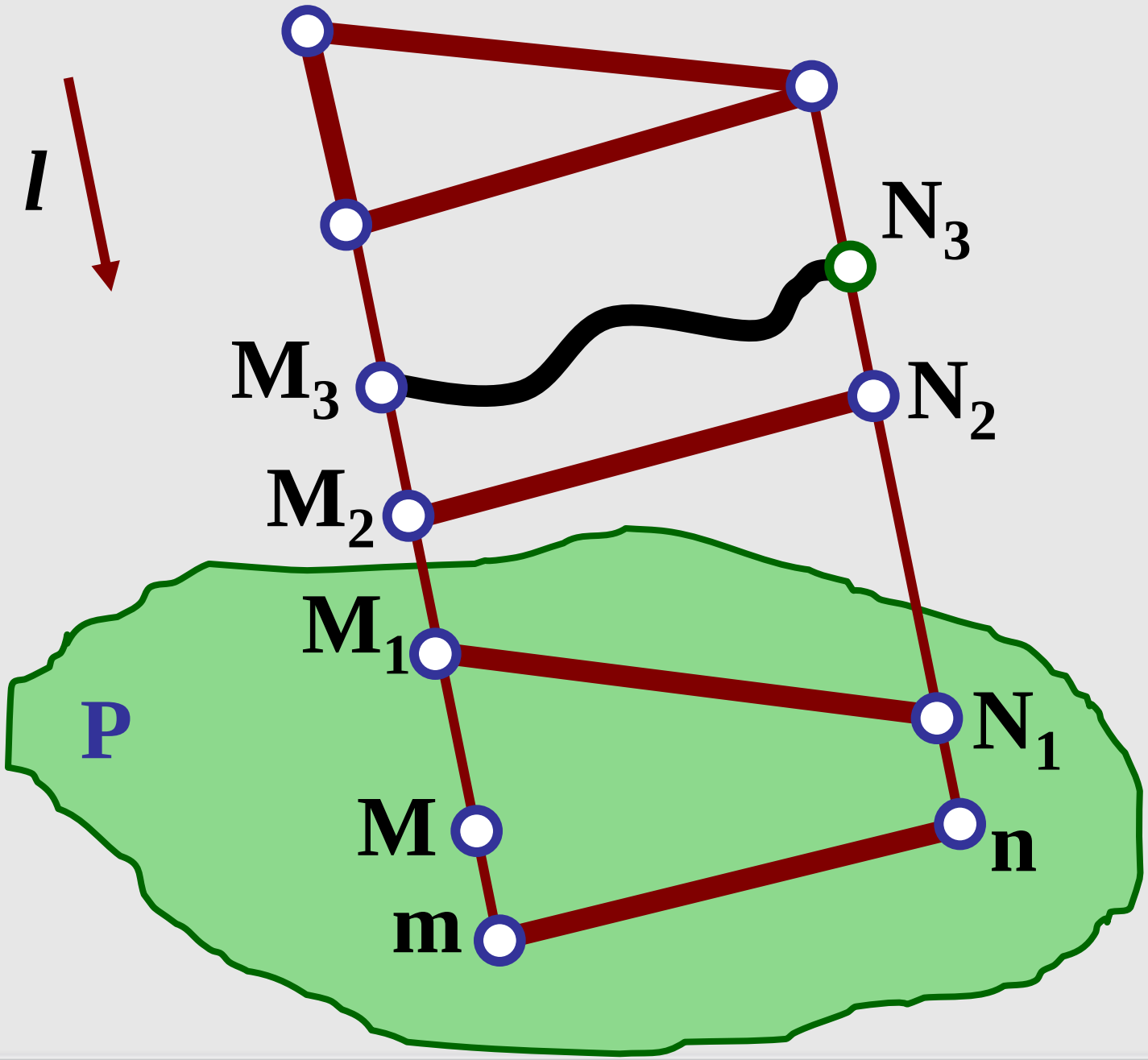
In other cases they are called oblique projections.

$\angle\alpha = 90^\circ$ - Rectangular Projection

$\angle\alpha \neq 90^\circ$ - oblique Projection

Parallel projection possesses all the properties of central projection and the following new ones:

1. Parallel projections of mutually parallel lines are parallel, and the ratio of those lines segments is equal to the ratio of their projections lengths.
2. A plane figure parallel to a projection plane projects to the same figure on the above plane.
3. A parallel transfer of a figure in space or in projection plane does not change the shape or dimensions of the figure projection.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N3
M3
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M2
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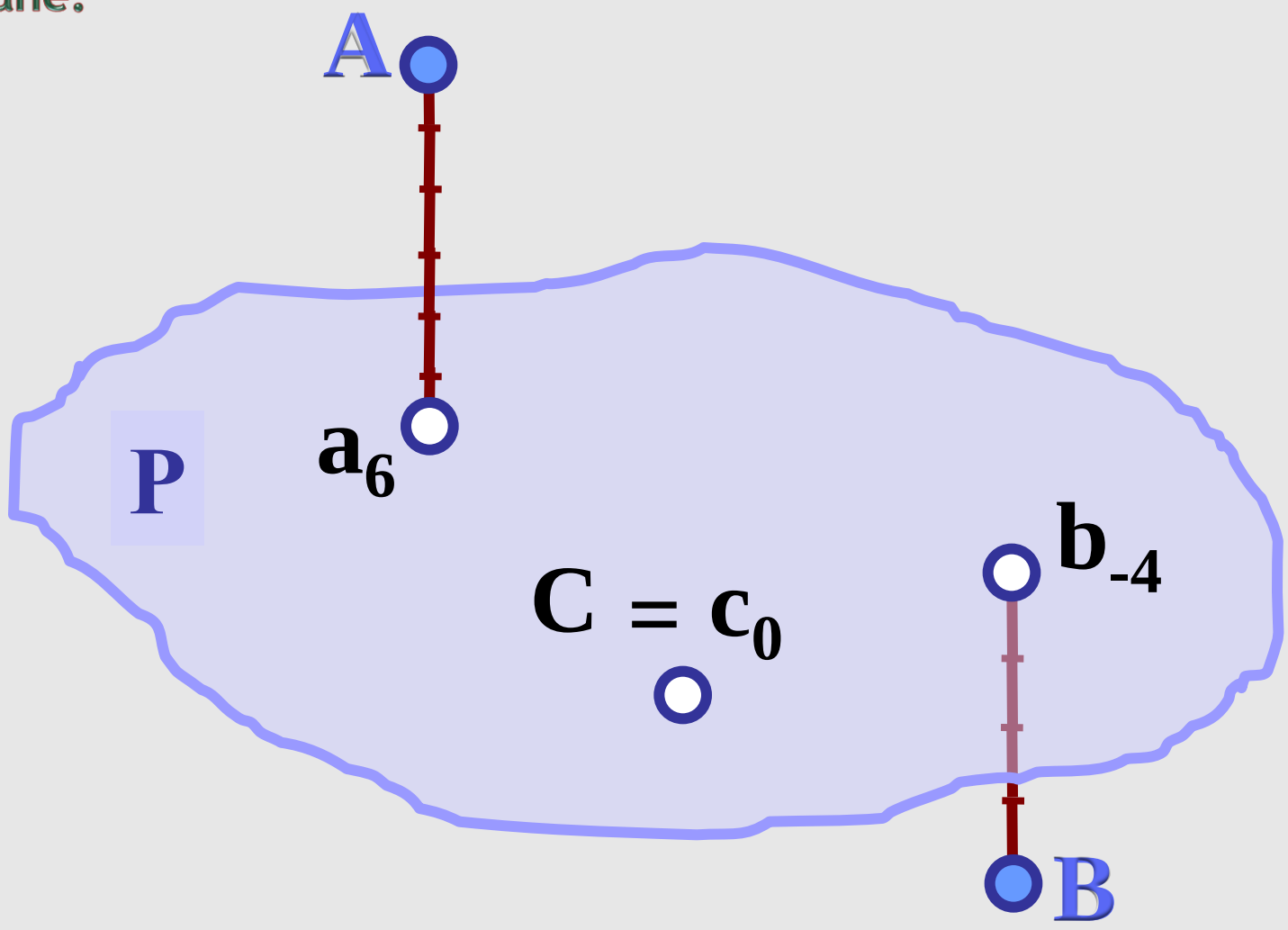
Methods of Projection Drawings Supplement

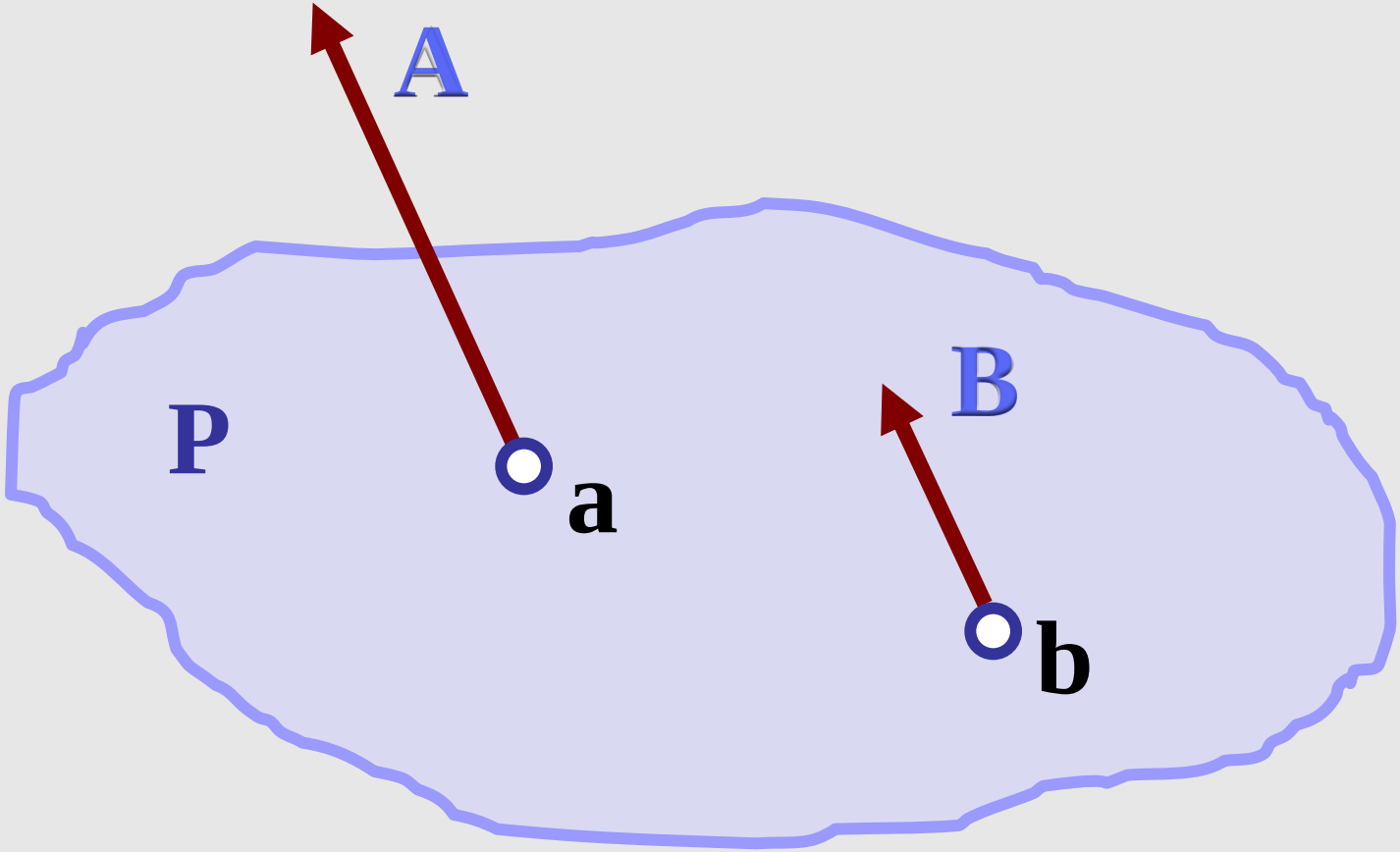
Method of Projection with Digital Marks

The essence of the method is that the position of any point in space is specified by its rectangular projection on a horizontal plane taken for a zero plane.



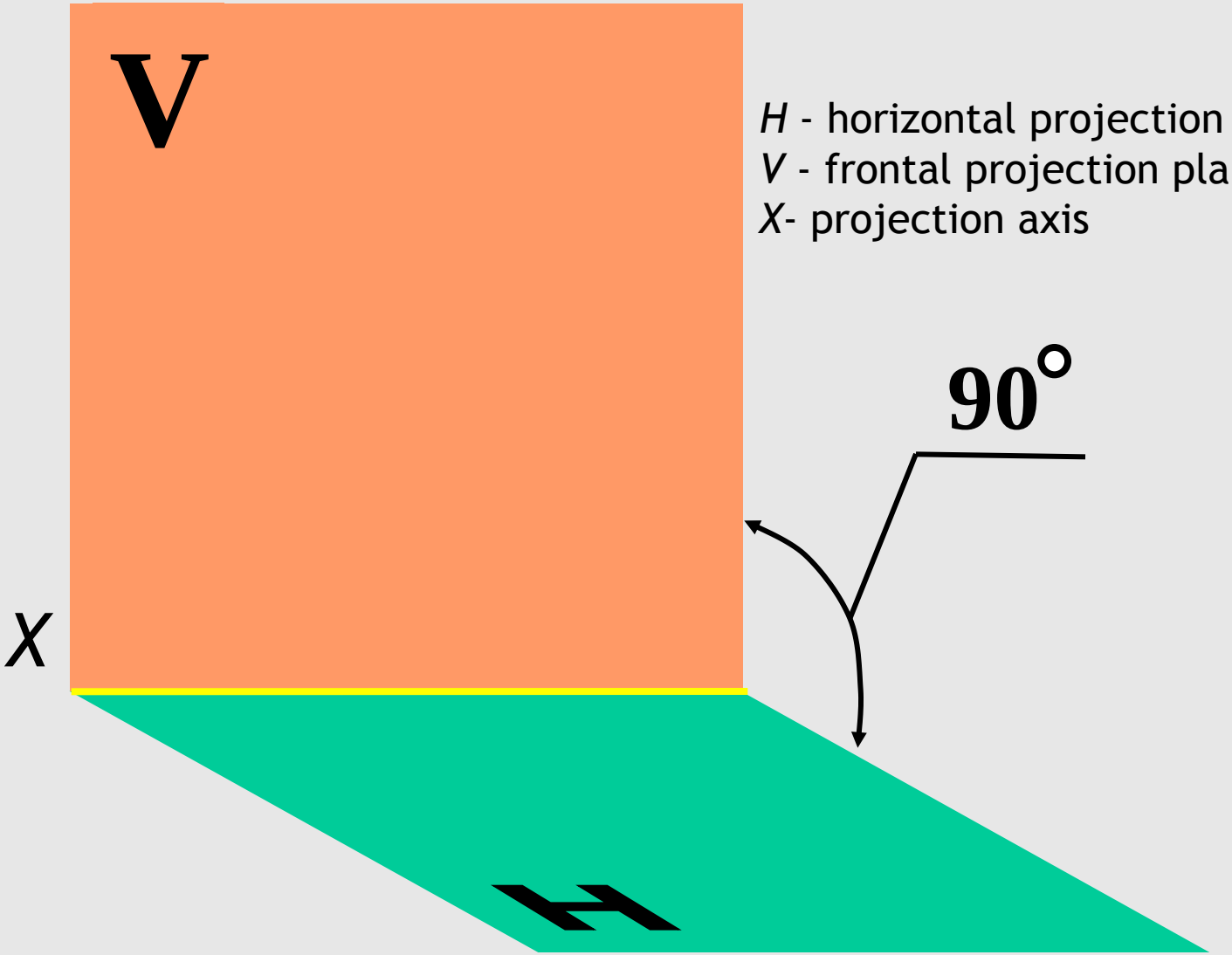
Method of Fyodorov

Academician E.S. Fyodorov suggested the representation of the points altitudes (heights) by means of parallel segments in the projection plane, the beginnings of which are situated on the projections of the respective points.



The Method of Orthogonal Projections

(Method of Monge)



The Method of Orthogonal Projections
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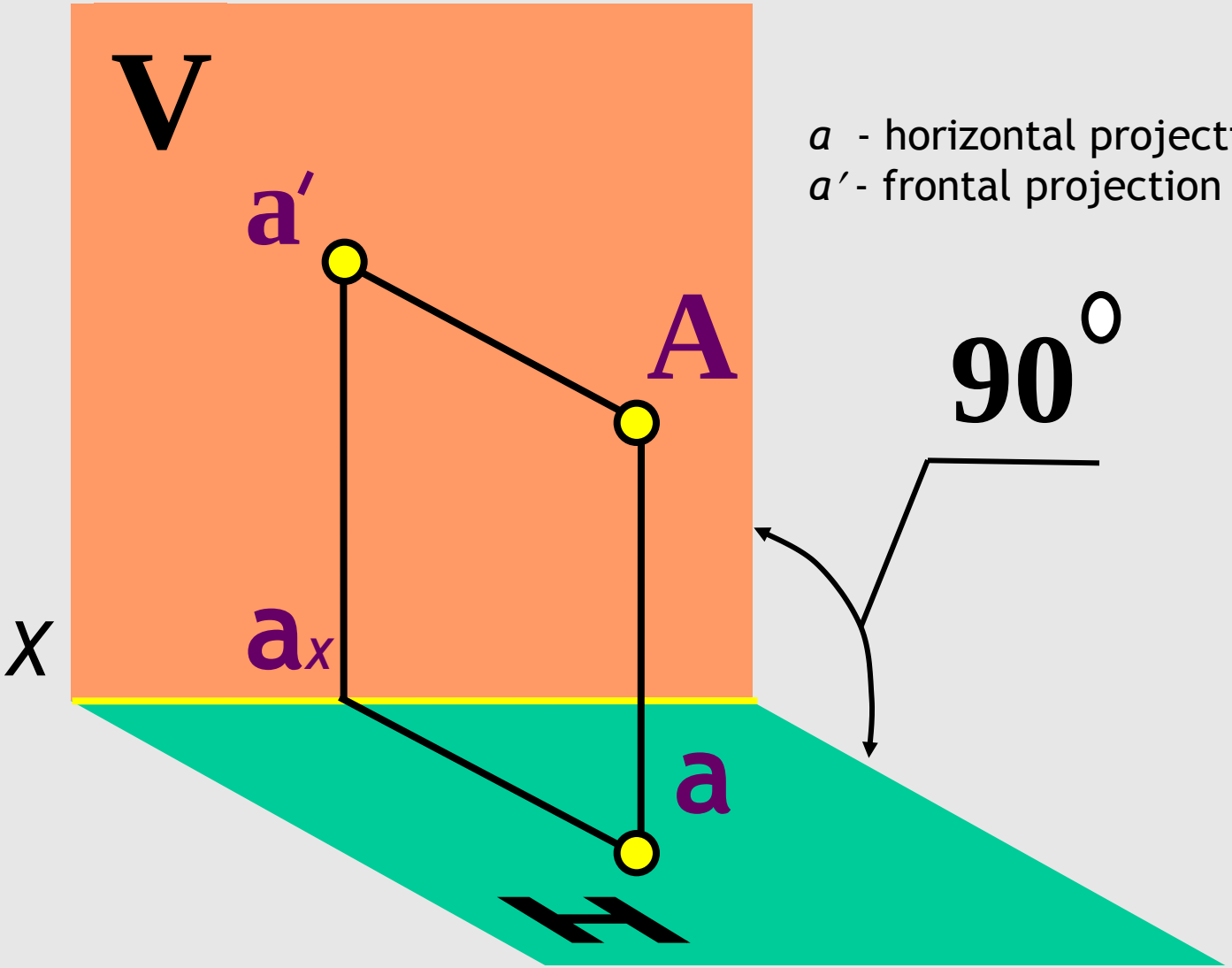
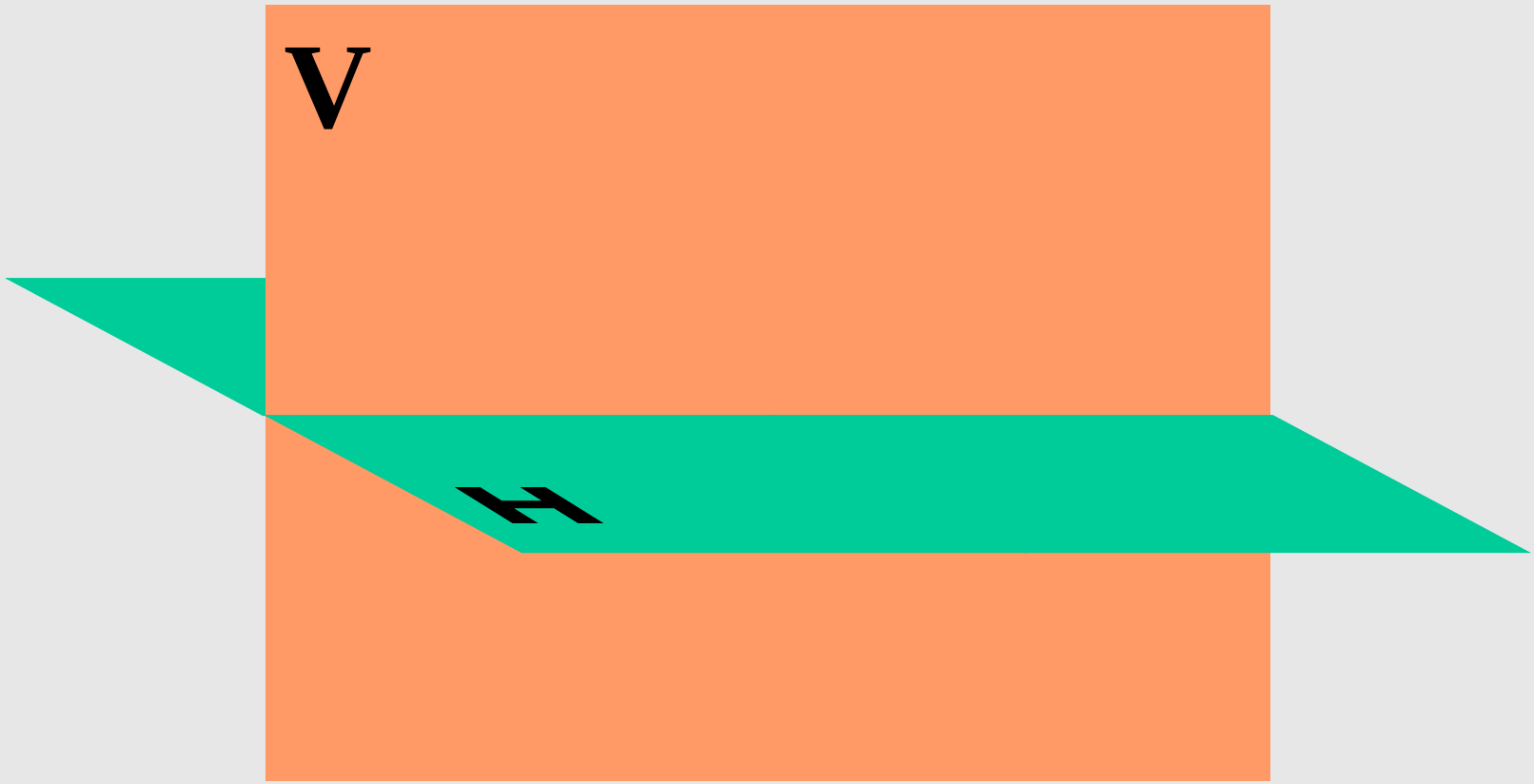


a - horizontal projection
a′ - frontal projection

Into the system of the planes *H* and *V*, let us introduce one more plane, perpendicular to them.

This plane is called the profile projection plane and is denoted by letter *W* .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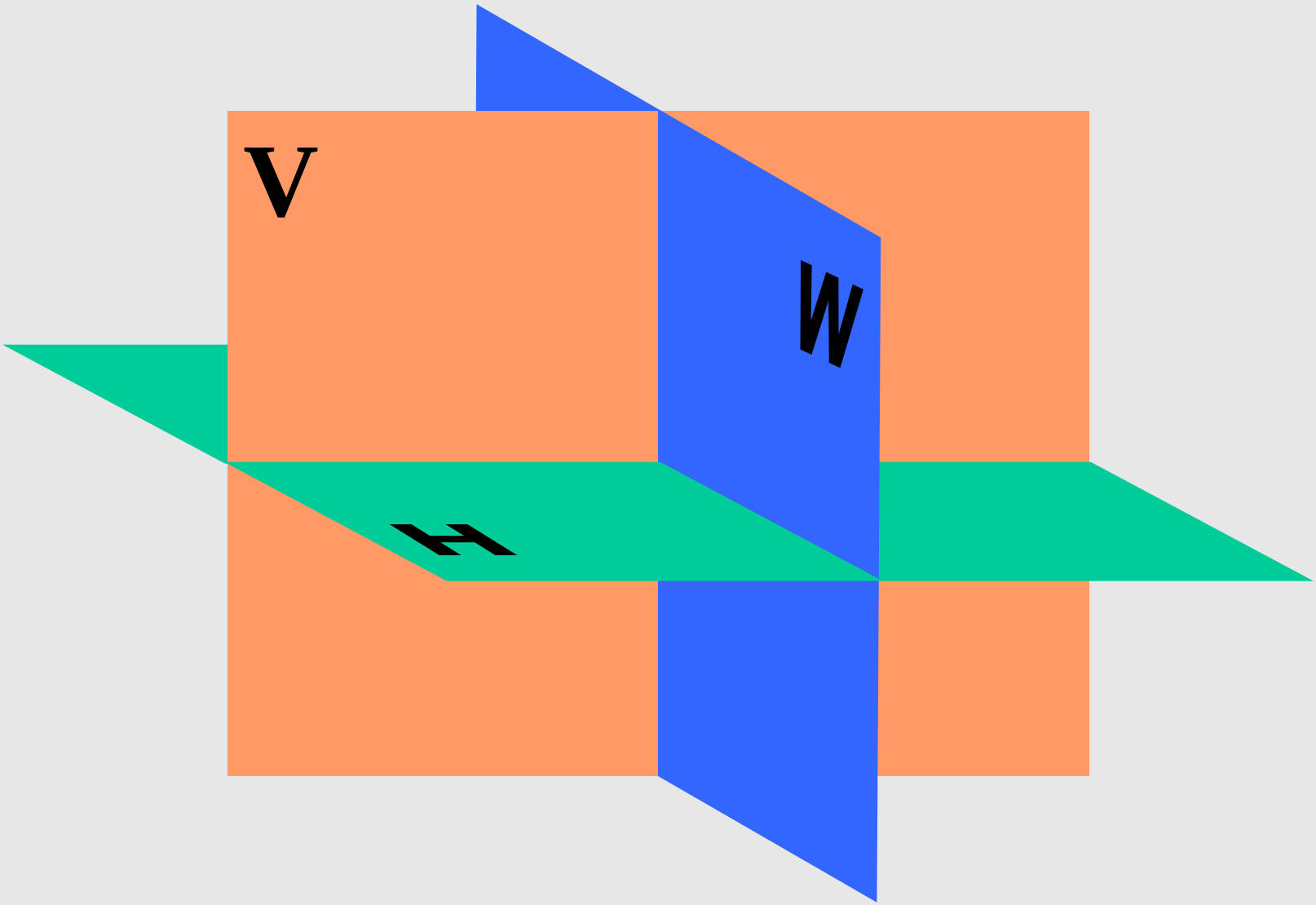
V
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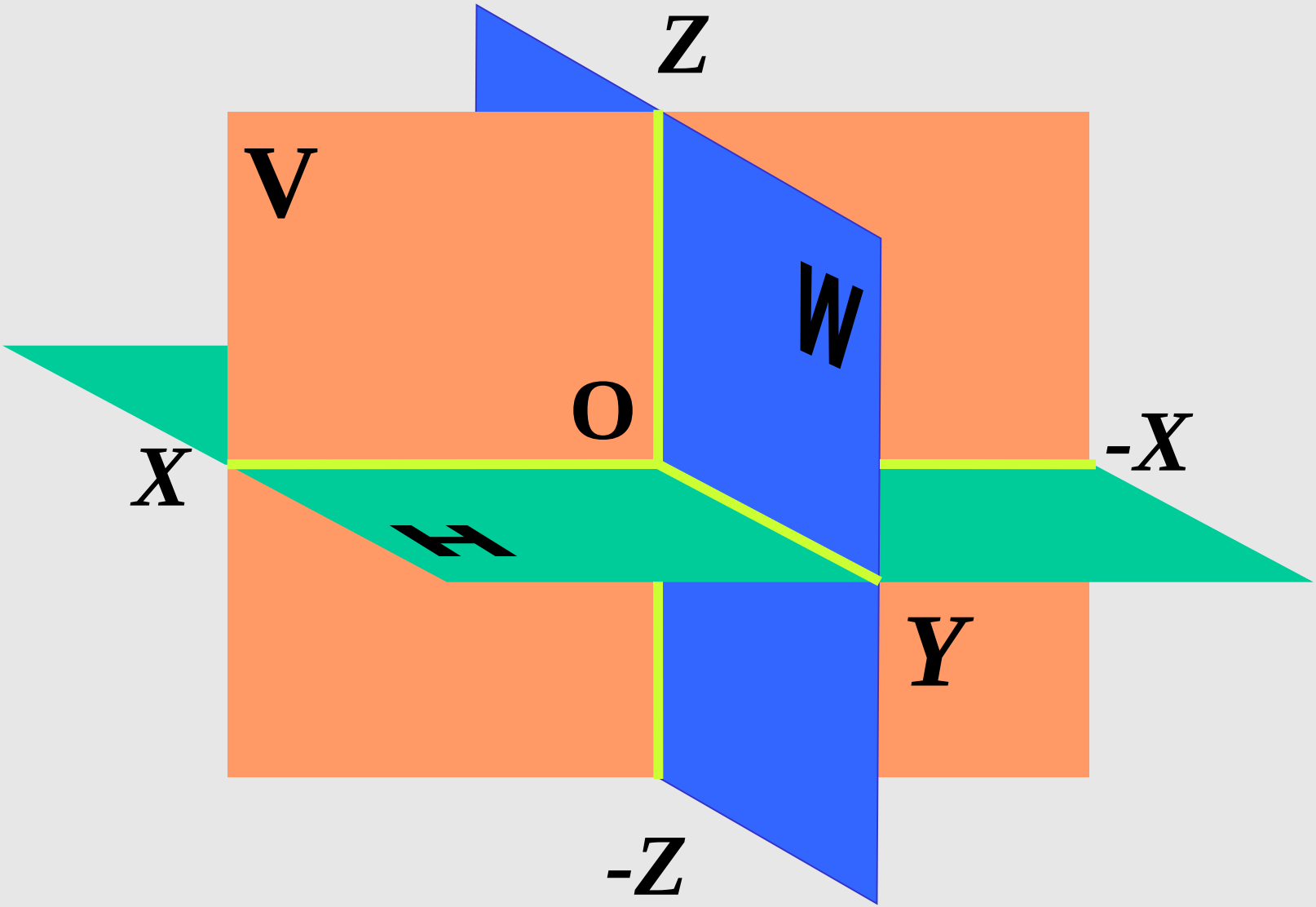
H



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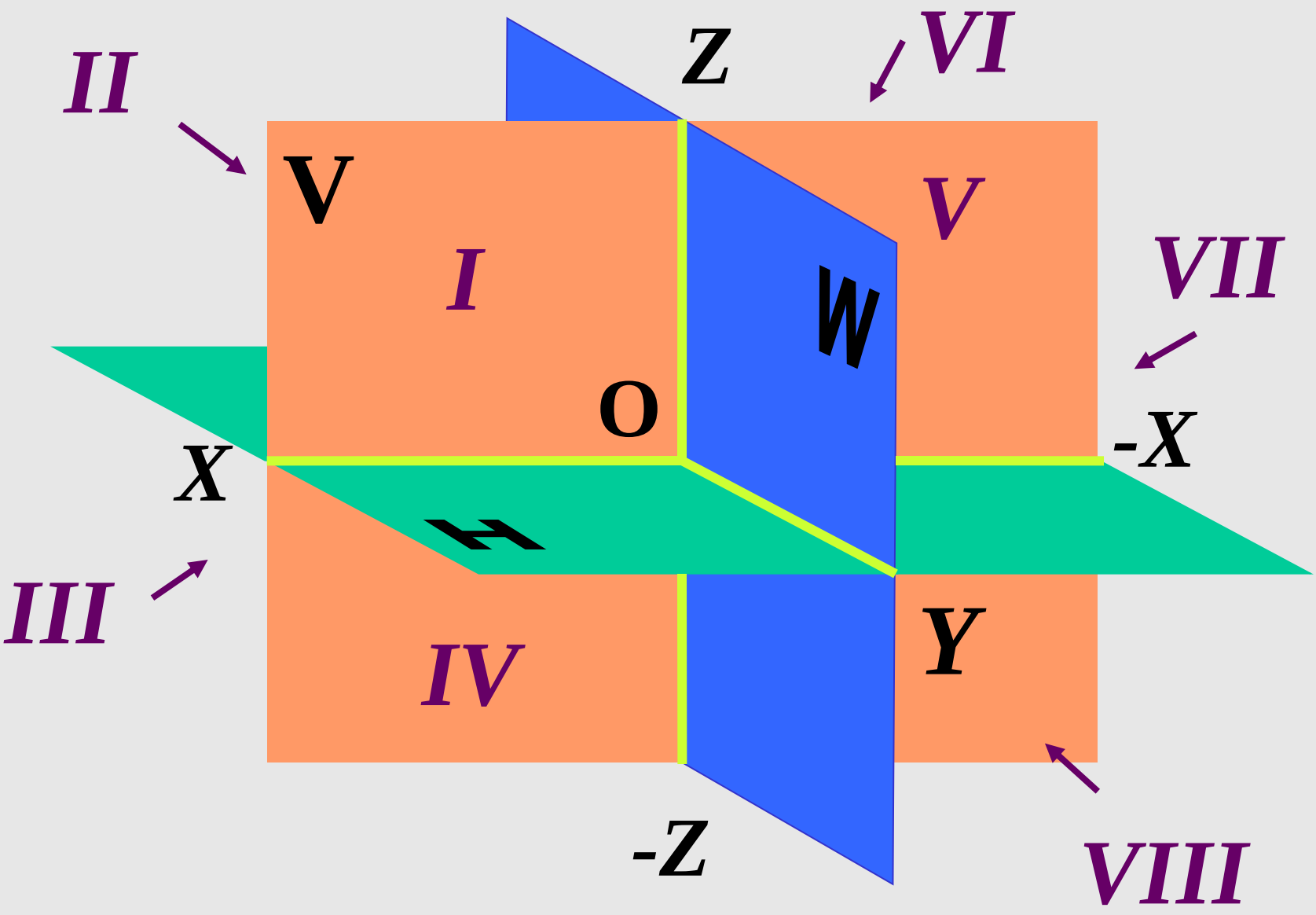
II
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VI
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-X
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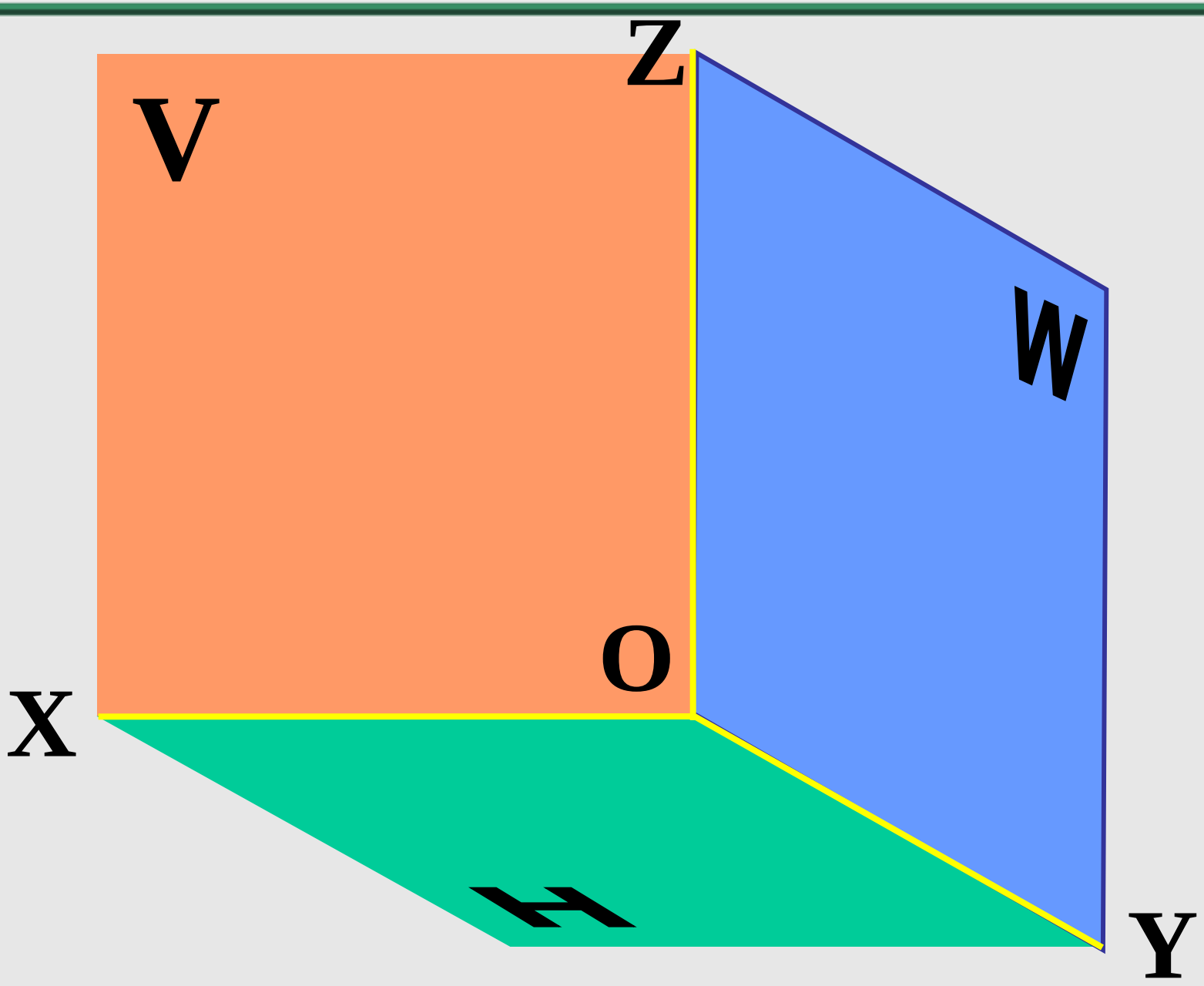
VIII

The Point Drawing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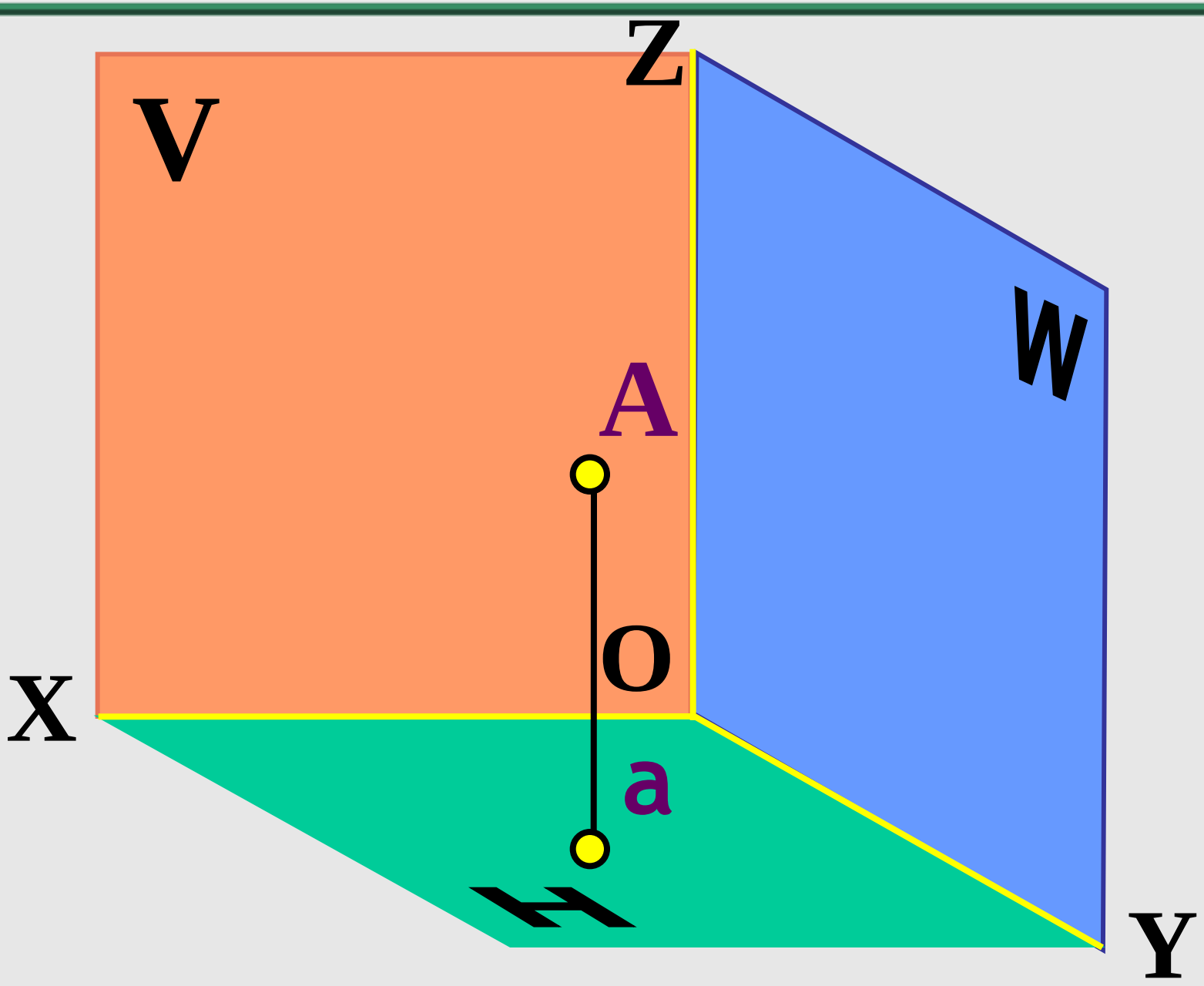
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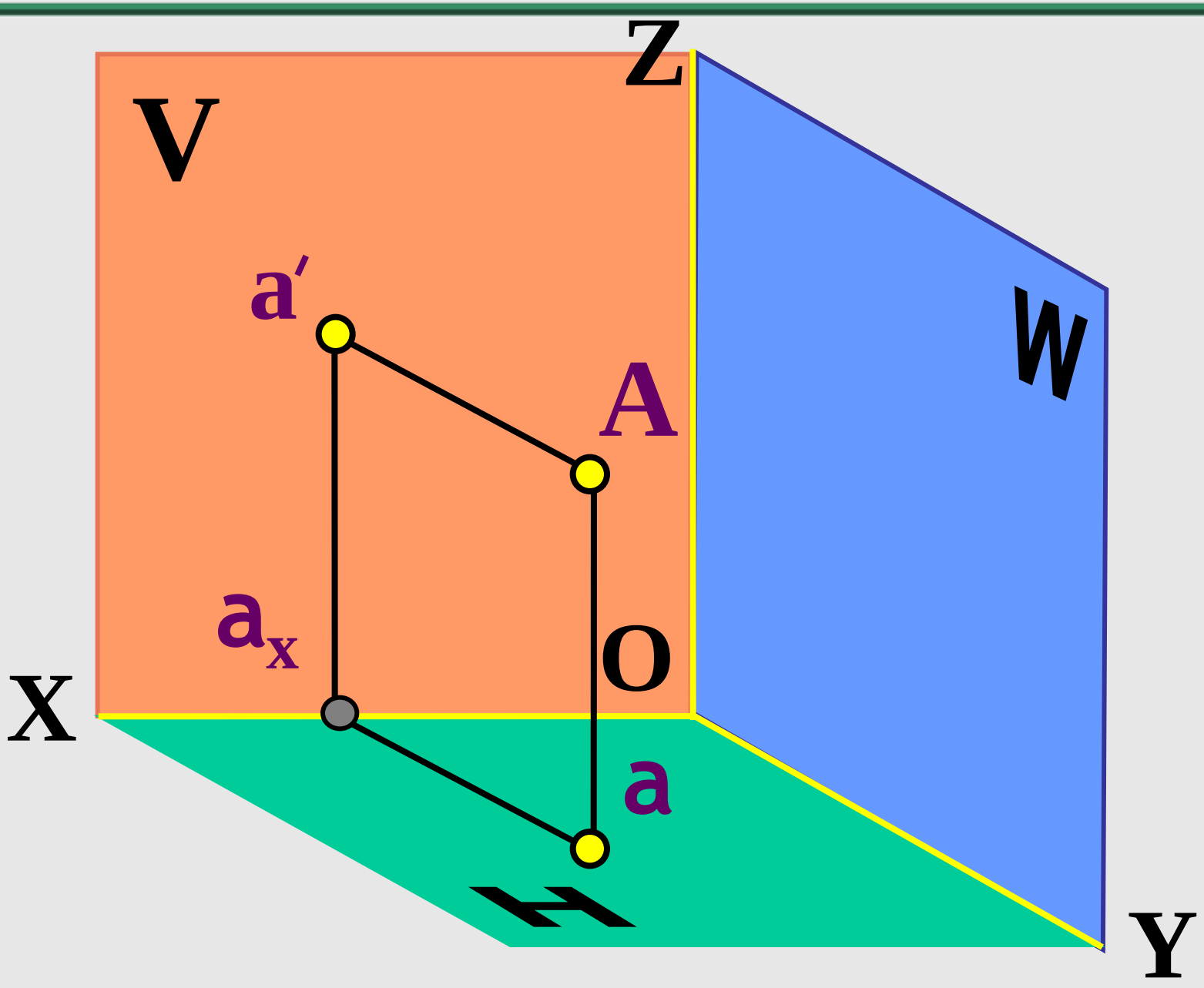
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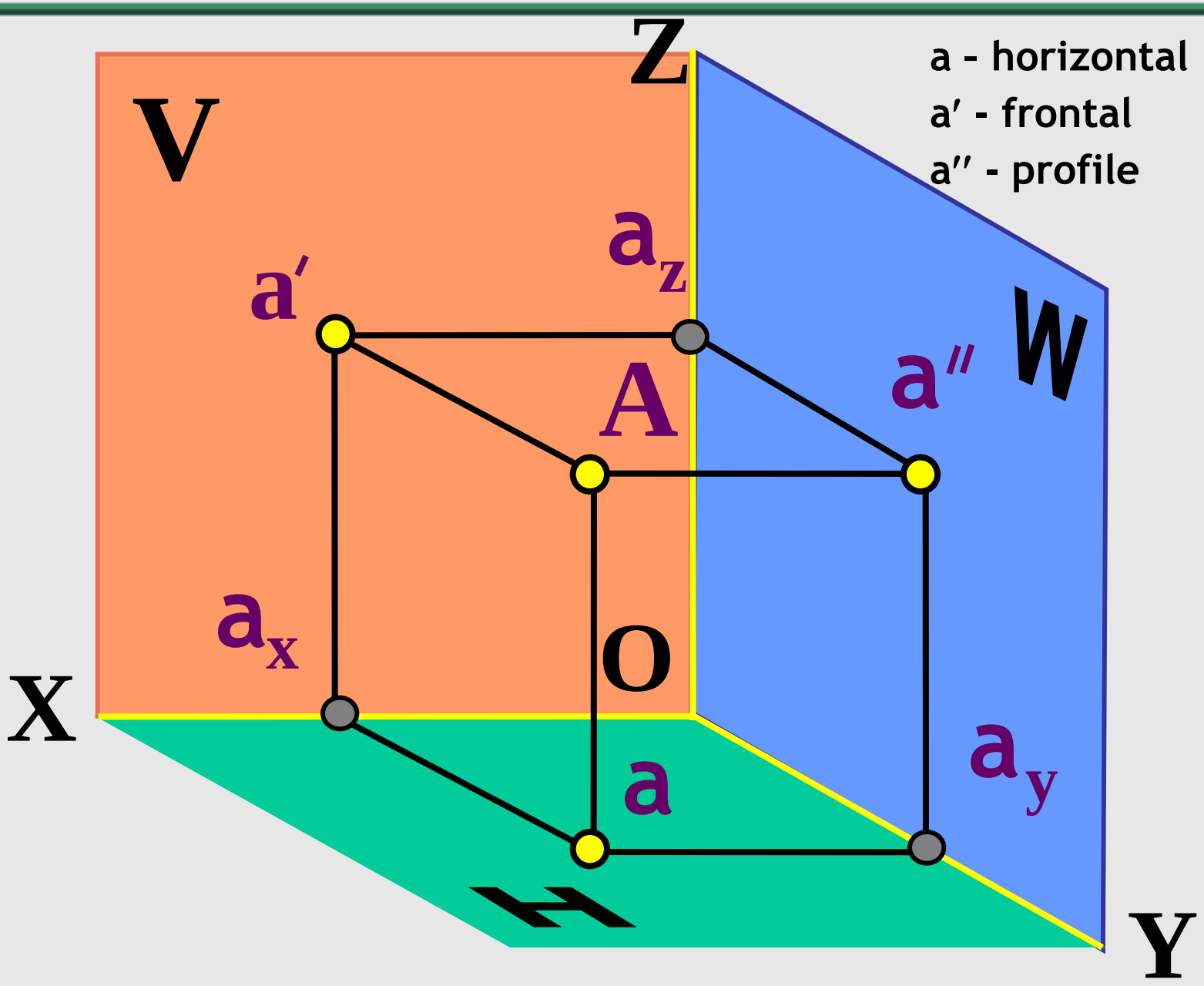
a - horizontal
a′ - frontal
a″ - profile
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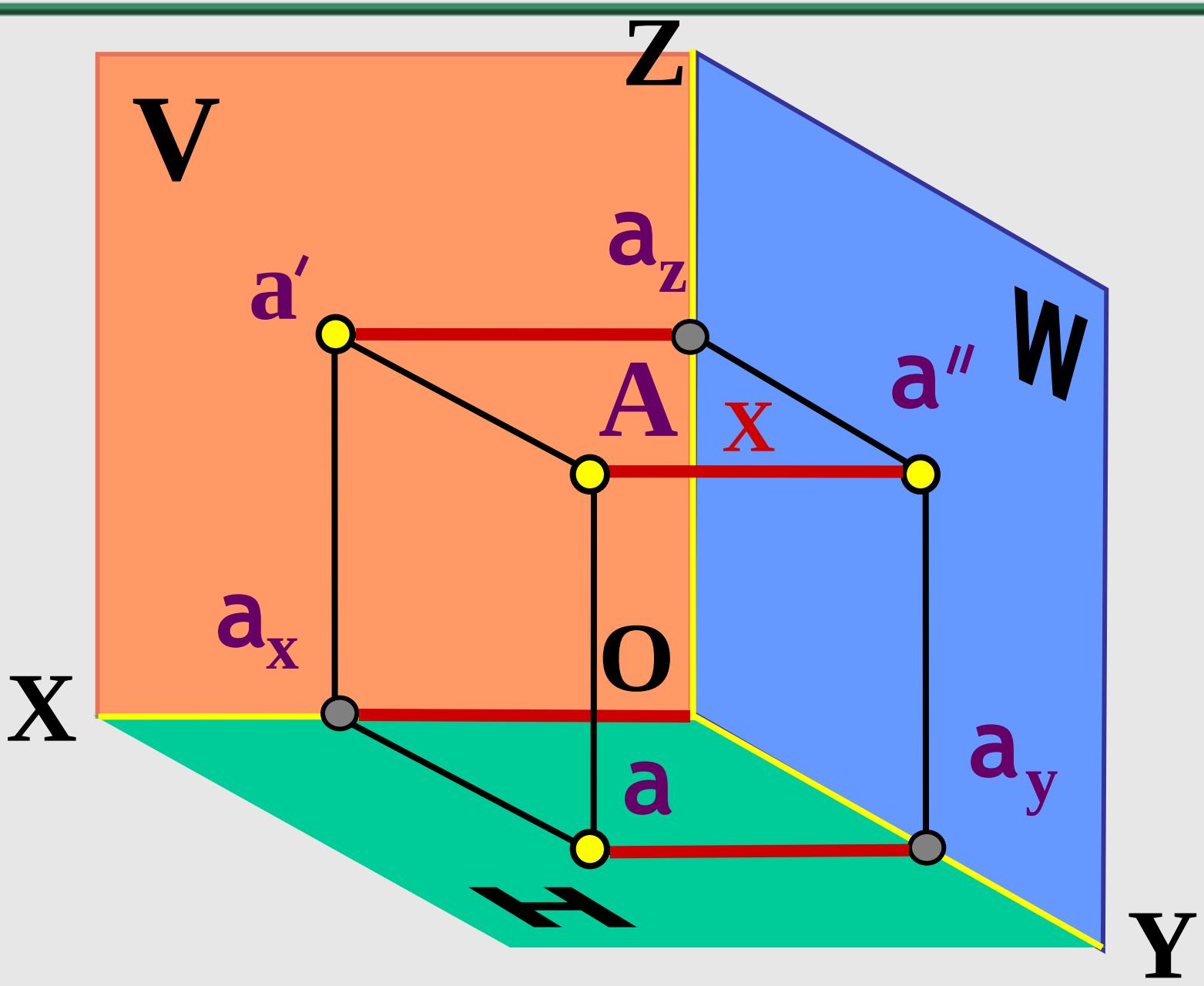
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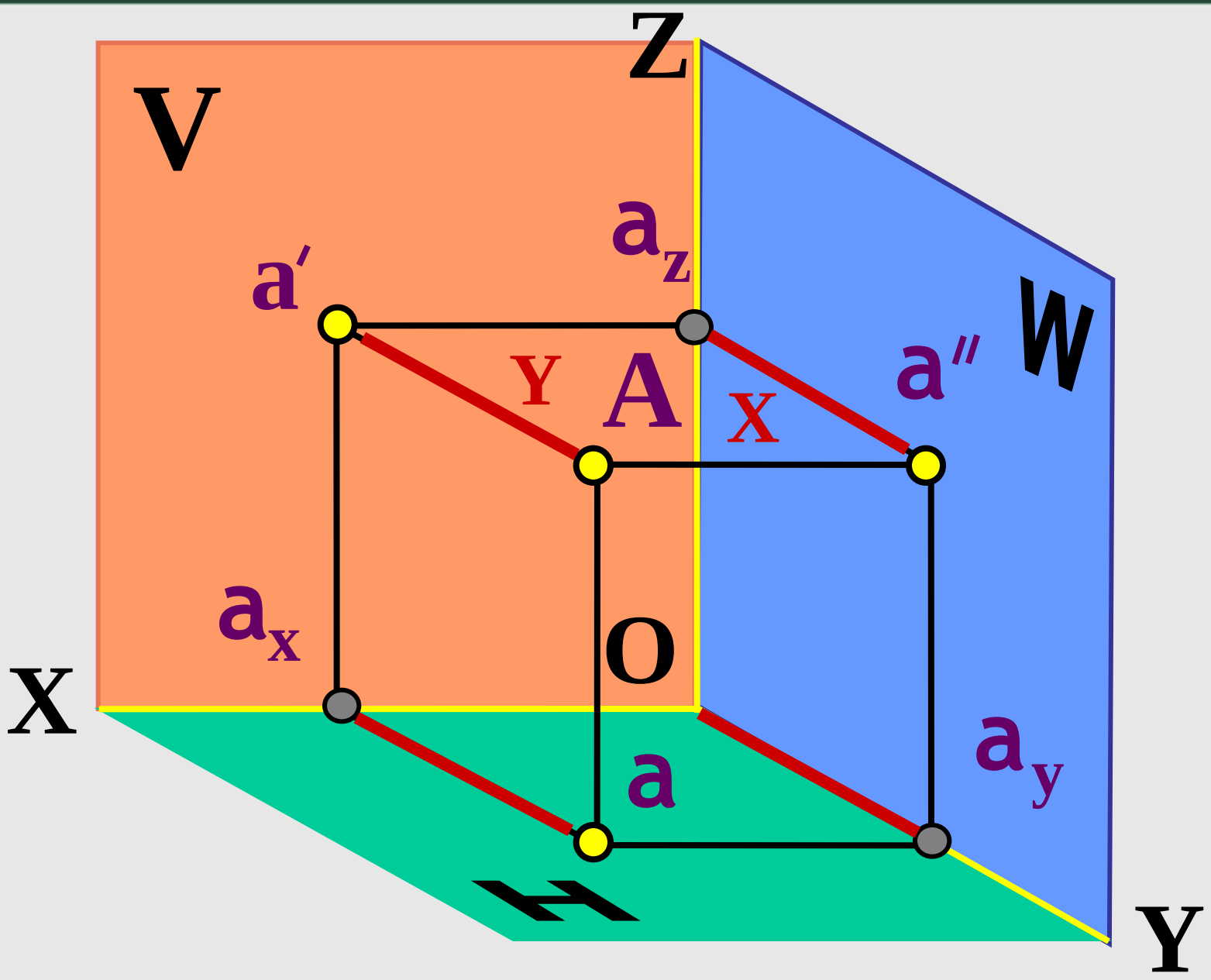
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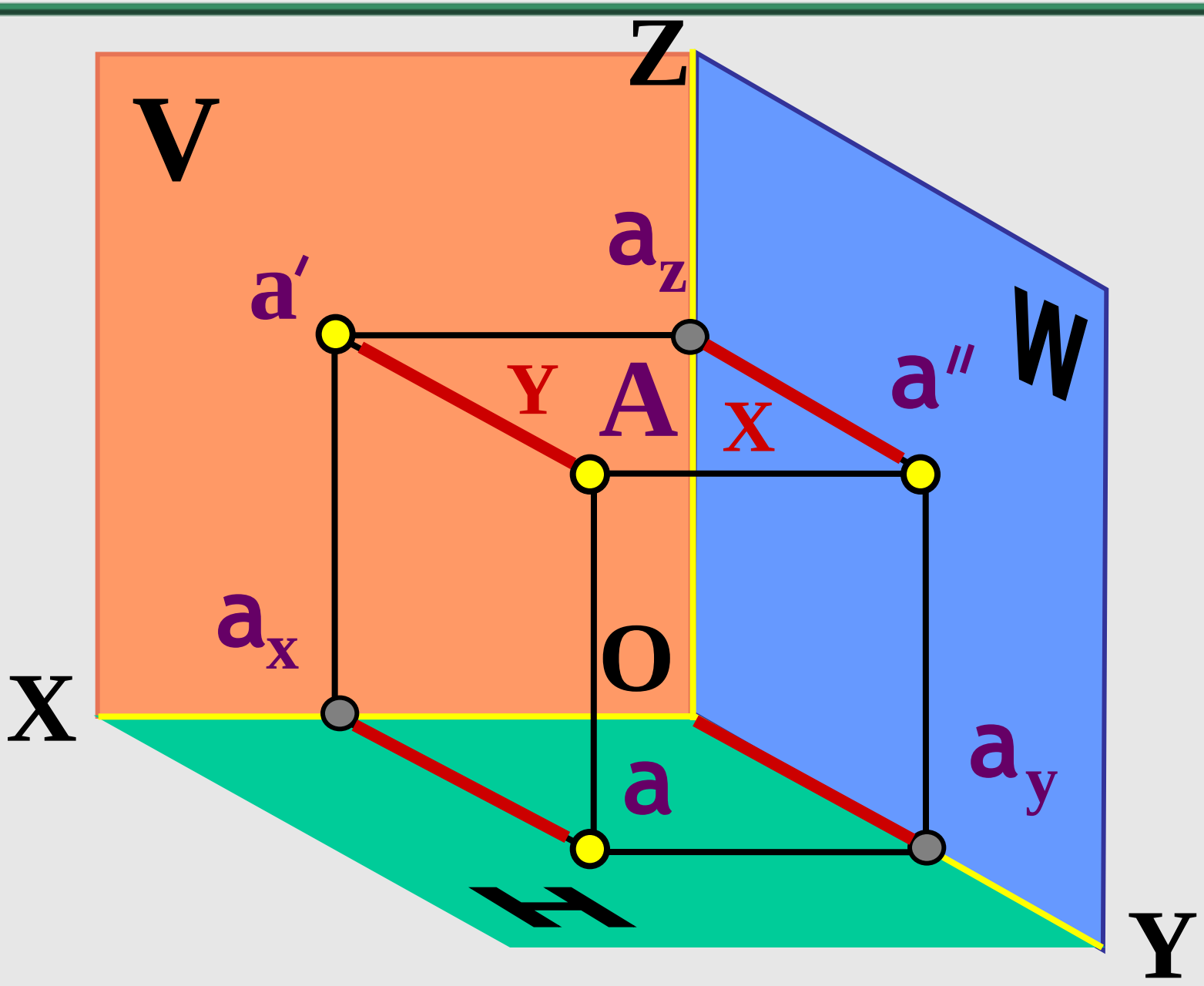
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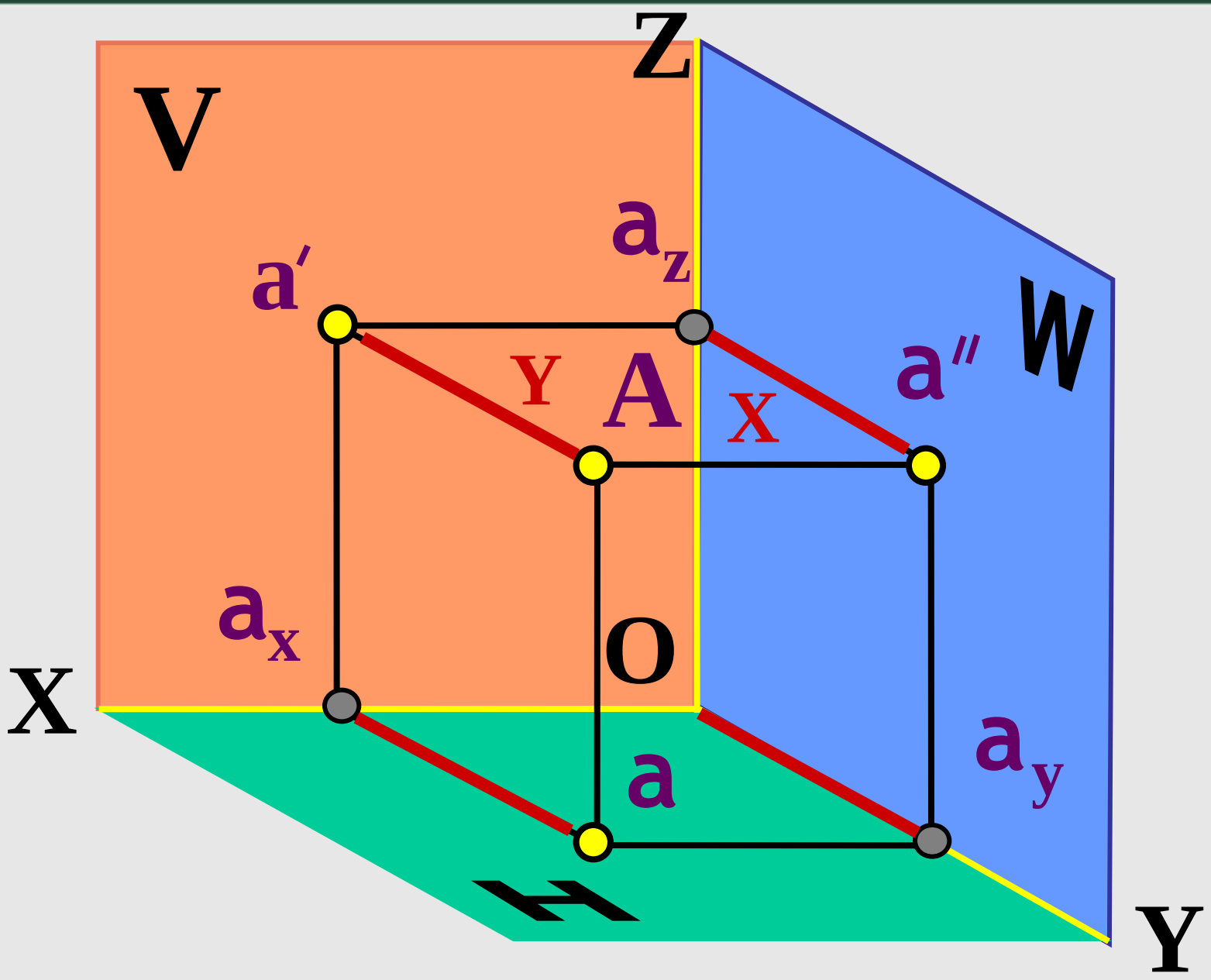
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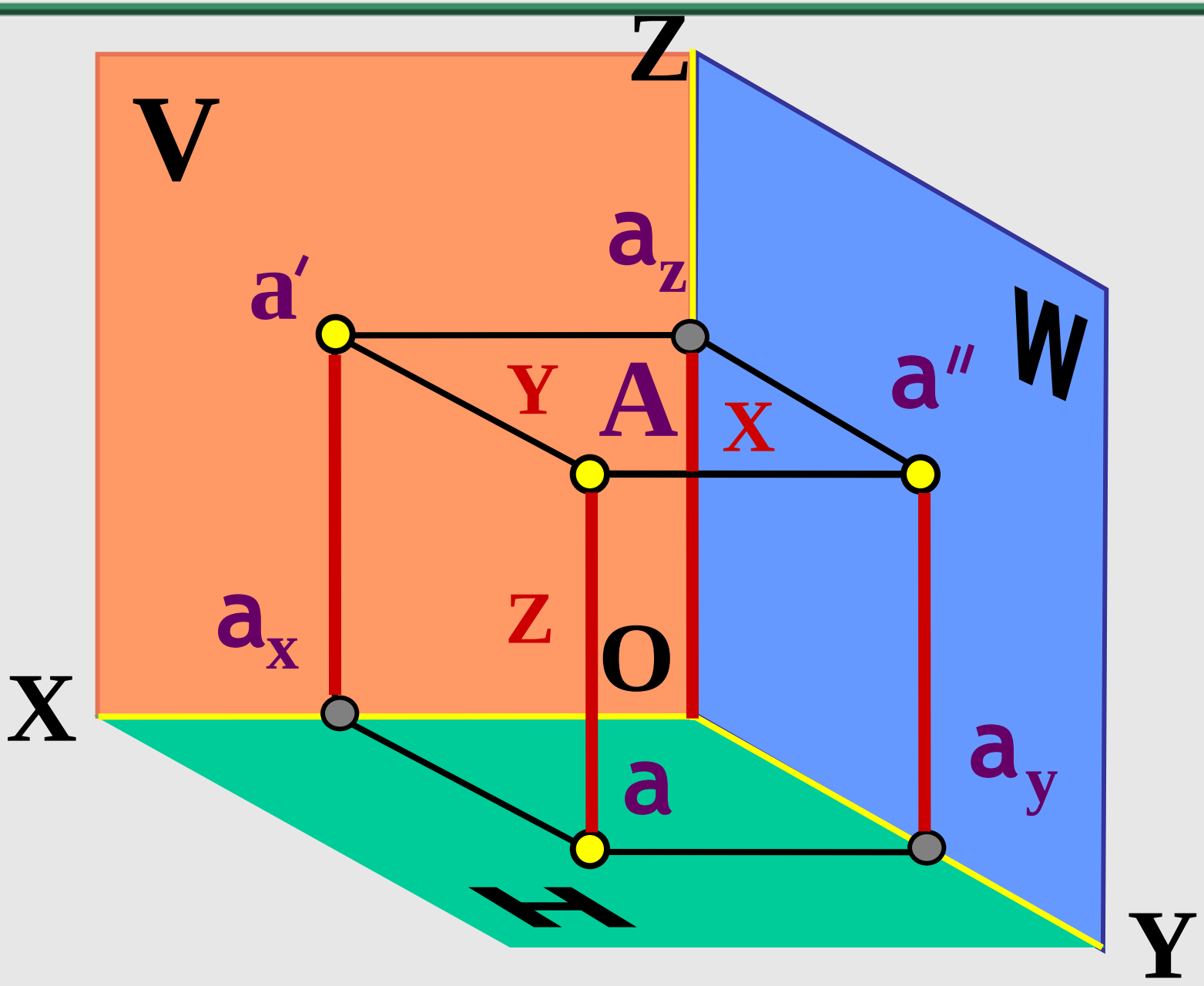
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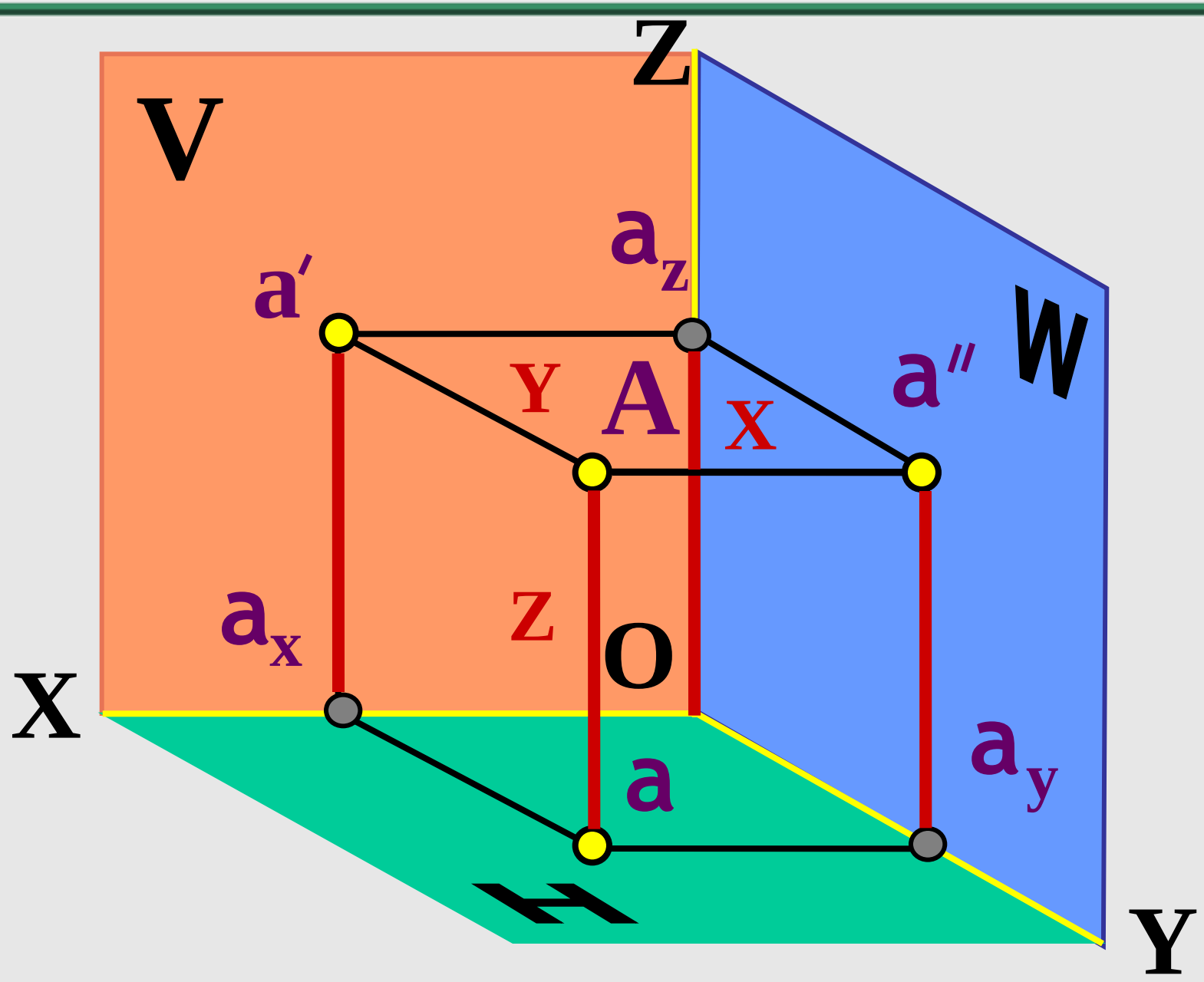
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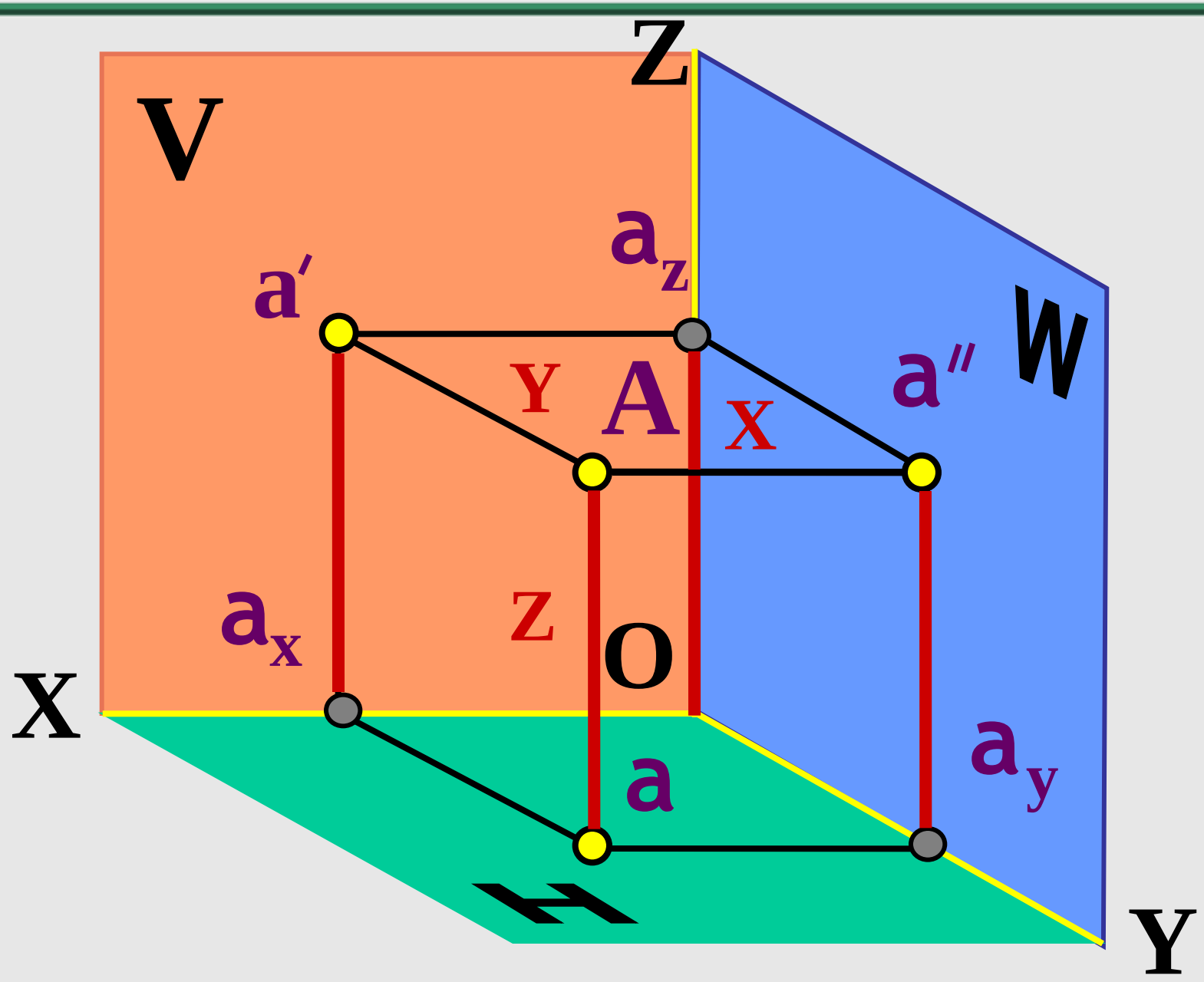
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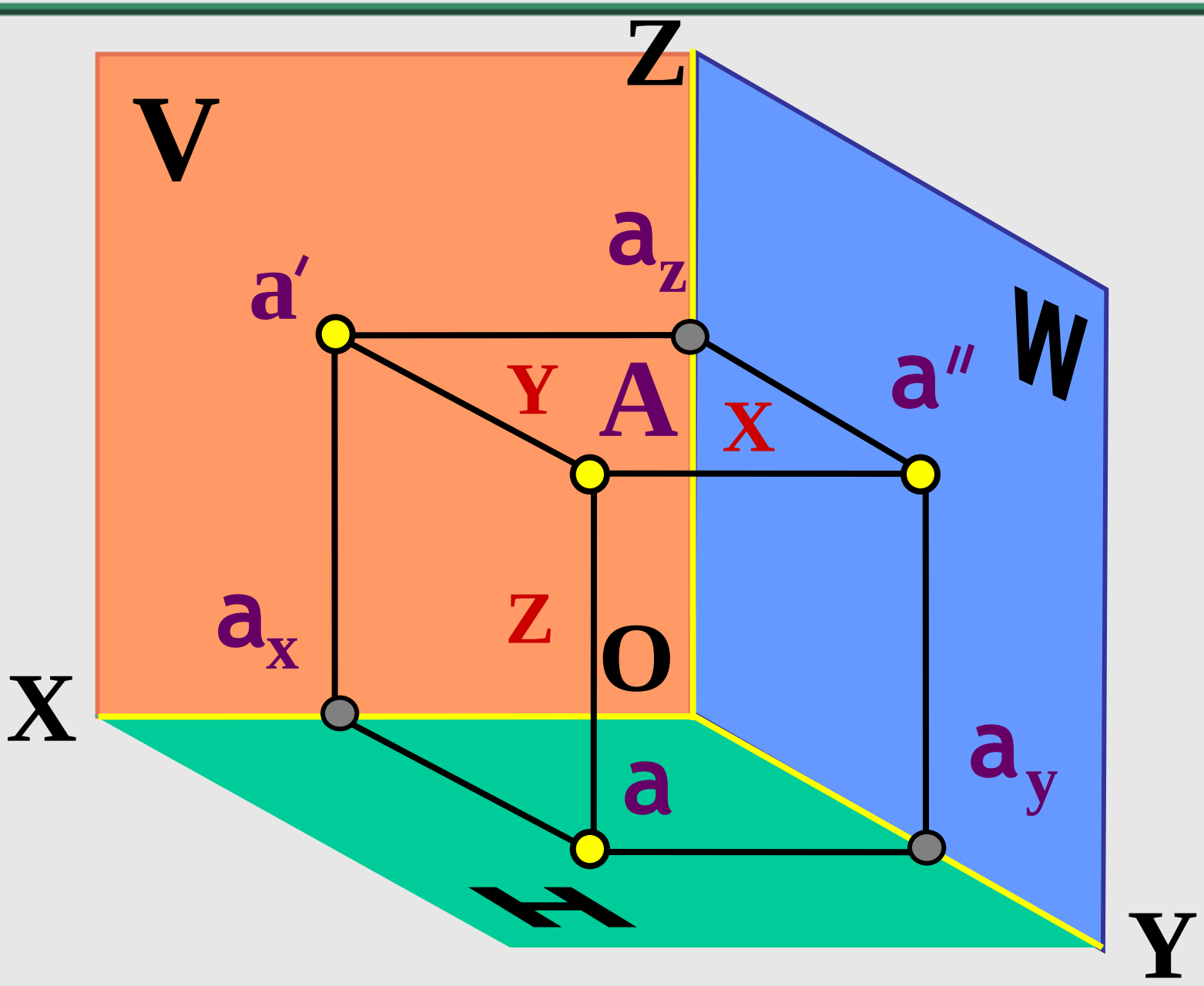
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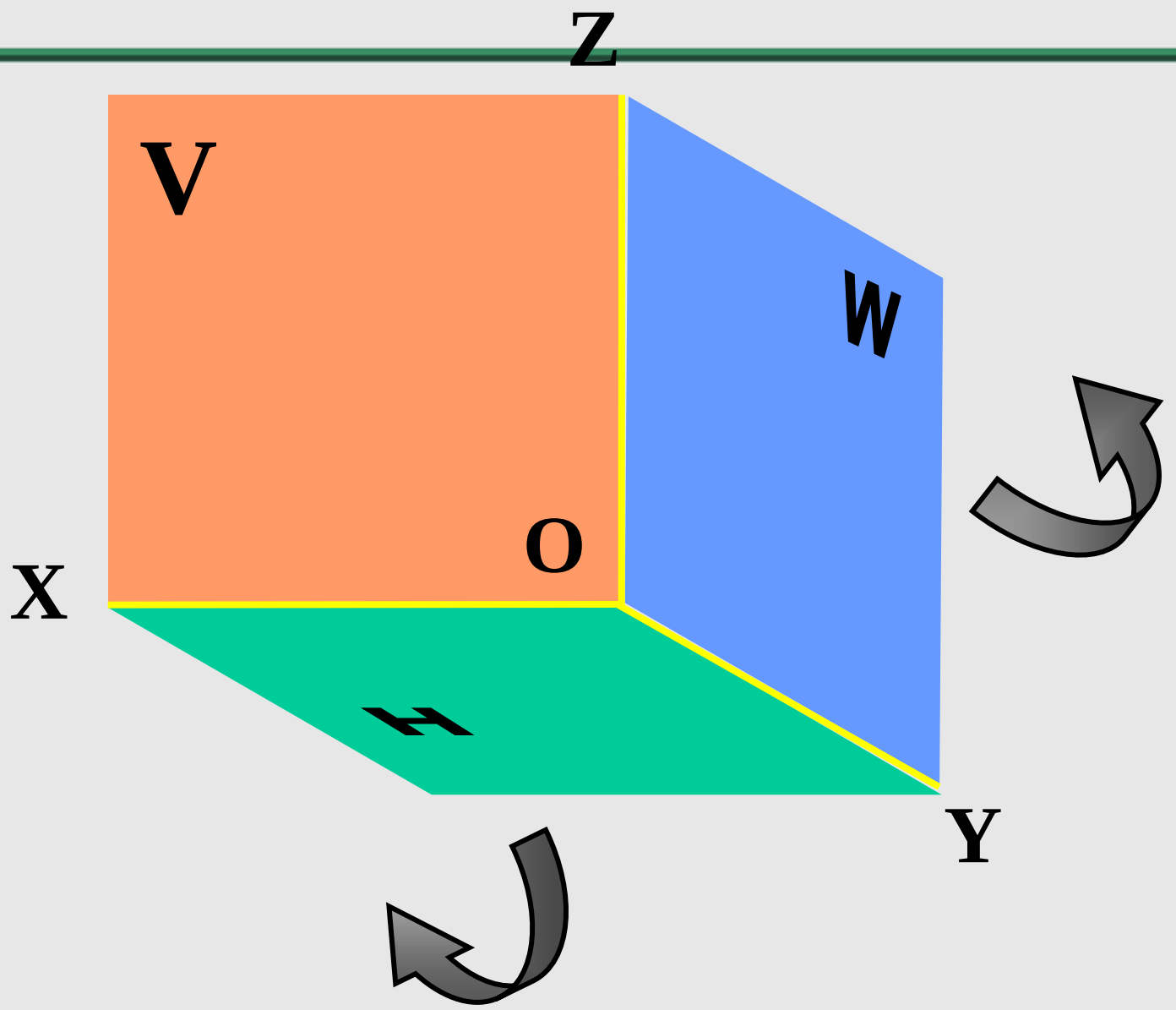
Rectangular projections of a point (in the *H*, *V* and *W* planes) are always obtained as the bases of perpendiculars, dropped from the given point onto each of projection planes

The location of a point in space is specified by means of its three coordinates (abscissa *x*, ordinate *y*, applicate *z*) A (x,y,z)

The location of a point in planes two coordinate:

a(x,y); a'(x,z); a"(y,z)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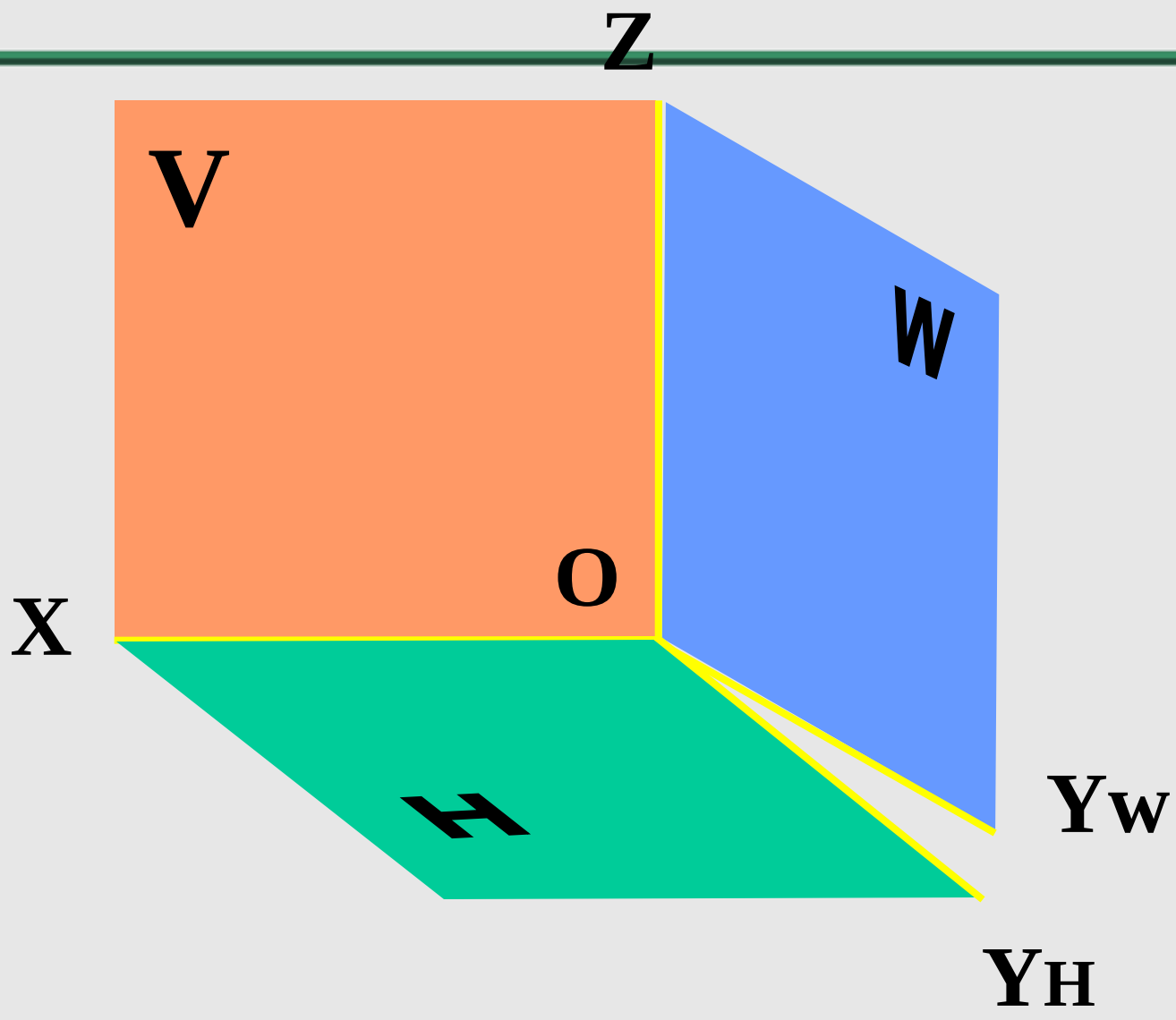
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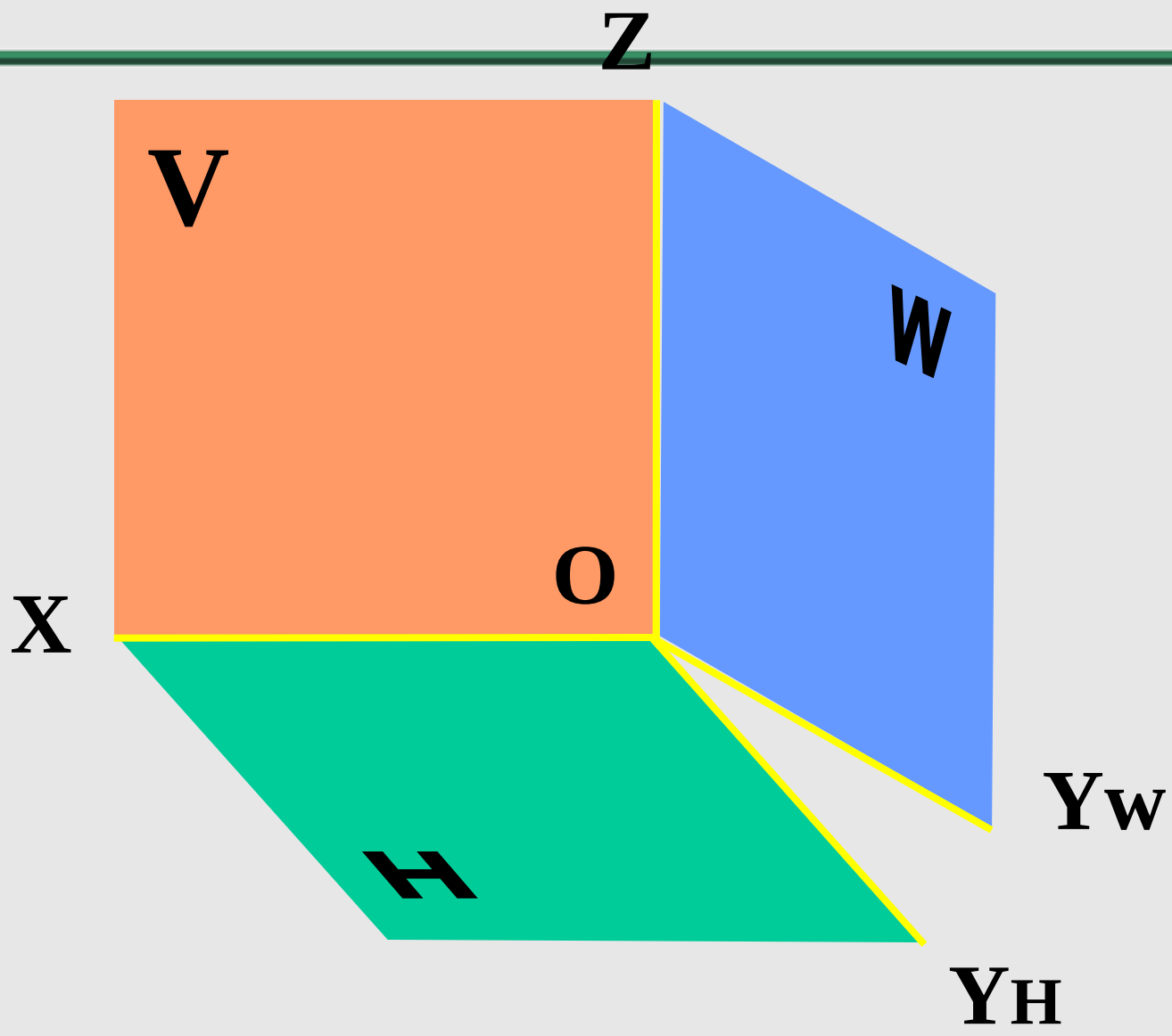
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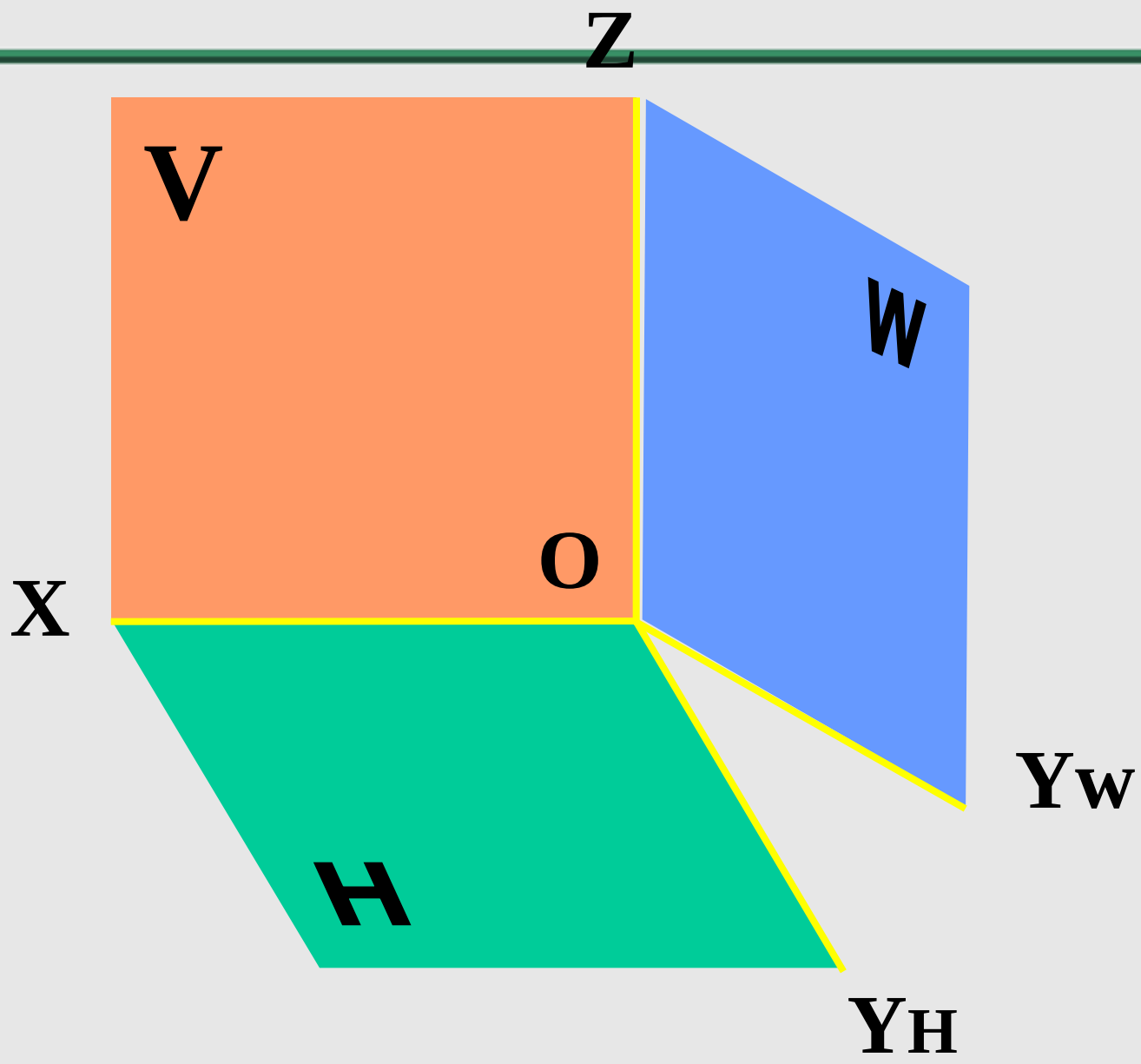
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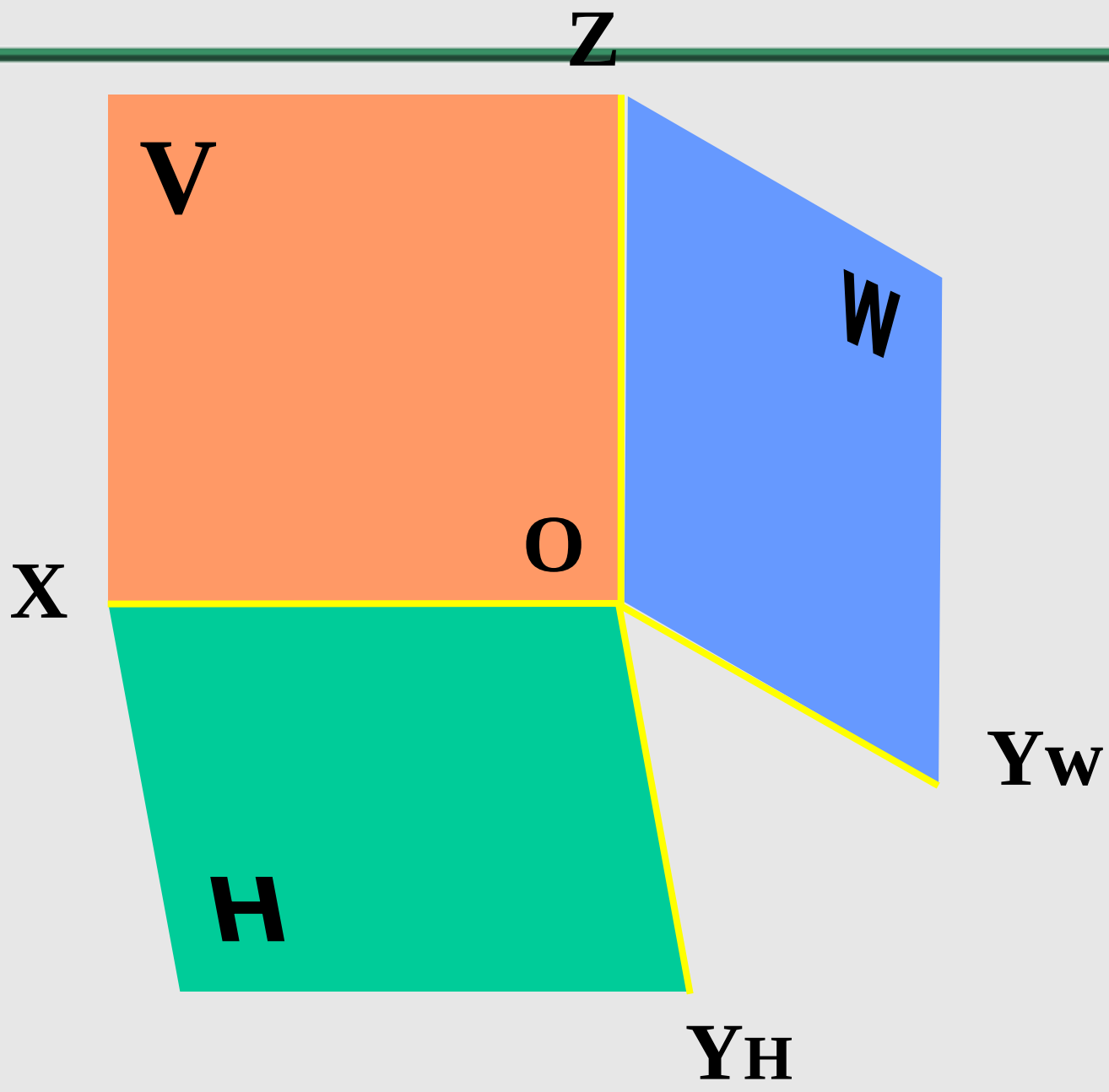
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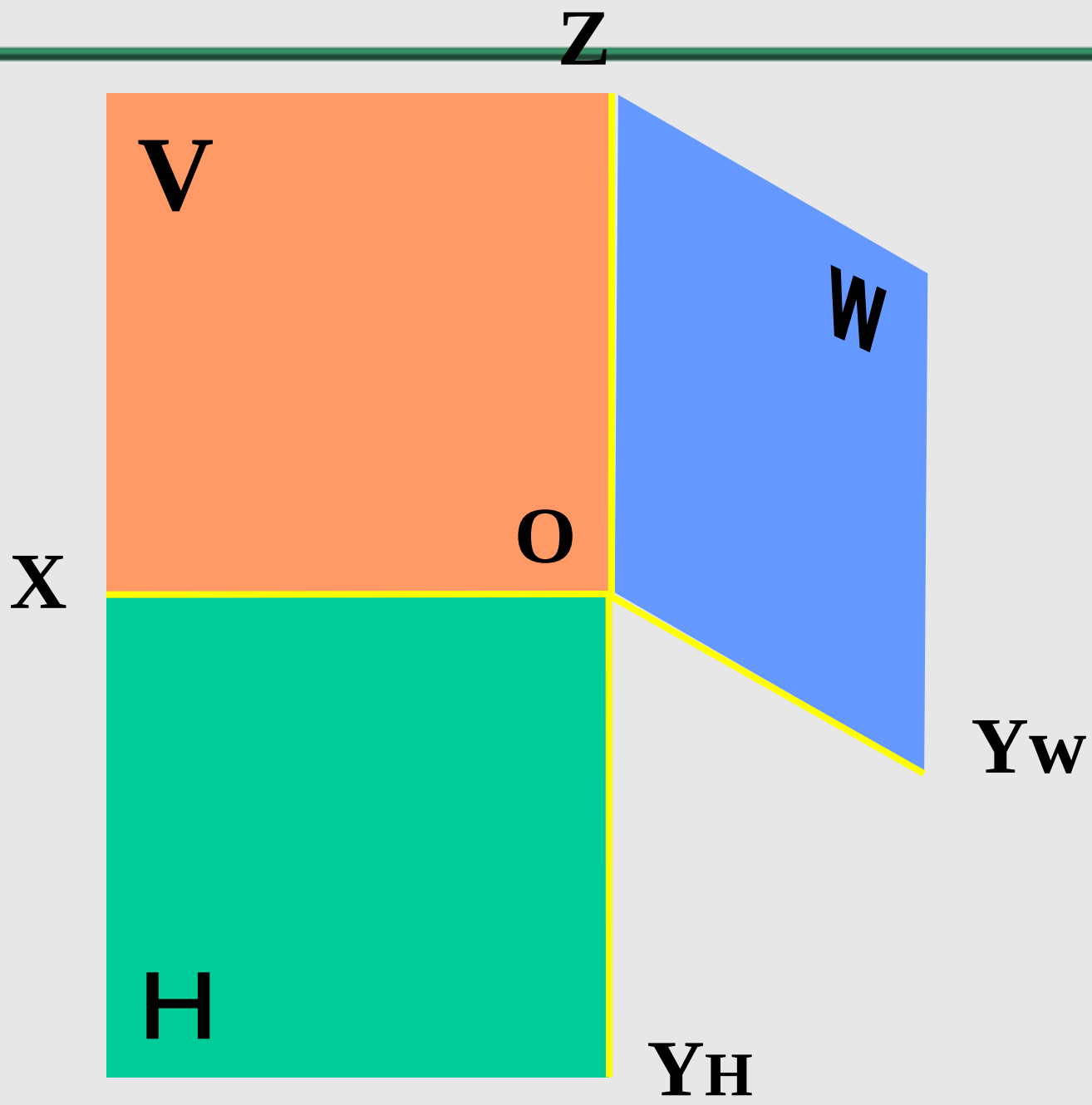
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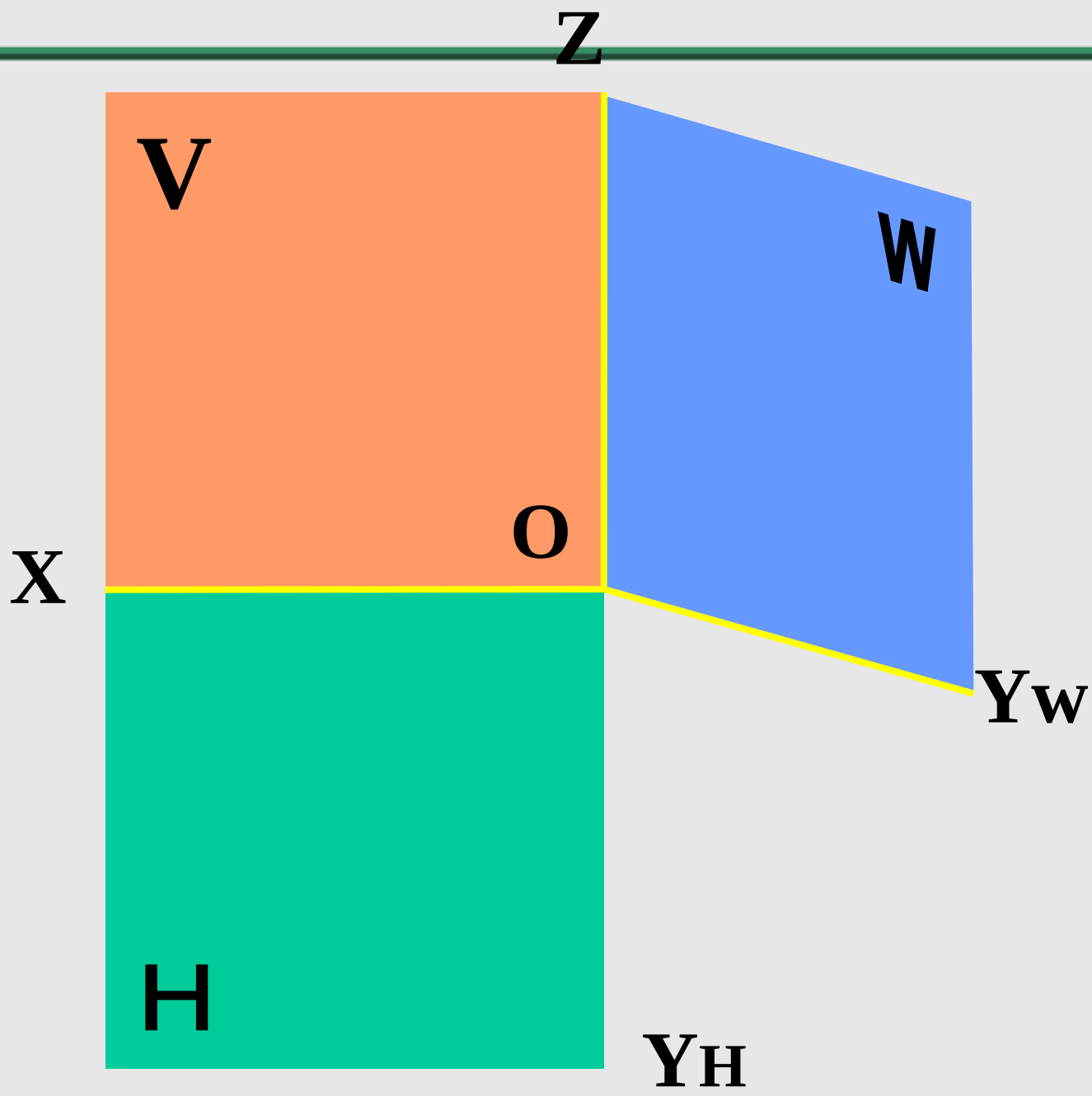
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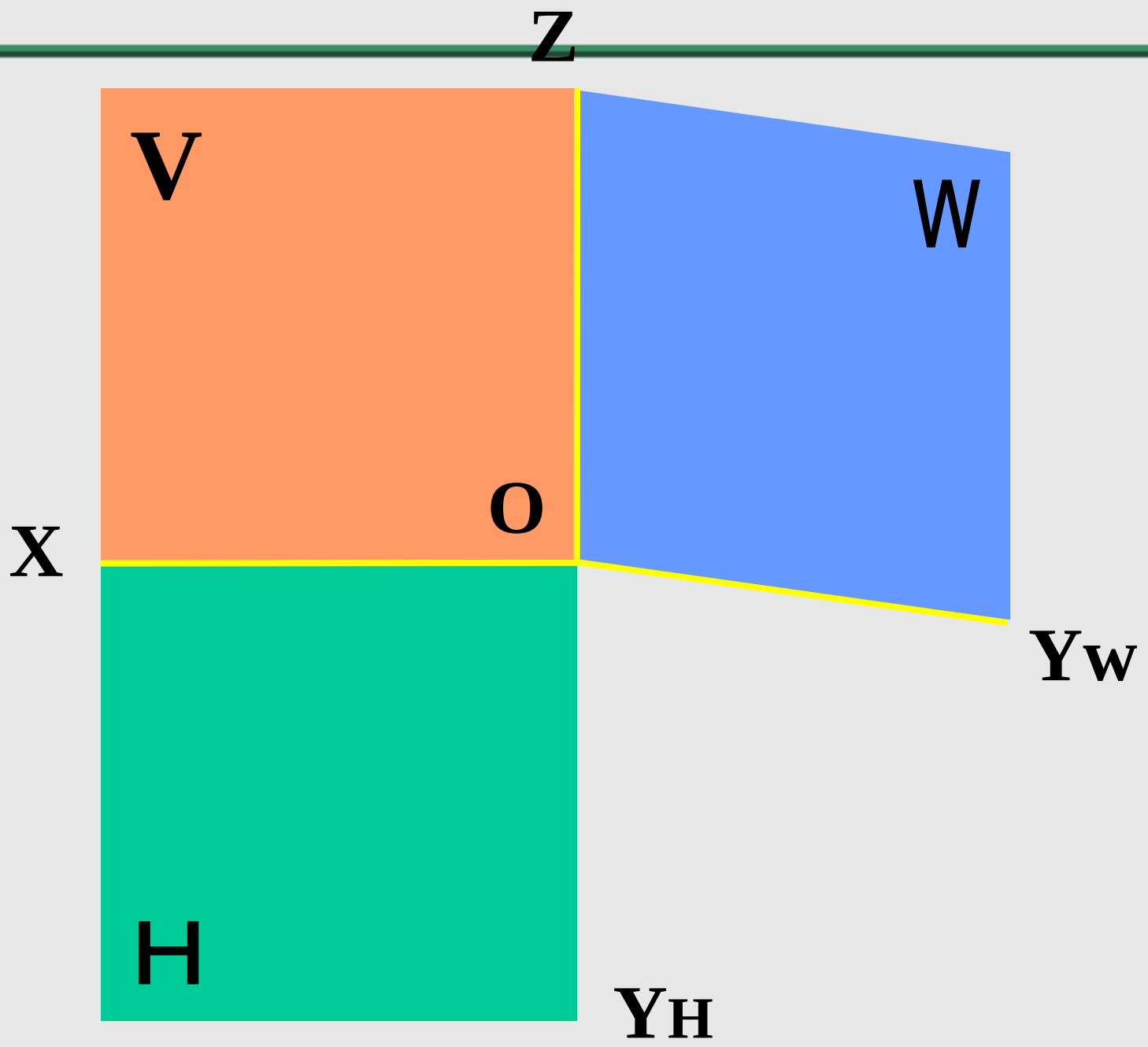
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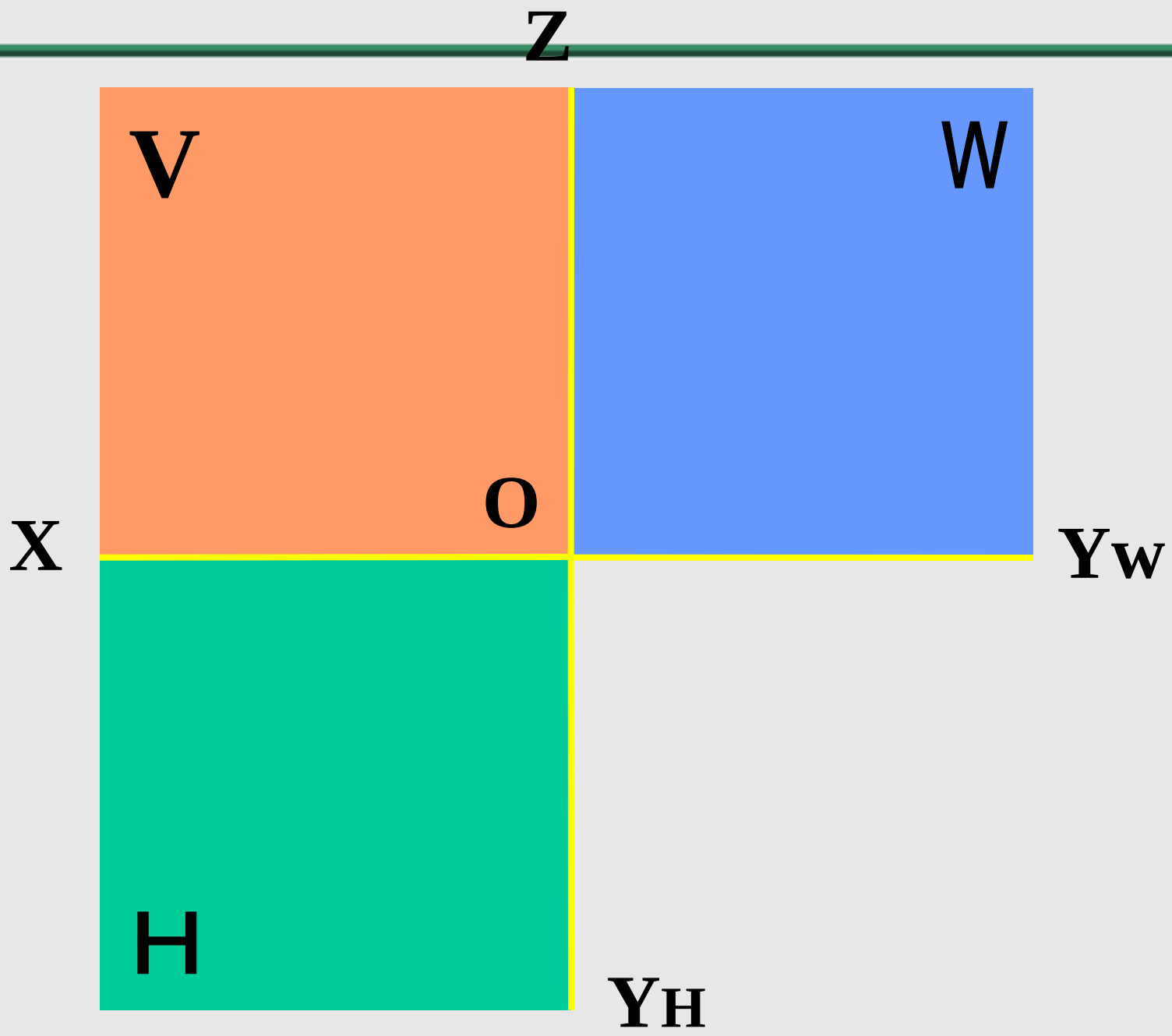
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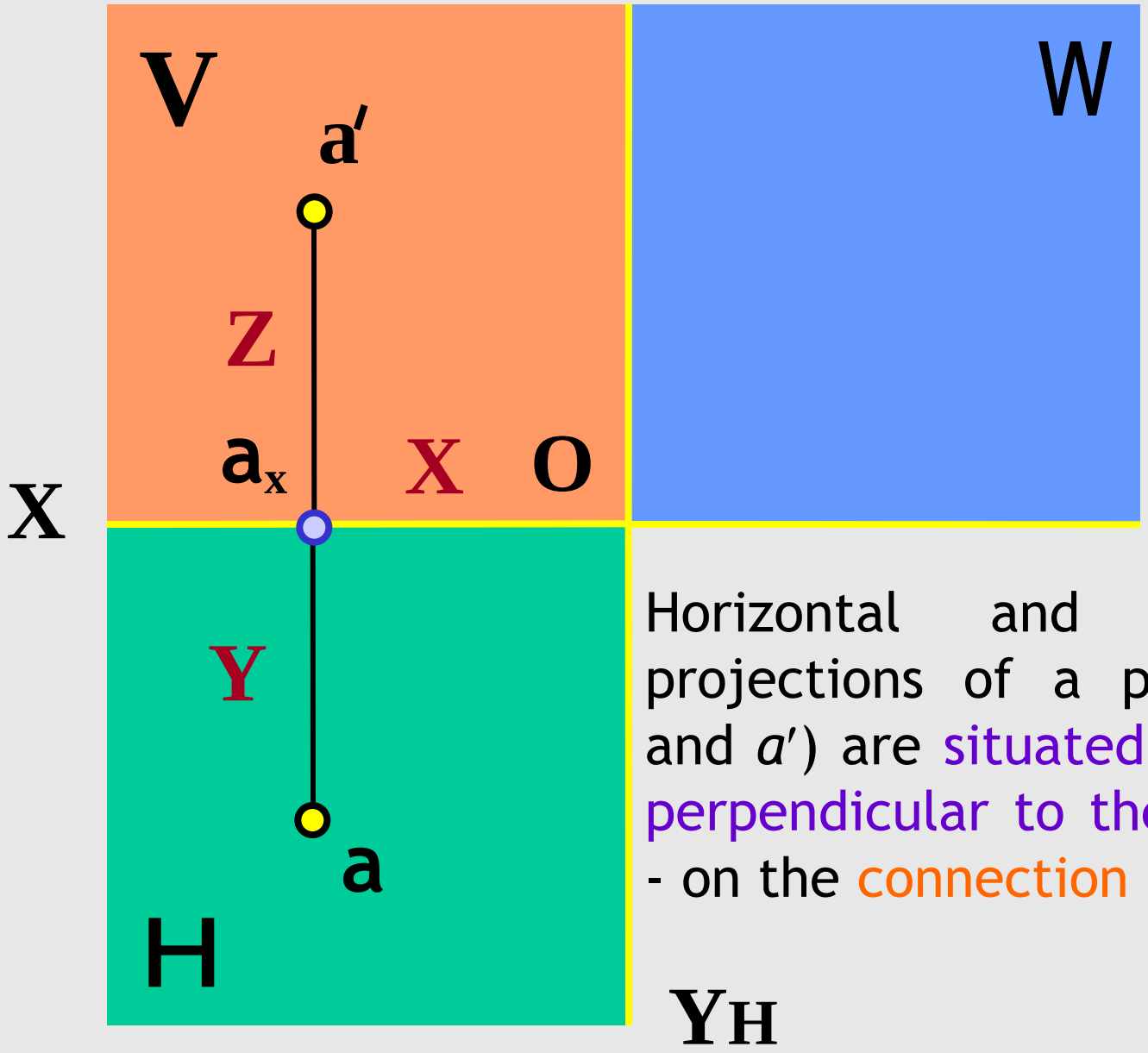
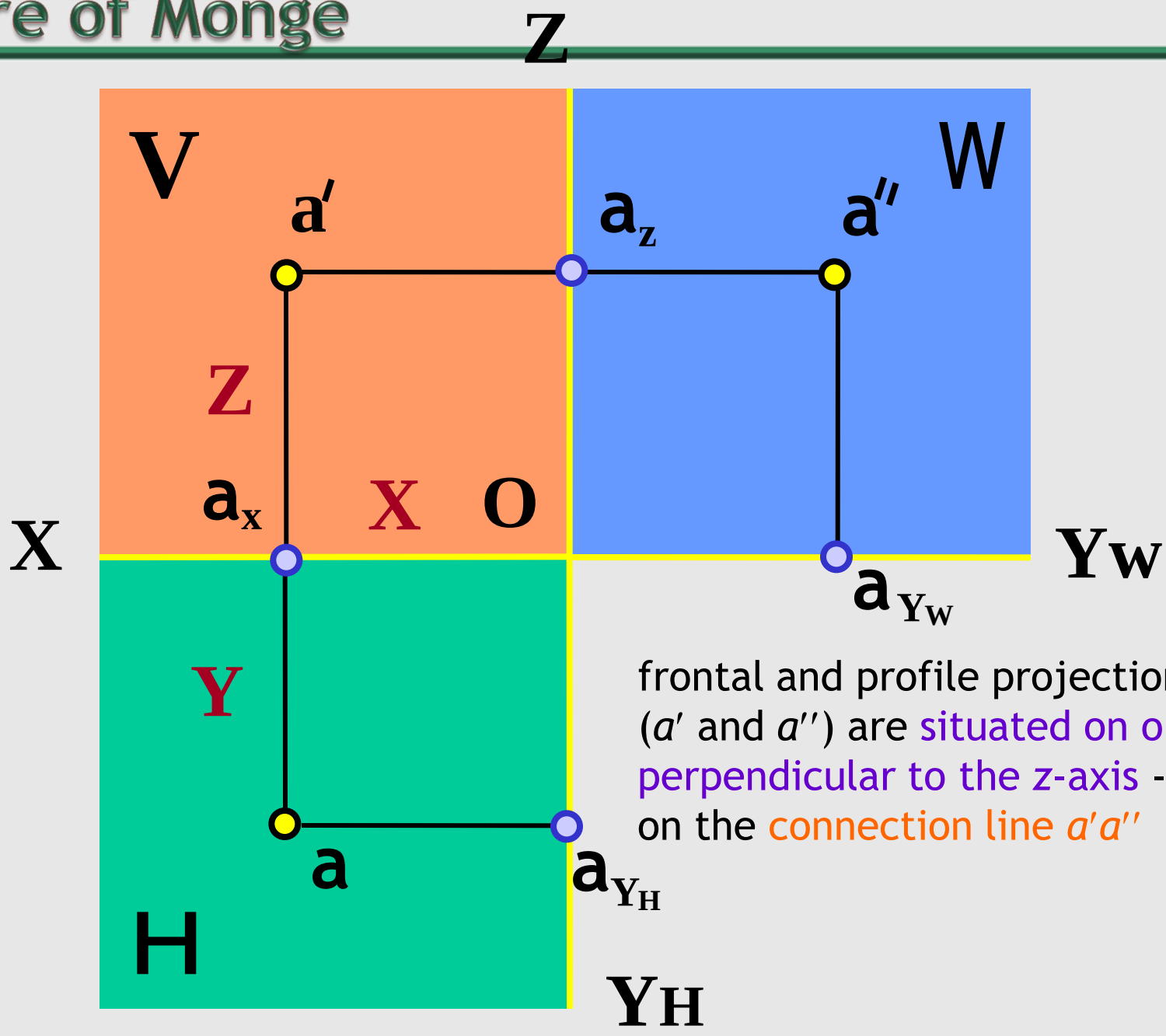
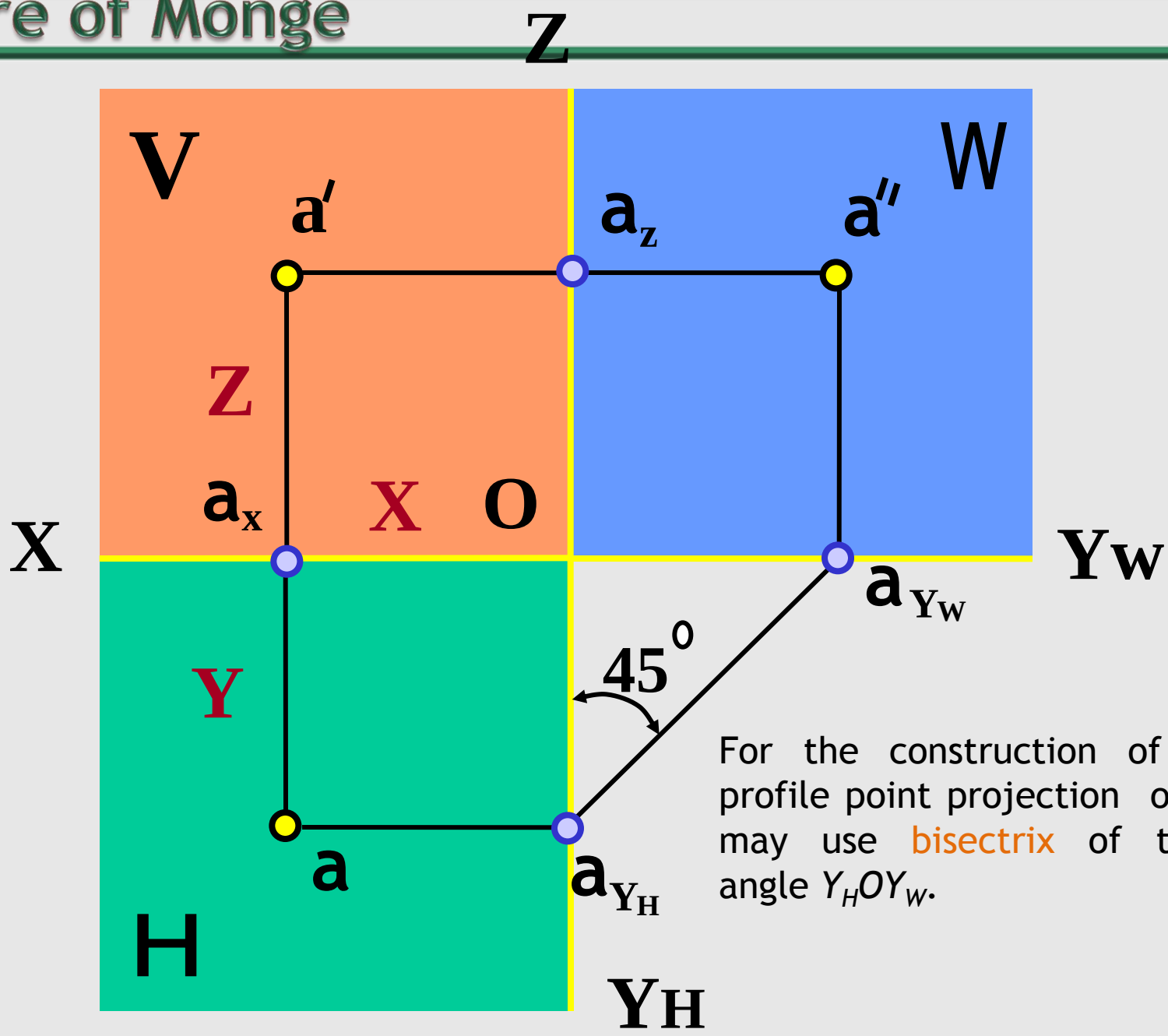


Horizontal and frontal projections of a point (*a* and *a*′) are situated on one perpendicular to the *x*-axis - on the connection line *aa*′

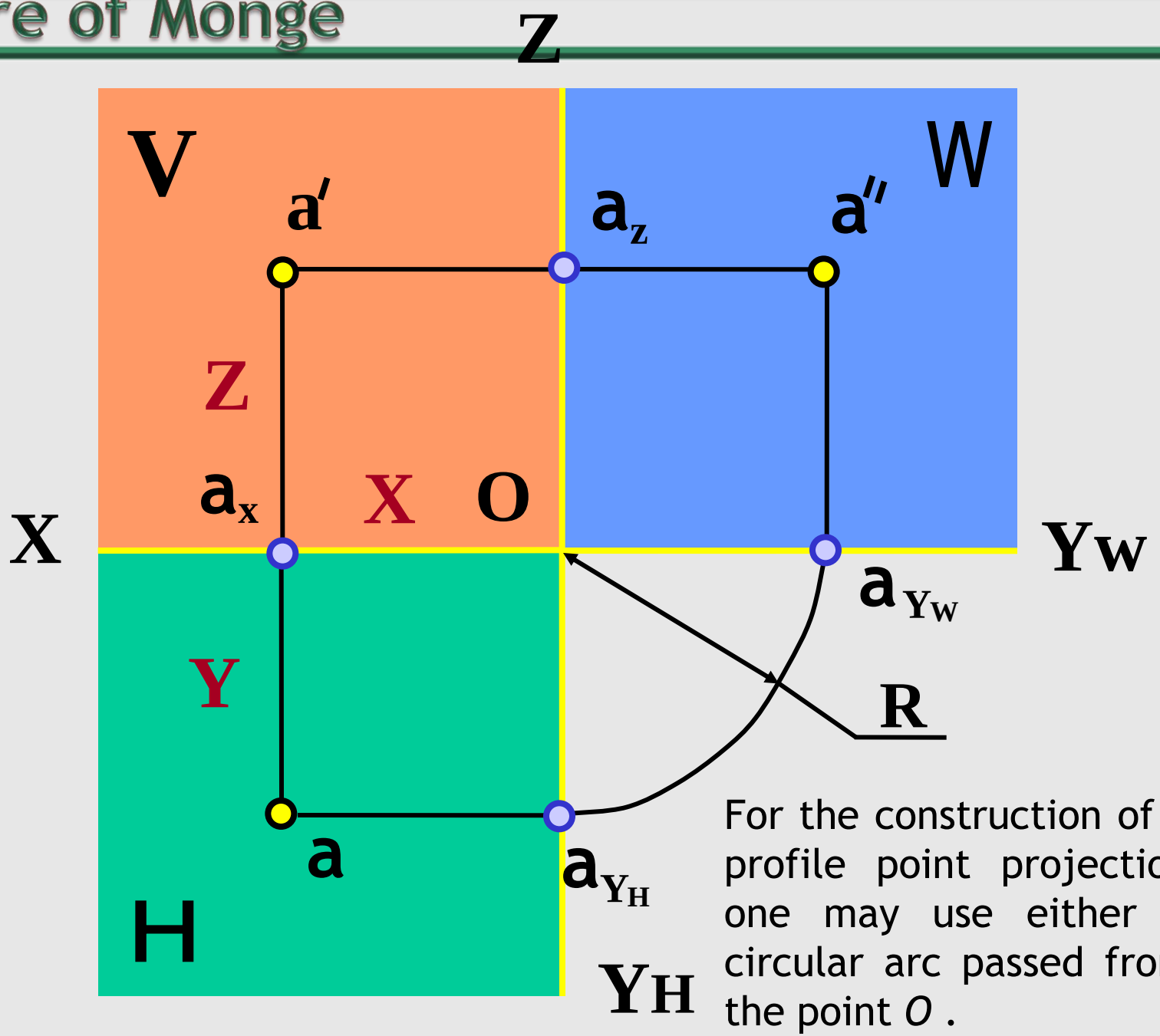


frontal and profile projections (*a′* and *a″*) are situated on one perpendicular to the z-axis - on the connection line *a′a″*



For the construction of a profile point projection one may use bisectrix of the angle $Y_H O Y_W$.

epure of Monge



For the construction of a profile point projection one may use either a circular arc passed from the point *O* .

Thus, in a complex drawing consisting of three orthogonal point projections:

- two projections are situated on one connection line;
- connection lines are perpendicular to the projection axes;
- two projections of a point specify the locus of its third projection;
- two projections of a point specify its locus in space.