DPs and CPs in Depiction Complements*

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Abstract

We present a compositional semantics for DP/CP-neutral depiction verbs (e.g. paint, imagine, visualize, write (about)) that interprets the DP and CP complements of these verbs in the same semantic type, $\langle s,t\rangle$ (i.e. as partial sets of situations). Our semantics answers several challenges for semantics for depiction reports (e.g. [29,32,33]) – in particular, the difficulty of interpreting declarative and coordinated DP/CP complements of these reports, of explaining the selectional restrictions (*qua* different kinds of CPs) of many depiction verbs, and of accounting for entailment relations between DP- and CP-complemented depiction reports. At the same time, it preserves the merits of existing semantics for depiction verbs.

1 Introduction

Depiction verbs are verbs like paint and imagine[1] (see [6, Ch. 7], [33]) whose complements can be used to describe the content of pictures or mental images (see (1), (2)):

(1) Paul is painting [$_{\text{DP}}$a penguin] ($\equiv$ Paul is pictorially representing a penguin)

(2) Uli is imagining [$_{\text{DP}}$a unicorn] ($\equiv$ Uli is mentally depicting a unicorn)

To capture the semantic properties of depiction verbs (esp. their missing readings and entailment pattern; see [29,32,33]), the object DPs of such verbs are commonly interpreted as (type-$\langle s,\langle e,t\rangle\rangle$) properties. Depending on the particular account, these are the properties that are denoted by the DP's restrictor (for the *de dicto*-reading of (2): the property 'is a unicorn', see (3); cf. [3,8,29]) or existentially quantified sub-properties of these properties (see (4); cf. [32]):

(3) $\mathit{imagine}_i(\mathit{uli}, \mathit{unicorn})$, where $\mathit{unicorn}$ is a non-logical constant of type $\langle s,\langle e,t\rangle\rangle$

(4) $(\exists P^{\langle s,\langle e,t\rangle\rangle})[P \sqsubseteq \mathit{unicorn} \wedge \mathit{imagine}_i(\mathit{uli}, P)]$, with $P \sqsubseteq Q$:= 'P is more specific than Q'

Property-type accounts like the above are fully compositional and capture the intensional behavior of depiction complements. These advantages notwithstanding, all current incarnations of such accounts face the following challenges:

Challenge (i): CP complements. Property-type semantics have traditionally focused on DP complements of depiction reports (see [3,8,32,33]). However, depiction verbs also license (certain kinds of) CP complements (see (5), (6)):

(5) Uli is imagining [$_{\text{NON-FIN}}$[$_{\text{DP}}$a girl] riding [$_{\text{DP}}$a unicorn]]

(6) Uli is imagining [$_{\text{FIN}}$that [$_{\text{DP}}$a girl] is riding [$_{\text{DP}}$a unicorn]]

Property-type accounts suggest – but do not explicitly claim – that clausal complements of depiction reports are also interpreted as properties. However, for CPs with *multiple* non-specific indefinites (e.g. (6)), this strategy fails[2] to yield a unique interpretation (see [31]). For example,

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[1] Other members of this class include conceive, visualize, portray, sculpt, write (about), and draw.

[2] This failure may be remedied by interpreting the complement of (6) as a *pair* of properties. However, since

this strategy interprets the doubly non-specific reading of (6) as (7a) and/or (7b):

(7) a. $imagine_i\,(uli, \lambda j^s \lambda x^e.\, unicorn_j(x) \wedge (\exists y^e)[girl_j(y) \wedge ride_j(y,x)])$
b. $imagine_i\,(uli, \lambda j^s \lambda y^e.\, girl_j(y) \wedge (\exists x^e)[unicorn_j(x) \wedge ride_j(y,x)])$

Challenge (ii): interaction of DP and CP complements. One could try to avoid the above problem by interpreting clausal depiction complements instead as type-$\langle s,t\rangle$ propositions. (This is indirectly suggested by the treatment in [3,24].) However, the resulting *different-type* interpretation of nominal complements (type $\langle s,\langle e,t\rangle\rangle$) and clausal complements (type $\langle s,t\rangle$) disables an easy (i.e. type-shift-free) modelling of DP/CP coordinations like (8) and of entailments from non-finite to nominal and finite depiction reports, respectively (e.g. (9), (10)):

(8) Uli is imagining [[$_{\text{DP}}$a unicorn] and [$_{\text{CP}}$that a girl is riding it]]

(9) a. Uli is imagining [$_{\text{NON-FIN}}$a girl riding [$_{\text{DP}}$a unicorn]]
⇒ b. Uli is imagining [$_{\text{DP}}$a unicorn]

(10) a. Uli is imagining [$_{\text{NON-FIN}}$a girl riding a unicorn]
⇒ b. Uli is imagining [$_{\text{FIN}}$that a girl is riding a unicorn]

Challenge (iii): restrictions on the selection of CP complements. The interpretation of clausal depiction complements is further challenged by the observation that – in contrast to imagine (see (6)) – many depiction verbs (incl. paint) do not license finite complements (see (11b)):

(11) a. ✓Paul is painting [$_{\text{NON-FIN}}$a penguin diving into the sea]
b. *Paul is painting [$_{\text{FIN}}$that a penguin is diving into the sea]

Uniform accounts, which interpret finite and non-finite depiction complements in the same semantic type, must do some extra work to explain the deviance of (11b) (see [20]; cf. [27]). Non-uniform accounts, which interpret these complements in different types, need to resort to type-shifts or other syntactic/semantic mechanisms to explain the acceptability of (5) *and* (6) ([7,15,22]).

2 Strategy: comparison with approaches to the semantics of responsive verbs

To see the landscape of options for the explanation of DP/CP flexibility in depiction complements, it is instructive to consider different accounts of the selectional flexibility of responsive verbs (i.e. verbs like know that accept both declarative and interrogative complements). Theiler *et al.* [27] outline four different approaches to this flexibility. These split into approaches which assume that declarative complements have a different (viz. simpler) semantic type from interrogative complements (i.e. type $\langle s,t\rangle$ *vis-à-vis* $\langle\langle s,t\rangle,t\rangle$) (hereafter, *non-uniform approaches*) and approaches which assume that declarative complements have the same type as interrogative complements (hereafter, *uniform approaches*, ❹; e.g. [27]). Non-uniform approaches include approaches ❶ that semantically reduce interrogative to declarative complements (*reductive approaches*; e.g. [11]), ❷ that generalize declarative to interrogative complements (*inverse reductive approaches*; e.g. [28]), and ❸ that connect the (different) lexical entries for verbs with declarative and interrogative complements (*twin approaches*; e.g. [9,25]).[3]

property-pairs typically have a different type from properties, this strategy would disable an easy answer to Challenge (ii).

[3]We here deviate from [27] in classifying meaning-postulate approaches (e.g. [25]) with twin approaches.

Analogues of the above are – at least in principle – also available for DP and CP complements of depiction reports (see Figure 1). These include the semantic reduction of DP to CP complements (below, '$[\![\text{DP}]\!] \mapsto [\![\text{CP}]\!]$'; see ❶), the generalization of CP to DP complements ($[\![\text{CP}]\!] \mapsto [\![\text{DP}]\!]$; see ❷), the (type-)distinction between DP and CP complements ($[\![\text{CP}]\!] \neq [\![\text{DP}]\!]$; see ❸), and the (type-)identification of DP and CP complements ($[\![\text{CP}]\!] = [\![\text{DP}]\!]$; see ❹):

SEMANTICS OF DP AND CP COMPLEMENTS

- NON-UNIFORM APPROACHES
  - ❶ REDUCTIVE APPROACHES $[\![\text{DP}]\!] \mapsto [\![\text{CP}]\!]$ Parsons 1997
  - ❷ INVERSE REDUCTIVE APPROACHES $[\![\text{CP}]\!] \mapsto [\![\text{DP}]\!]$ Challenge (i)
  - ❸ TWIN APPROACHES $[\![\text{DP}]\!] \neq [\![\text{CP}]\!]$ this paper (external argument)
- ❹ UNIFORM APPROACHES $[\![\text{DP}]\!] = [\![\text{CP}]\!]$ this paper (internal argument)

Figure 1: Options for the semantics of DP and CP complements (cf. [27, p. 410]).

The inability of CP complements of depiction verbs to be interpreted in the type of DP complements of such verbs, $\langle s, \langle e, t\rangle\rangle$ (see Challenge (i)) already rules out an inverse reductive approach to DP/CP flexbility (❷).[4] Given the original motivation for property-type semantics (see esp. [29, 33], *pace* [21]) and the non-existence of an injective function from properties to propositions, similar observations hold for a reductive approach (❶). Since DPs and CPs in non-complement position are traditionally interpreted in different types (i.e. $\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$ resp. $\langle s, t\rangle$) – and since the lifting of CPs to the type $\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$ would require re-thinking a large part of contemporary formal semantics –, a uniform approach is also not tenable (❹). This seemingly leaves twin approaches (i.e. ❸) as the only option for explaining DP/CP flexibility. However, the different-type interpretation of DP and CP complements in these approaches disables an easy modelling of DP/CP interaction (see Challenge (ii)).

This paper provides an alternative approach to DP/CP flexibility that combines a twin approach with aspects of a uniform approach. Our semantics assumes that DPs and CPs make a <u>different</u> compositional contribution (i.e. of type $\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$ resp. $\langle s, t\rangle$) to the interpretation of depiction reports to which they serve as complements (see ❸). As a result, our semantics requires different lexical entries for DP- and CP-taking occurrences of depiction verbs. However, since this semantics interprets these different occurrences through the <u>same</u> non-logical constant, it still enables a (type-)uniform interpretation of DPs and CPs *in the complement* of these verbs. This is achieved by incorporating an $\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$-to-$\langle s, t\rangle$ type-shifter into the lexical entry for DP-taking occurrences of depiction verbs. DP-denotations are then converted into CP-denotations during semantic composition. Since this type-shifter is built into the semantics of the verb (and is not freely available for all DPs), it does not falsely predict DP/CP flexibility for the complements of CP-biased verbs. In this regard, our semantics improves upon reductive approaches.

The rest of the paper is organized as follows: below, we first present our proposed semantics for depiction reports with DP complements (in Sect. 3). To answer Challenges (i) to (iii), this semantics is then extended to depiction reports with different kinds of CP complements (in

[4]This approach is further rejected by the fact that a $\langle s, t\rangle$-to-$\langle s, \langle e, t\rangle\rangle$ type-shifter (which would allow CPs to serve as input to the verbs' DP-entry) would fail to explain the syntactic selection behavior of DP-biased verbs.

Sect. 4.1). We show that the relations between depiction reports with nominal and clausal complements capture the interaction of DP and CP complements in depiction reports (see Sect. 4.2) and that they help explain the selectional restriction on CP complements (see Sect. 4.3). The paper closes with a summary of our results and with pointers to future work.

3 Proposal and Background

We have suggested above that our proposed semantics uniformly interprets DP and CP complements of depiction verbs in the type $\langle s, t\rangle$. More precisely, this semantics identifies the semantic complements of DP-taking occurrences of depiction verbs as propositionally coded situations. This identification is motivated by the observation that transitive occurrences of depiction verbs (e.g. (2)) select for a semantic situation- (event- or state-)argument and by the possibility of representing (or *coding*) situations by sets of situations (i.e. in the type for propositions).

The ability of imagine to take a semantic situation argument is supported by the possibility of replacing the object DP in nominal imagination reports by an explicitly situation-denoting construction (see (12)) and/or by an event-denoting *how*-phrase (see (13)), and by the possibility of modifying the matrix verb in these reports through an 'experiential' modifier like vividly or in vivid / lifelike detail (see (14); cf. [26, p. 156]). These possibilities are corroborated by the observation that physical and mental images typically do not represent isolated items of information (e.g. Kratzer-style *facts*), but informationally richer objects (see [33, p. 433]).

(12) a. Uli is imagining [$_{\text{DP}}$a unicorn]
$\equiv$ b. Uli is imagining [$_{\text{DP}}$*a situation/scene* in which there is a unicorn]

(13) a. Uli is imagining [$_{\text{DP}}$a unicorn cantering]
$\equiv$ b. Uli is imagining [$_{\text{DP}}$*how* a unicorn is cantering]

(14) a. Uli is *vividly* imagining [$_{\text{DP}}$a unicorn]
b. Uli is imagining [$_{\text{DP}}$a unicorn] *in vivid/lifelike detail*

The representation of the situation-argument through *sets* of situations is motivated by the fact that – in contrast to visual scenes – depicted situations are often not anchored in a particular world/time, and by the possibility of representing non-anchored situations by sets of isomorphic (= qualitatively identical) situations (see [17, p. 667]; cf. [5, 136]). The latter are situations in which exactly the same propositions are true (resp. false).

Arguably, the identity of the depicted situation depends on the particular manner of depicting (e.g. painting *vis-à-vis* imagining), the depicting agent, and the time of depicting. To capture this dependence, we use a choice function, f, that selects a subset from a given set of situations $\lambda j\,[\ldots]$ in dependence on a parameter, e, for the described depicting event (cf. [12, 16]). For e an imagining event, this subset represents the imagined situation/event (for (2): the situation or imaginary scene to which Uli stands in the imagining relation in the evaluation situation). The obtaining of this relation requires that Uli forms a mental image of this situation that has the same experiential character as perceptual witnessing (see [26, p. 153]).

The interpretation of the *de dicto*-reading of (2) is given in (15).[5] In what follows, `imagine` is a non-logical constant of type $\langle s, \langle v, \langle\langle s, t\rangle, \langle e, t\rangle\rangle\rangle\rangle$, where v is the type for events:

[5]For reasons of simplicity, we hereafter neglect tense and aspect in the interpretation of our example sentences.

(15) $[\![\text{Uli is imagining } [_{\text{DP}}\text{a unicorn}]]\!]^i = (\exists e)[\mathtt{imagine}_i(e, \mathit{uli}, \underbrace{f_e(\lambda j \exists x.\, \mathit{unicorn}_j(x))}_{\text{Uli's (coded) imagined situation / mental image}})]$

(15) is obtained from the standard semantics for proper names (type e) and object DPs (type $\langle s, \langle\langle s, \langle e, t\rangle\rangle, t\rangle\rangle$) through the lexical entry for nominal/transitive imagine in (16). In this entry, E is a situation-relative existence predicate (see [19, p. 117 ff.]):

(16) $[\![\text{imagine-DP}]\!]^i = \lambda \mathcal{Q}^{\langle s, \langle\langle s, \langle e,t\rangle\rangle, t\rangle\rangle} \lambda z^e (\exists e)[\mathtt{imagine}_i(e, z, f_e(\lambda j.\, \mathcal{Q}_j(E)))]$

This entry interprets imagine as a relation between an evaluation situation (i), an event (e), an agent (z), and (a propositional representation, $f_e(\lambda j. \ldots)$, of) the depicted situation. The last argument is obtained by applying the e-parametrized choice function f to the proposition, $\lambda j\, [\mathcal{Q}_j(E)]$, that results from applying the standard semantic value of the DP to the property of situation-relative existence. In virtue of this application, the compositional interpretation of (2) initially comes out as (17):

(17)

$$[\![\text{imagine-DP}]\!]^i\big([\![\text{Uli}]\!], [\![\text{a unicorn}]\!]\big)$$
$$(\exists e)[\mathtt{imagine}_i(e, \mathit{uli}, f_e(\lambda j \exists x.\, \mathit{unicorn}_j(x) \wedge E_j(x)))]$$

$$[\![\text{Uli}]\!] \quad \mathit{uli}$$

$$[\![\text{imagine-DP}]\!]^i\big([\![\text{a unicorn}]\!]\big)$$
$$\lambda z (\exists e)[\mathtt{imagine}_i(e, z, f_e(\lambda j \exists x.\, \mathit{unicorn}_j(x) \wedge E_j(x)))]$$

$$[\![\text{imagine-DP}]\!]^i \quad \lambda \mathcal{Q} \lambda z (\exists e)[\mathtt{imagine}_i(e, z, f_e(\lambda j.\, \mathcal{Q}_j(E)))]$$

$$[\![\text{a unicorn}]\!] \quad \lambda k \lambda P (\exists x)[\mathit{unicorn}_k(x) \wedge P_k(x)]$$

The assumption that every individual that is a unicorn in a situation exists in this situation (formally: $(\forall j)(\forall x)[\mathit{unicorn}_j(x) \to E_j(x)]$) then warrants the equivalence of (17) with (15).

4 Answering the Challenges

With our semantics for nominal depiction reports in place, we are now ready to address Challenges (i) to (iii):

4.1 Answering challenge (i): CP complements

We have seen in Section 1 that property-type semantics for depiction reports resist an extension to clausal reports. In contrast, our semantics from the previous section can be straightforwardly generalized to such reports: in particular, to give a semantics for clausal depiction reports, we use Stephenson's [26] observation that gerund depiction complements are also[6] interpreted as (coded) situations (see our interpretation of (5) in (18)). This interpretation uses the semantics for non-finite occurrences of imagine in (19):

(18) $[\![\text{Uli is imagining } [_{\text{NON-FIN}}\text{a girl riding a unicorn}]]\!]^i$
$= (\exists e)[\mathtt{imagine}_i(e, \mathit{uli}, \underbrace{f_e(\lambda j \exists x.\, \mathit{unicorn}_j(x) \wedge (\exists y.\, \mathit{girl}_j(y) \wedge \mathit{ride}_j(y, x))))}_{\text{Uli's (coded) imagined situation}}]$

(19) $[\![\text{imagine-NON-FIN}]\!]^i = \lambda p^{\langle s,t\rangle} \lambda z^e (\exists e)[\mathtt{imagine}_i(e, z, f_e(p))]$

[6] In fact, [26] focuses on gerund complements. Nominal depiction reports are only treated in passing.

To interpret depiction reports with a finite that-clause complement (e.g. (6)), we use a close variant (in (20)) of the familiar semantics for finite occurrences of imagine. This semantics interprets imagine as a relation to a proposition (i.e. to an object of the form $\lambda j\,[\ldots]$), rather than to a (propositionally coded) situation (i.e. to an object of the form $f_e(\lambda j.\ \ldots)$). The former differs from the latter in that it does not contain any information that is not encoded in p.

(20) $[\![\text{imagine-}\textsc{fin}]\!]^i \;=\; \lambda p^{\langle s,t\rangle}\lambda z^e (\exists e)[\mathtt{imagine}_i(e,z,p)]$

Our semantics for finite imagine enables a unique interpretation of the doubly non-specific reading of (6), as desired:

(21) $[\![\text{Uli is imagining } [_{\textsc{fin}}\text{that a girl is riding a unicorn}]]\!]^i$
$= (\exists e)[\mathtt{imagine}_i(e, uli, \underbrace{\lambda j\,\exists x.\, unicorn_j(x) \wedge (\exists y.\, girl_j(y) \wedge ride_j(y,x))}_{\text{a proposition whose content Uli is imagining}})]$

4.2 Answering challenge (ii): interaction of DP and CP complements

Above, we have introduced separate lexical entries for differently complemented occurrences of imagine. However, in contrast to other non-uniform semantics for selectionally flexible verbs (e.g. [2,7,26]), our semantics uses entries with the same non-logical constant (above: `imagine`). This facilitates the modelling of DP/CP coordinations in the complements of depiction reports (I) and enables the obtaining of entailment relations between reports with different kinds of complements (II).

Admittedly, the ability of our semantics to capture DP/CP coordinations in depiction complements (see (I)) is still impeded by the fact that the lexical entries for DP- and finite CP-taking imagine (see (16), (20)) require different inputs (of type $\langle s, \langle\langle s,\langle e,t\rangle\rangle, t\rangle\rangle$ and $\langle s,t\rangle$, respectively). To compensate for these different requirements, we use the semantics for coordinating and in (22). This semantics interprets the conjunction of a DP and a finite CP as an intensional generalized quantifier of the form '$\lambda j\,\lambda P\left[[\![\textsc{dp}]\!]^j(P) \wedge [\![\textsc{cp-fin}]\!]^j\right]$':

(22) $[\![\textsc{dp}\text{-and-}\textsc{fin}]\!] \;=\; \lambda p^{\langle s,t\rangle}\lambda \mathcal{Q}^{\langle s,\langle\langle s,\langle e,t\rangle\rangle,t\rangle\rangle}\lambda j^s \lambda P^{\langle s,\langle e,t\rangle\rangle}[\mathcal{Q}_j(P) \wedge p_j]$

The above enables the interpretation of (8) as (25). This interpretation treats that in (8) as the trivial complementizer, $\text{that}_{\textsc{t}}$ (in (23); see [18]), and assumes that coordinations of a DP and a finite CP complement are licensed by imagine-DP. Our interpretation uses the intermediate step in (24). In (24) and (25), $\mathcal{T}_1$ is a higher-order trace that ranges over intensional quantifiers:[7]

(23) $[\![\text{that}_{\textsc{t}}]\!] \;=\; \lambda p\,\lambda j\,[p_j]$

(24) $[\![\text{[a unicorn]}\,[\lambda_1\,[\mathcal{T}_1 \text{ and that}_{\textsc{t}} \text{ a girl is riding } \mathcal{T}_1]]]\!]$
$\equiv \big(\lambda_1.\,[\![\text{and}]\!]\big([\![\text{that}]\!]\big([\![\text{a girl is riding } \mathcal{T}_1]\!]\big), [\![\mathcal{T}_1]\!]\big)\big)\big([\![\text{a unicorn}]\!]\big)$
$= \big(\lambda \mathcal{Q}\,\big(\lambda p \lambda \mathcal{P} \lambda j \lambda P\,[\mathcal{P}_j(P) \wedge p_j]\big(\lambda k \exists y.\, girl_k(y) \wedge \mathcal{Q}_k(\lambda l \lambda z.\, ride_l(z,y)), \mathcal{Q}\big)\big)\big)$
$\big(\lambda j' \lambda Q\, \exists x.\, unicorn_{j'}(x) \wedge Q_{j'}(x)\big)$
$\equiv \lambda \mathcal{Q} \lambda j \lambda P\,[\mathcal{Q}_j(P) \wedge (\exists y.\, girl_j(y) \wedge \mathcal{Q}_j(\lambda l \lambda z.\, ride_l(z,y)))]\big(\lambda k \lambda Q\, \exists x.\, unicorn_k(x) \wedge Q_k(x)\big)$
$\equiv \lambda j \lambda P\,[(\exists x.\, unicorn_j(x) \wedge P_j(x)) \wedge (\exists y.\, girl_j(y) \wedge (\exists z.\, unicorn_j(z) \wedge ride_j(z,y)))]$

[7] The assumption of higher-order traces enables us to simultaneously allow for the *de dicto*-reading of (8) and for the anaphoric binding of the pronoun in (8). However, this move is independent of the proposed semantics. Our use of an example with anaphoric binding is motivated by the observation that the most natural embedded DP/CP coordinations are ones where the DP binds a pronoun in the CP.

(25) $[\![\text{Uli imagines-DP } [[\text{a unicorn}]\,[\lambda_1\,[\mathcal{T}_1 \text{ and that a girl is riding } \mathcal{T}_1]]]]\!]$
$\equiv [\![\text{imagine-DP}]\!]^i\big([\![\text{Uli}]\!], [\![[\text{a unicorn}]\,[\lambda_1\,[\mathcal{T}_1 \text{ and that a girl is riding } \mathcal{T}_1]]]\!]\big)$
$= \lambda\mathcal{Q}\lambda u(\exists e)[\texttt{imagine}_i(e,u,f_e(\lambda l.\,\mathcal{Q}_l(E)))]\big(uli,$
$\lambda j\lambda P\,[(\exists x.\,unicorn_j(x) \wedge P_j(x)) \wedge (\exists y.\,girl_j(y) \wedge (\exists z.\,unicorn_j(z) \wedge ride_j(z,y)))]\big)$
$= (\exists e)[\texttt{imagine}_i(e, uli, f_e(\lambda j.[(\exists x.\,unicorn_j(x) \wedge E_j(x)) \wedge$
$(\exists y.\,girl_j(y) \wedge (\exists z.\,unicorn_j(z) \wedge ride_j(z,y)))]))]$
$\equiv (\exists e)[\texttt{imagine}_i(e, uli, f_e(\lambda j\,\exists x.\,unicorn_j(x) \wedge (\exists y.\,girl_j(y) \wedge ride_j(x,y))))]$

On (II): since our interpretation of transitive imagine (in (16)) applies the parametrized choice function f_e to the proposition $\lambda j\,[\mathcal{Q}_j(E)]$ (where $\mathcal{Q}$ is the semantic value of the DP complement), it predicts that (2) is equivalent to the result (in (26)) of enriching the object DP in (2) with VP being there (see [21, pp. 375–376]):

(26) Uli is imagining $[_{\text{NON-FIN}}[_{\text{DP}}$a unicorn$]$ being there (in his imagined situation)$]$

Our proof of this equivalence (in (30)) interprets the predicate be there through the existence predicate E (in (27)). This proof uses the intermediate step in (29). It is based on the assumption that every individual that is a unicorn in a situation exists in this situation (see (28)):

(27) $[\![\text{be there}]\!]^i \equiv [\![\text{exist}]\!]^i = \lambda\mathcal{Q}\lambda j\,[\mathcal{Q}_j(\lambda k\lambda y.\,E_k(y))]$

(28) $(\forall j)(\forall x)[unicorn_j(x) \rightarrow E_j(x)]$

(29) $[\![\text{a unicorn being there}]\!] \equiv [\![\text{be there}]\!]\big([\![\text{a unicorn}]\!]\big)$
$= \lambda\mathcal{Q}\lambda j\,[\mathcal{Q}_j(\lambda k\lambda y.\,E_k(y))]\big(\lambda l\lambda P(\exists x)[unicorn_l(x) \wedge P_l(x)]\big)$
$\equiv \lambda j\,(\exists x)[unicorn_j(x) \wedge E_j(x)]$
$\equiv \lambda j\,(\exists x)[unicorn_j(x)]$ (by (28))

(30) $[\![\text{Uli is imagining } [_{\text{NON-FIN}}\text{a unicorn being there}]]\!]^i$
$\equiv [\![\text{imagine}]\!]^i\big([\![\text{Uli}]\!], [\![\text{a unicorn being there}]\!]\big)$
$= \lambda p\lambda z(\exists e)[\texttt{imagine}_i(e,z,f_e(p))]\big(uli, \lambda j\,(\exists x)[unicorn_j(x)]\big)$
$\equiv (\exists e)[\texttt{imagine}_i(e, uli, f_e(\lambda j\,\exists x.\,unicorn_j(x)))]$
$= [\![\text{Uli is imagining } [_{\text{DP}}\text{a unicorn}]]\!]^i$ (see (15))

(**MP 1**), below, generalizes the observed equivalence between (2) and (26) to the relation between nominal and gerund occurrences of depiction verbs (below, imagine):

(**MP 1**) $(\forall\mathcal{Q})(\forall z)\big[[\![\text{imagine-DP}]\!]^i(z,\mathcal{Q}) \equiv [\![\text{imagine-NON-FIN}]\!]^i(z, \lambda j.\,\mathcal{Q}_j(E))\big]$

(**MP1**) enables a straightforward account of the obtaining of entailment relations between clausal and nominal depiction reports. In particular, the entailment in (9) (see (31)) is based on the fact that all situations in which a girl is riding a unicorn are situations in which there is a unicorn (see (31b)). The entailment further relies on the intuitive parthood principle in (31c) and on the upward-monotonicity of the complement of imagine (see (31d)):

(31) a. $[\![\text{Uli is imagining } [_{\text{NON-FIN}}\text{a girl riding } [_{\text{DP}}\text{a unicorn}]]]\!]^i$
$= (\exists e)[\texttt{imagine}_i(e, uli, f_e(\lambda j\,\exists x.\,unicorn_j(x) \wedge (\exists y.\,girl_j(y) \wedge ride_j(y,x))))]$
b. $(\forall j)[(\exists x.\,unicorn_j(x) \wedge (\exists y.\,girl_j(y) \wedge ride_j(y,x))) \rightarrow (\exists z.\,unicorn_j(z))]$
c. $(\forall p)(\forall q)[p \subseteq q \rightarrow (\forall e.\,f_e(p) \subseteq f_e(q))]$
d. $(\forall p)(\forall z)(\forall e)[\texttt{imagine}_i(e,z,p) \rightarrow (\forall q.\,p \subseteq q \rightarrow \texttt{imagine}_i(e,z,q))]$

$\Rightarrow$ e. $(\exists e)[\texttt{imagine}_i(e, uli, f_e(\lambda j\,\exists x.\,unicorn_j(x)))] = [\![\text{Uli is imagining } [_{\text{DP}}\text{a unicorn}]]\!]^i$

Analogously to the above, the entailment in (10) is based on the relation between gerund and finite clause occurrences of depiction verbs. This relation is specified in (**MP 2**). It is supported by the lexical entries for imagine in (19) and (20):

(**MP 2**) $(\forall p)(\forall z)\big[[\![\text{imagine-NON-FIN}]\!]^i(z,p) \;\equiv\; [\![\text{imagine-FIN}]\!]^i(z, f_e(p))\big]$,
where e is bound by the quantifier $(\exists e)$ in $[\![\text{imagine-FIN}]\!]^i$

Given the upward monotonicity of imagine (see (32c)), the membership of the semantic value of a girl riding a unicorn in the value of that a girl is riding a unicorn (see (32b)) then supports the entailment in (10) (see (32)):

(32) a. $[\![\text{Uli is imagining } [_{\text{NON-FIN}}\text{a girl riding a unicorn}]]\!]^i$
$= (\exists e)[\mathtt{imagine}_i(e, \mathit{uli}, f_e(\lambda j \exists x.\, \mathit{unicorn}_j(x) \wedge (\exists y.\, \mathit{girl}_j(y) \wedge \mathit{ride}_j(y,x))))]$
b. $(\forall p)(\forall e)[f_e(p) \subseteq p]$
c. $(\forall p)(\forall z)(\forall e)[\mathtt{imagine}_i(e,z,p) \rightarrow (\forall q.\, p \subseteq q \rightarrow \mathtt{imagine}_i(e,z,q))]$ (see (31d))
⇒ d. $[\![\text{Uli is imagining } [_{\text{FIN}}\text{that a girl is riding a unicorn}]]\!]^i$
$= (\exists e)[\mathtt{imagine}_i(e, \mathit{uli}, \lambda j \exists x.\, \mathit{unicorn}_j(x) \wedge (\exists y.\, \mathit{girl}_j(y) \wedge \mathit{ride}_j(y,x)))]$ (see (21))

4.3 Answering challenge (iii): restrictions on the selection of CP complements

Our semantics interprets finite and non-finite complements of depiction verbs as classical propositions (see (20)) respectively as propositionally coded situations (see (19)). This interpretation opens up new possibilities for the explanation of the distribution of DPs and (finite) CPs: since it predicts that depiction verbs combine with both DPs and CPs, this interpretation suggests that the selectional restrictions of these verbs (e.g. the fact that – unlike imagine – paint rejects finite CP complements; see (11b)) are explained in terms of independently observable semantic properties of these verbs.[8]

Specifically, to account for the deviance of (11b), we argue that the degree of abstractness of classical propositions – *vis-à-vis* propositionally coded situations – is correlated with the possible degree of abstractness of the content of imagining vs. painting: while it is, in principle,[9] possible to imagine that there is a unicorn without imagining any specific properties of this unicorn, constraints on physical depiction (e.g. painting, drawing, and sculpting) block this possibility. These constraints include the choice of color and stroke (for painting/drawing) or of a particular shape (for sculpting). Since these choices are often influenced by the concrete properties of the depicted object, they allow for (some) inferences to the depicted object having these properties.

To capture the lower degree of abstractness of the content of physical pictures (*vis-à-vis* the content of mental images), we assume that – in contrast to `imagine` – the logical translation, `paint`, of paint is undefined for (classical propositions, or sets of situations that code) minimal situations in the sense of [17]. This undefinedness then underlies the deviance of (11b).

5 Conclusion

In this paper, we have presented a compositional semantics for DP/CP-neutral depiction verbs that interprets the DP and CP complements of these verbs as propositions or propositionally coded situations. This is achieved combining a twin approach to DP/CP flexibility with aspects of a uniform approach: in line with the former, our semantics assumes that DPs and CPs provide

[8] I thank Floris Roelofsen directing my attention to this point.
[9] We interpret the difficulty of this endeavor as support for the situation argument of depiction reports.

different-type inputs to the denotation of depiction verbs. As a result, our semantics postulates different lexical entries for DP- and CP-taking occurrences of such verbs. However, in contrast to existing semantics, our semantics assumes that these entries incorporate different type-shifters that send the different-type inputs to the type $\langle s, t\rangle$ (i.e. $\lambda\mathcal{Q}\lambda j\,(\exists e)[f_e(\lambda k.\,\mathcal{Q}_k(E))_j]$ for DPs, $\lambda p\,\lambda j\,(\exists e)[f_e(p)_j]$ for non-finite CPs, and $\lambda p\lambda j\,[p_j]$ for finite CPs). The resulting same-type interpretation of different depiction complements exemplifies a uniform approach to DP/CP flexibility. We have shown that our semantics answers several challenges for semantics of depiction reports, including the difficulty of interpreting CP complements of these reports, of accounting for the semantic interaction of DPs and CP in depiction complements, and of explaining the selectional restrictions of depiction verbs.

This paper has focused on depiction verbs that show all three hallmark features of intensionality, viz. referential opacity, non-specificity, and lack of existential import (see [30, p. 516]). We leave it to future work to apply the presented semantics to depiction verbs (e.g. portray) that only show some of these features (here: referential opacity).

6 References

[1] J. Barwise, *Scenes and other situations*, J. of Philosophy **78/7** (1981), 369–397.

[2] T. Bernard and L. Champollion, *Negative events in compositional semantics*, Proc. of SALT 28, 2018, pp. 512–532.

[3] A.R. Deal, *Property-type objects and modal embedding*, Proc. of SuB 12, 2008, pp. 92–106.

[4] J. van der Does, *A generalized quantifier logic for naked infinitives*, Linguistics and Philosophy **14/3** (1991), 241–294.

[5] K. Fine, *Properties, propositions, and sets*, J. of Philosophical Logic **6** (1977), 135–191.

[6] G. Forbes, *Attitude Problems*: *An essay on linguistic intensionality*, Oxford University Press, 2006.

[7] ———, *Content and theme in attitude ascriptions*, Non-Propositional Intentionality (A. Grzankowski and M. Montague, eds.), Oxford University Press, 2018, pp. 114–133.

[8] V. van Geenhoven and L. McNally, *On the property analysis of opaque complements*, Lingua **115** (2005), 885–914.

[9] B. Ross. George, *Question Embedding and the Semantics of Answers*, Doctoral dissertation, University of California, Los Angeles, 2011.

[10] J. Groenendijk and M. Stokhof, *Studies on the Semantics of Questions and the Pragmatics of Answers*: *Doctoral dissertation*, University of Amsterdam, 1984.

[11] I Heim, *Interrogative semantics and Karttunen's semantics for* know, Proc. of IATL (R. Buchalla and A. Mittwoch, eds.), Academon, 1994, pp. 128–144.

[12] K. von Heusinger, *The salience theory of definiteness*, Perspectives on Linguistic Pragmatics, Springer, 2013, pp. 349–374.

[13] J. Higginbotham, *Remembering, imagining, and the first person*, manuscript (2003).

[14] L. Karttunen, *Syntax and semantics of questions*, Linguistics and Philosophy **1/3** (1977), 3–44.

[15] I. Kastner, *Factivity mirrors interpretation*: *The selectional requirements of presuppositional verbs*, Lingua **164, Part A** (2015), 156–188.

[16] A. Kratzer, *Scope or pseudoscope*: *Are there wide-scope indefinites?*, Events and Grammar (S. Rothstein, ed.), Kluwer, 1998, pp. 163–96.

[17] ______, *Facts: particulars or information units?*, Linguistics and Philosophy **25/5-6** (2002), 655–670.

[18] ______, *Decomposing attitude verbs*, Honoring Anita Mittwoch on her 80th birthday at The Hebrew University of Jerusalem (2006).

[19] K. Liefke, *A Single-Type Semantics for Natural Language*, Doctoral dissertation, Center for Logic and Philosophy of Science, Tilburg University, 2014.

[20] K. Liefke and M. Werning, *Evidence for single-type semantics – an alternative to e/t-based dual-type semantics*, Journal of Semantics **35/4** (2018), 639–685.

[21] T. Parsons, *Meaning sensitivity and grammatical structure*, Structures and Norms in Science (M.L. Dalla Chiara et al., ed.), Kluwer, 1997, pp. 369–383.

[22] C. Potts, *The lexical semantics of parenthetical* -as *and appositive* -which, Syntax **5/1** (2002), 55–88.

[23] J. Pustejovsky, *Situating events in language*, Conceptualizations of Time **52** (2016), 27–46.

[24] F. Schwarz, *On* needing *propositions and* looking for *properties*, Proceedings of SALT XVI, 2006, pp. 259–276.

[25] B. Spector and P. Egré, *A uniform semantics for embedded interrogatives*: *An answer, not necessarily the answer*, Synthese **192/6** (2015), 1729–1784.

[26] T. Stephenson, *Vivid attitudes*: *Centered situations in the semantics of 'remember' and 'imagine'*, Proceedings of SALT XX, 2010, pp. 147–160.

[27] N. Theiler, F. Roelofsen, and M. Aloni, *A uniform semantics for declarative and interrogative complements*, Journal of Semantics **35/3** (2018), 409–466.

[28] W. Uegaki, *Content nouns and the semantics of question-embedding*, Journal of Semantics **33** (2016), 623–660.

[29] T.E. Zimmermann, *On the proper treatment of opacity in certain verbs*, Natural Language Semantics **1/2** (1993), 149–179.

[30] ______, *Unspecificity and intensionality*, Audiatur Vox Sapentiae (C. Féry and W. Sternefeld, eds.), Akademie Verlag, Berlin, 2001, pp. 524–543.

[31] ______, *Coercion vs. indeterminacy in opaque verbs*, Intensionality (R. Kahle, ed.), AK Peters/CRC Press, 2005, pp. 227–279.

[32] ______, *Monotonicity in opaque verbs*, Linguistics and Philosophy **29/6** (2006), 715–761.

[33] ______, *Painting and opacity*, Von Rang und Namen (W. Freitag, H. Rott, H. Sturm, and A. Zinke, eds.), Mentis, 2016, pp. 427–453.