ENGINEERING GRAPHICS: SEMIOTIC ASPECTS

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Abstract. Engineering and technology students learn to perform the engineering drawing (graphic representation) as reflection of an existing object or geometric structure of a future object. The basic course in this field of teaching is Engineering Graphics, which can be divided into two parts: understanding of logical development of concepts, and application of these concepts to practical situations. In other terms, the course deals with geometrical variables in logical relationships as well as with graphic variables (semiotic tools) i.e. the system of sign representing icons, indexes and symbols, both being properties of the universe [1]. In our treatment of the semiotic (graphic) drawing we proceed from Peirce´s model of the sign and from the triadic model of symbolic representation [2].

Keywords: Engineering Drawing, Geometrical Variables, Semiotic Variables, Representation, Triadic Model, System of Sign

1 Introduction

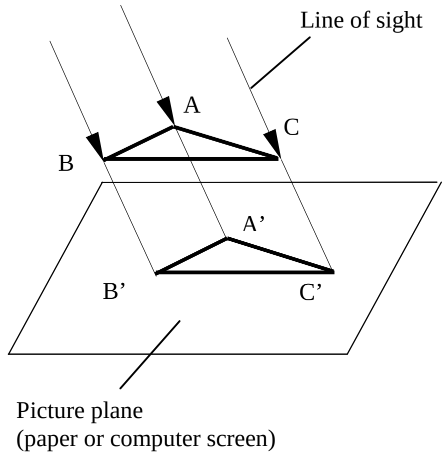
Engineering graphics depends on projection methods (perspective and parallel), which are based on projection theory. The whole projection theory is based on two variables: the line of sight, and the plane of projection or, briefly the logic of ´sight` [3]. Projection theory comprises the principles used for graphic representation of 3-D objects on 2D media. In other words, a two-dimensional or graphic design is the projection of the three-dimensional means of expression onto a surface. It seems reasonable to suppose that the impressions associated with the three-dimensional common geometric primitives [cube, right rectilinear prism (block), right triangular prism, (wedges), sphere, cone, torus and cylinder] are similar to the impressions associated with their two-dimensional projections (in design trilogy, the basic shapes are the square, the triangle, or the circle).

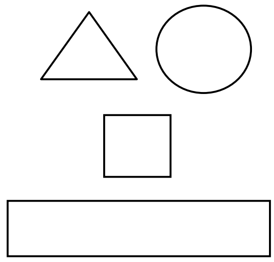
In principle, a future object can be constructed using mathematical methods (digital images). However, as engineers generally prefer visual images, we consider graphic variables and accordingly, the main semiotic device used by designers is visual representation. In our treatment of the semiotic (graphic) drawing we proceed from Peirce´s model of the sign (system of sign representing icons, indexes and symbols) and the triadic model of symbolic representation [2]. At the beginning of each course, irrespective of its content, it is reasonable to attempt to create for a student a framework or a wider picture of things into which it is possible to fit acquired knowledge.

2 Graphic representation of the design object and a triadic model of representation after Peirce

Engineering drawing (serving as a graphic model) is a graphic representation of design objects and structures (which make it possible to produce a product). The most realistic representations of the design object can be obtained using pictorial view or physical models created, e.g. of modeling clay.

According to Bense, the design object is a special type of sign in which a combination of particular characteristics from all three conceptual fields is realized: geometry, semiotics and technology [4]. Hence our study course deals with geometry and graphics (semiotics), the first one providing logical relationships and the latter semiotic tools (Fig. 1).





Geometrical variables
Logical relationships (logic of ´sight`)

Graphic variables
Semiotic tools

Fig. 1: Geometric and graphic variables of the design object

The simplest definition of semiotics is that it is *the study of signs*. The study of signs is the study of the construction and maintenance of reality. According to Peirce, ´a sign…[in the form of a *representamen*] is something which stands to somebody for something in some respect or capacity` [2]. Below, we present a triadic model after Peirce (see Fig. 2) [2].

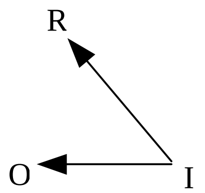


Fig. 2: Form of symbolic representation. R-representamen: the form which the sign takes; I-interpretant: not an interpreter but rather the sense expressed by the sign; O-object: to which the sign refers

The interaction between the representamen, the object and the interpretant is referred to as 'semiosis' by Peirce. The sign in relation to its material dimension, in relation to the object it stands for, and in relation to its interpretation and use [4]. Peirce divided the system of sign into icons, indexes and symbols.

3 System of sign: icons, indexes and symbols in engineering graphics

Peirce stated that an iconic sign represents its object 'mainly by similarity'.

The iconic representation of an object is the pictorial drawing, which is excellent for depicting the appearance of the object. Pictorial drawings (also as production illustrations) are a type of technical illustrations that are frequently used in technical documents, sales literature, maintenance manuals, and documentation supplements in technical drawings [3].

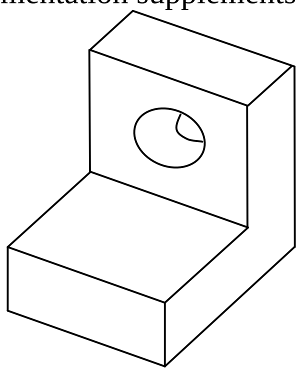


Fig. 3: Pictorial drawing of the design object as icon

Actually, icons are views which serve as the part in the functioning position (e. g. front view/principal view, view from left) [6].

According to Peirce, the indexical sign is like ´a fragment torn away from the object` [2]. Indexical signs are direct connection to the object. In our study course indexical sign may be referred to as sections (half, successive, local) and section view, which illustrate the internal structure of an object. Peirce offers also that kind of criteria for an index. ´Anything which focuses the attention is an index` [2]. Indexical signs are symbols on sections: the cutting plane is identified by designations, e. g. by capital letters, and the directions of viewing are indicated by arrows (Fig. 4).

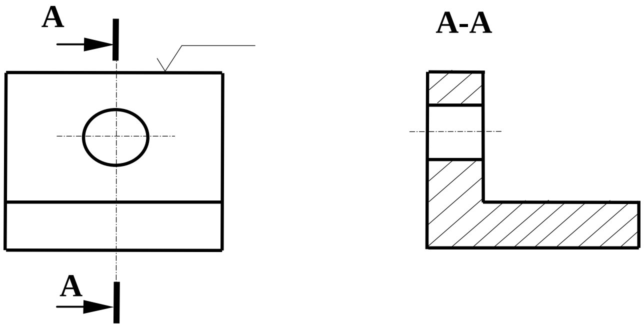


Fig. 4: Section in one plane. Placement of cutting plane lines

The indexical sign becomes a symbol when the section is used to indicate the material of a component on the cutting plane (hatching).

According to Peirce´s concept, a symbol constitutes a sign merely or mainly by the fact that it is used and understood as such [2]. The form of a symbolic representation is based on conventions which are commonly accepted practices, rules, or methods [5].

Hatching can be used to indicate different materials whose meaning will be clearly defined through hatching (Fig. 5).

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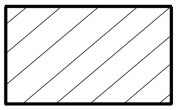
Cast or malleable iron and general use for all materials



Marble, slate, glass, porcelain, etc

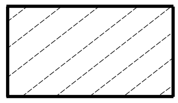
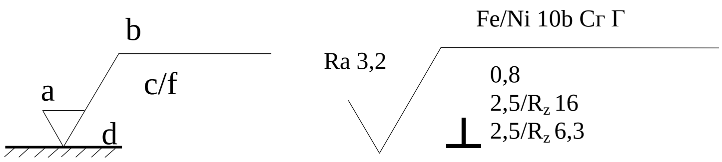


Fig. 5: Hatching indicating the type of materials. ANSI Standard [3]

Graphic symbols for indication of surface texture presented in Fig. 6 are one of the most miscellaneous symbols.



a, b, c, d, f are alphanumerical data

Fig. 6: Composition of complete graphical symbols for indicating surface texture

In the engineering drawing, visual representation is produced in a highly conventional way, expressing the meaning exactly and systematically, but all the same drawing may be very abstract. Such texts usually serve as a monomodel, with the written text (for instance instructions as the indexical signs) playing a very limited role.

4 Conclusion

The engineering drawing (graphical representation) or the graphic model is a medium through which visual images in the mind of the designer are converted into the real object (the product to be produced).

The course is divided to geometry and graphics: geometrical variables are the line of sight and the plane of projection and graphic variables (semiotic tools) are common geometric primitives.

The engineering drawing as a sign is studied proceeding from Peirce´s system of sign and from the triadic model of representation.

Three main categories of signs of representamen can be distinguished from engineering drawings,: the icon (pictorial view, view as part of the functioning position) as observer's response; the index as a fragment of the object or the image in pointing to the locations of parts of the object (half, successive and local sections, section view); the symbol (hatching, welding and tolerance symbols etc) as an arbitrary sign.

Semiotics offers tools for the designer in creation of the product, which allows him (her) to define better, structure and connect the design factors.

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GRAFIKA INŻYNIERSKA: ASPEKTY SEMIOTYCZNE

Studenci inżynierii i technologii uczą się rysunku technicznego wykonując przedstawienie graficzne istniejącego obiektu (jako jego odbicie) lub projektują geometryczną strukturę przyszłego obiektu. Kurs podstawowy w dziedzinie nauczania grafiki inżynierskiej, można podzielić na dwie części: rozumienie logiczne rozwoju pojęć i stosowanie tych pojęć w praktycznych sytuacjach. Innymi słowy, podczas kursu omawiane są w zmiennych geometrycznych powiązania logiczne, a także system oznaczeń przedstawiający ikony i symbole indeksów jako właściwości pewnego uniwersum [1]. Omawianą w pracy semiotykę rysunku traktuje się w oparciu o model Peirce'a i triadyczne reprezentacje symboliczne [2].