Picture Descriptions and Centered Content

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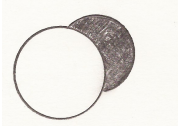
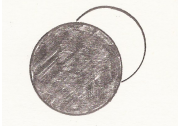
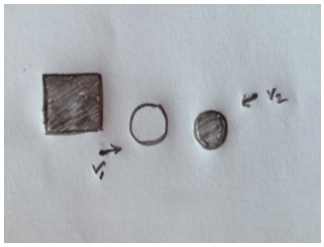
Ross (1997) gives the following argument in favor of the position that the semantic content of a picture is a relation between viewpoints and worlds, i.e. a viewpoint-centered proposition. The semantics of lexical items such as the complex preposition *in front of* are analyzed as referring to viewpoint parameter, so that assessing the truth of (1) requires fixing the viewpoint parameter indexically or anaphorically. (2a,b) are descriptions of pictorial content involving the same construction. (2a) is judged true with *the picture* referring to (3a), and false with it referring to (3b). For (2b), the truth values are reversed. Suppose pictures have propositional contents, the contents of (3a) and (3b) are the same (roughly "there is a black ball and a white ball"), and the referent of *the picture* enters into the semantics of (2a,b) via its propositional semantic content. Then the judgments about (2a,b) can not be captured. Ross proposed that instead of propositional contents, pictures have viewpoint-centered semantic contents, and that the semantics of the construction in (2) is sensitive both to the viewpoint-centered semantics of the complement of *in*, and to the viewpoint-sensitive semantics of the prejacent sentence.

(1) There is a white ball in front of a black ball.

(2) a. In the picture, there is a white ball in front of a black ball.
b. In the picture, there is a black ball in front of of a white ball.

(3) a.  b.  c. 

This presentation re-examines the argument assuming the projective possible-worlds semantics for pictures that is used in current research on the semantics and pragmatics of pictures and pictorial narratives (Greenberg 2011, 2013, Abusch 2012, 2014). The definition of semantic values refers to a geometric definition of projection lines and a picture plane in terms of a viewpoint, a marking rule, and a modal space of possible scenes. Given a specific scene, viewpoint, and marking rule, a picture is uniquely determined. Picture (3a) is derived from a specific mathematically defined scene containing two spheres, a specific viewpoint, and this marking rule: mark a point in the picture plane in black if the minimally distant point on a directed projection line through the point that is on the surface of an object is such that the object is black at the point of intersection or is such that the projection line is tangent to the object, and otherwise in white. A propositional semantic content is derived by inverting projection: the content of a picture p is the set of worlds w that project to p with respect to some viewpoint. Or a content is taken to be a relation between scenes and viewpoints: the content of p is the set of pairs of worlds w and viewpoints v such that w projects to p with respect to v. We write $c^{ml}(p)$ for the centered content of picture p and $d^{ml}(p)$ is the corresponding non-centered content. We also use the relation $E^{ml}(w, v, w', v')$ interpreted as w from v projecting to the same picture as w' from v', corresponding to a circumstantial modal base function. The data about (1)-(3) are derived by (i) assuming that the semantics of *in front of* includes a free designated viewpoint parameter v; (ii) using a viewpoint-centered projective semantics for pictures, as described above; and (iii) stipulating the semantics (4) for the construction in (2).

(4) Where $[\![A]\!]^{M,w,v,g}$ is a picture, $[\![\text{in A}, \phi]\!]^{M,w,v,g} = 1$ iff for every w', v' such that $c^{m,l}([\![A]\!]^{M,w,v,g})(w', v') = 1$, $\lambda w, v[\![\phi]\!]^{M,w,v,g}(w', v') = 1$.

Ross (1997) and Blumson (2010) assume that pictures (3a) and (3b) have identical propositional contents. However (3c) diagrams a world w_1 that contains exactly three objects and projects to (3a) with respect to viewpoint v_1, so that w_1 is an element of the propositional content of (3a). On the other hand there is no viewpoint v such that w_1 projects to (3b) with respect to w_1, v. For instance w_1 does not project to (3b) with respect to v_2, because from v_2 a black cube is in view. (5) is an alternative semantic rule for picture descriptions that uses a propositional content for pictures. It works by decoding or "doxing" viewpoints from the basic propositional pictorial content.

(5) Where $[\![A]\!]^{M,w,v,g}$ is a picture, $[\![\text{in A}, \phi]\!]^{M,w,v,g} = 1$ iff for every w', v' such that $d^{ml}([\![A]\!]^{M,w,v,g})(w')$ and $d^{ml}([\![A]\!]^{M,w,v,g}) = \lambda w'' \exists v'' E(w', v', w'', v'')$, $\lambda w v[\![\phi]\!]^{M,w,v,g}(w', v') = 1$.

We counter this problem for the argument from the balls. First, to dox the viewpoint, semantic rule (5) has to refer to the specific parameters that generate a propositional content for the picture. This is awkward, because the same construction is used for other media as in (6). Further it is problematic in examples where the marking rule is not fixed, such as an understanding of (7) where the modal quantifies marking rules, "according to some plausible marking rule" (e.g. one which maps blue to black and red to white).

(6) In the novel/movie, a policeman loses his gun.
(7) In the picture, there may be a blue ball in front of a red ball.

Second we construct an explicit account of pictures and projection in lineland (Abbott 1884) where contents of pictures are too weak for the counterexample to work. A world is a string of characters drawn from `r` (red object), `y` (yellow object) , `b` (black, a red object in a picture), `w` (white, a yellow object in a picture), `g` (gray, parts of pictures in pictures), `[`, `]` (oriented front of picture) `(`, and `)` (back of a picture. For instance "`rrr[bw)rrr(ww]rrr`" is a world with nine red objects, a picture of a red object in front of a yellow object, and a picture of two yellow objects. A viewpoint is an oriented location in the string. A picture is an ordered sequence of two characters $\langle x_1, x_2 \rangle$. The centered content of $\langle x_1, x_2 \rangle$ is defined to hold of w and v if and only if (i) x_1 is `b` and the object immediately in front of v in w is `r`, or x_1 is `w` and the object immediately in front of v in w is `y`, or x_1 is `g` and the object immediately in front of v in w is neither `r` nor `y`; and (ii) x_2 is `b` and the object two steps in front of v in w is `r`, or x_2 is `w` and the object two steps in front of v in w is `y`, or x_2 is `g` and the object two steps in front of v in w is neither `r` nor `y`. In this model the pictures "`[bw)`" and "`[wb)`" have the same propositional content (namely 'there is a red object adjacent to a yellow object", and distinct centered contents, because the centered content of $\langle$`b,w`$\rangle$ requires that the object directly in front of the viewpoint is red, while the centered content of $\langle$`w,b`$\rangle$ requires that the object directly in front of the viewpoint is yellow. This reconstructs the argument, assuming that we want sentence (8a) to be true in the world mentioned above, and sentence (8b) to be false. The counterpart of the counterexample (3c) does not work, because the propositional contents from v_1 and v_2 are the same, even though centered propositional contents are different. We argue that in this modal space, there are no counterexamples of the kind (3c).

(8) a. In one picture, there is a red object in front of a yellow object.
b. In one picture, there is a yellow object in front of a red object.

For comparison, a version of the viewpoint problem is constructed in Lewis's centered semantics for belief (Lewis 1979). Starting from a basic agent-centered proposition $\lambda ub\text{Dox}(w, a, u, b)$ representing the centered doxastic alternatives for a (Andy) in w, it is assumed (perhaps perversely) that the nominal *Andy's view* closes this to an ordinary proposition by existential closure in the agent position b. In (9) this creates a configuration isomorphic to (2) in the theory where pictures denote sets of worlds.

(9) In Andy's view, he is sick.

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