<center>OBITUARIO</center>

On Modality and Reference
Ruth Barcan Marcus (1921-2012)

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It is difficult to think of Ruth Barcan Marcus without almost automatically thinking about her pioneering work in modal logic and, in particular, about the long lasting impact of the Barcan Formula, a formula that she introduced as an axiom of the modal system she presented and explored in her first paper, published in 1946 [Barcan (1946)]. This, however, should not obscure the depth and width of Ruth Barcan Marcus' contributions to other, related and not so related, fields. Professor Marcus did not only produce work that advanced the development of modal logic and influenced decisively central discussions in the philosophy of modality. She also published papers in ethics, medical ethics, epistemology, metaphysics, philosophy of language and history of philosophy. Besides influential discussions of formal systems of modal logic and quantification, in her papers she discussed historical figures such as Spinoza and Russell and she addressed issues about identity, essentialism, belief attribution, rationality, substitutivity, reference, patients' consent, and moral dilemmas. In fact, her most cited paper is the 1980 'Moral Dilemmas and Consistency'[1] an article that constitutes the entire focus of E.G. Austin's recent article in *The Economist* on occasion of Prof. Marcus' death [Austin (2012). It would not be feasible to review even the more basic aspects of her many contributions in such limited space, so we will focus here on two main areas – and even so, attention will have to be restricted to just a few of the main points. But before proceeding, a few details about Ruth Barcan Marcus' life are in order.

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I. Some Biographical Data

Ruth C. Barcan was born in New York in August 1921. She graduated from New York University in 1941 where she majored in mathematics and philosophy and she went on to join the graduate program at Yale. She was an accomplished fencer and she would have participated in the 1940 Olympic Games had they not been cancelled due to the world war. In 1942 she married another champion fencer, physicist Jules A. Marcus and she then changed her name to Ruth Barcan Marcus. At Yale she studied under Frederick Fitch and her first paper, published in 1946, the year she was awarded her PhD from Yale, contained material from her dissertation on quantified modal logic, including the famous Barcan Formula. The paper appeared in the *Journal of Symbolic Logic*, followed shortly afterwards by two more papers published under the name Ruth C. Barcan. Alonzo Church, editor of the Journal, eventually insisted that she publish using her official name, and so a 1950 paper in the same Journal appeared already as authored by Ruth Barcan Marcus. Had Prof. Church's naming criteria been followed throughout, we would now be discussing the famous *Marcus Formula*.

After she received her PhD, Ruth Barcan Marcus and her husband moved to Illinois, where he had accepted a position at Northwestern University. She spent an academic year as a post-doctoral fellow at the University of Chicago where Rudolf Carnap, whose paper 'Modalities and Quantification' had appeared also in 1946, and whose seminal *Meaning and Necessity* was published in 1947 [Carnap (1946), (1947)], was also working on quantified modal logic.[2] After that year she held a series of post-doctoral, temporary or visiting positions and taught at Roosevelt University from 1959 to 1963. In 1964 she became head of the philosophy department of the University of Illinois, Chicago Circle and taught also at Northwestern. In 1973 she moved to Yale. She retired in 1992 but continued to be actively involved in philosophy dividing the time between her position as a senior research scholar at Yale and a distinguished visiting professorship at the University of California, Irvine.

II. Modality and Modal Logic

Ruth Barcan Marcus' 1946 paper presents the first system of modal logic that combines modal operators and quantifiers. A question that had arisen regarding any such system is whether theorems of the non-modal predicate calculus such as

(1) $\forall x \, (Px \rightarrow Qx) \rightarrow (\forall x \, Px \rightarrow \forall x \, Qx)$

would also be theorems, were the conditional uniformly interpreted as C.I. Lewis' strict conditional.[3]

As it turns out, the strict conditional version of (1):

(2) $\forall x \ (Px \Rightarrow Qx) \Rightarrow (\forall x \ Px \Rightarrow \forall x \ Qx)$

is not derivable in the system that results from adding quantifiers to Lewis' S2. However, (2) is derivable if we can count on this formula:

(3) $\Diamond \ \exists x \ Px \Rightarrow \exists x \ \Diamond Px.$

(3) is precisely the Barcan Formula. It was introduced in the system of the 1946 paper as Axiom 11, which allows the derivation of (2) – theorem 19, p. 5.

Nowadays the Barcan Formula is stated as a material conditional and introduced, in some systems, as an axiom[4]

(BF) $\Diamond \ \exists x \ Px \rightarrow \exists x \ \Diamond Px.$

BF says that if it is possible that something be P, then there is something that is possibly P. An equivalent version of the Barcan Formula states that if everything is necessarily P, then it is necessary that everything be P:

(BF') $\forall x \ \Box Px \rightarrow \Box \ \forall x \ Px$

The converse of the Barcan Formula:

(CBF) $\exists x \ \Diamond Px \rightarrow \Diamond \ \exists x \ Px,$

equivalent to

(CBF') $\Box \ \forall x \ Px \rightarrow \forall x \ \Box Px$

is already derivable in the system without the addition of any special axiom (and in the 1946 paper it is proven, as a strict conditional, as theorem 37, on page 7).

From a purely technical point of view, there are important advantages to the introduction of the Barcan Formula. And from a philosophical point of view, the acceptance of the Barcan Formula and its converse expresses a commitment to what has come to be known as *actualism*, a view that can, very roughly and simplistically, be characterized as defending that the possible ways the world could be are determined by what there is and its properties; that the possibilities are grounded in the things that there are and in the

properties they do exemplify. Together, the Barcan Formula and its converse entail that the different ways the world could be involve the same individuals or, in other words, that the domain of quantification remains constant in all possible worlds. There is something undeniably plausible, I believe, to the idea that the span of possible alternatives is *grounded* in the way things are (in spite of the lack of precision in the idea of grounding): if it is true that I could have been a pianist, that has to be because my nature, a nature I have because of what I am and because of the things I come from, makes it possible, not because of the properties of some possible individual that has some sort of similarity relation to me, as David Lewis and other philosophers of modality would have it. However, the Barcan Formula and its converse have been, ever since their inception, a matter of controversy, for the Barcan Formula appears to entail that, for instance, a childless person could not have had a child,[5] and the converse of the Barcan Formula entails that an existing person could not have failed to exist. The Universe could not have contained one more or one less particle, something that seems, quite simply, contrary to common sense. Kripke models, with their varying domains, appeared to free quantified modal logic of such an implausible feature. If domains are allowed to increase across different possible worlds, then 'Wittgenstein could have had a child' is true without entailing a commitment to 'There is some individual that could have been Wittgenstein's child,' and if domains are allowed to decrease, the truth of 'necessarily, whatever there is exists' does not entail that whatever there is exists as a matter of necessity.

And yet, the Barcan Formulas have not been put to rest. Quite to the contrary, the discussion of the formulas is as intense today as it ever was. True, some philosophers simply reject the formulas. But others strongly defend them. Thus, Bernard Linsky and Edward Zalta [Linsky and Zalta (1994)], as well as Timothy Williamson [Williamson (1998)][6] have pointed out that the rejection is based on a narrow characterization of the ontology, and they have pushed for different versions of a conception of what there is that includes not just run of the mill concrete objects such as apples and oranges, and run of the mill abstract entities such as numbers, but also, to use Timothy Williamson's version of the view, another kind of things, *non-concrete* objects that actually exist, and that could be concrete objects, and hence could be children of Wittgenstein or new particles. The result is a form of *necessitism*, the view that what there is, is there necessarily.[7] A question that may arise as regards such a conception of the ontology is whether, in spite of saving the Barcan formulas, some of the spirit that arguably inspires them is lost: the reason we think that Quine could have been a pianist is that, because of his origin and his nature, he has properties that do not rule out that possibility. In the case of non-concrete objects, though, their potentialities are not determined by their origins, the properties they instantiate, the kinds they do belong to. Their potentialities are grounded purely in potentialities.[8]

Another way of combining the acceptance of the Barcan Formula and the intuition of possible existence, without appeal to the non-concrete, is presented by Ori Simchen, who preserves the spirit that the possible is grounded in the actual by interpreting the question about the possible existence of a P – a child of Wittgenstein's, a present day dodo, or a talking donkey – as a question about whether there is or has been something in the world that could give rise to a P [see Simchen (2006) and (2012), chapters 1 and 2].

These are discussions of deep metaphysical import. Ruth Barcan Marcus' pioneer work in quantified modal logic is the origin of a technical and philosophical controversy that gives no sign of being settled.

In 1947 Prof. Marcus published 'The identity of individuals in a strict functional calculus of second order,' a paper where she proved the necessity of identity:

(LI) $x = y \rightarrow \Box\, x = y$.

Unlike the Barcan Formulas, nowadays the necessity of identity is hardly questioned.[9] But at the time, the proof of the necessity of identity caused perhaps even more shock than the Barcan Formulas, and it took some time for it to subside. On August 21st 1967, twenty years after of the publication of the paper, Wilfrid Sellars sent a letter to Prof. Marcus, then at Chicago Circle, which he opened expressing his puzzlement at the proof of the necessity of identity: "We (or, at least I) want to say things like $x = y \cdot \Diamond(x \neq y)$. Clearly in some state descriptions belonging to a semantical system S $a = (\acute{}x)\, fx$ holds, whereas in others it does not, e.g. where $\neg fa$ holds." And he remarked: "Now, I am all in favor of quantified modal logic, but I find (6) [$x = y \rightarrow \Box\, x = y$] hopelessly paradoxical" [http://www.ditext.com/sellars/marcus.html]. And in their 1968 *Introduction to Modal Logic*, G. E. Hughes and M. J. Cresswell, warn the reader that in adding identity to the modal predicate calculus "[a]mong the theorems that we can now derive there are two [the necessity of identity and the necessity of non-identity] which under the intended interpretation are apt to appear intuitively unacceptable" [Hughes and Cresswell (1968), p. 190].

Undaunted by the stir, Ruth Barcan Marcus had no doubts. In 1961 [see Marcus (1993)] she acknowledges that "Professor Quine finds these results offensive," [p. 9] and after reviewing the traditional ('the morning star is the evening star') alleged counterexamples, she remarks: "Now if [$a = b$] is a true identity, then a and b are the same thing. [$a = b$] does not say that a and b are two things that happen, through some accident, to be one. True, we are using two different names for that same thing, but we must be careful about use and mention." [p. 10]. It is hard not to detect some subtle irony in these remarks, especially if we recall the sin that, according to Quine, modal logic had been conceived in.

III. THE THEORY OF REFERENCE

There is another area on which Ruth Barcan Marcus' views have a decisive impact, even though their influence may not be so clearly perceived and assessed. Prof. Marcus did not present her views on the theory of reference in one paper, or a series of papers devoted entirely to a discussion of the semantic function of names or definite descriptions, and this may account for the misperception. However, her papers are filled with remarks and arguments that leave little doubt as to her position. Here I will not try to collect the quotes that, put together, give us the evidence of the underlying theory. I think her position is, at least on the surface, well known: her use of the metaphor of names as tags, and her sharp distinction between tagging and describing justify taking her as a representative of what has come to be known as Millianism. But I think that there is a widespread mischaracterization of the import of her position. Some have argued that Ruth Barcan Marcus' views about the semantics of names and definite descriptions are precursors of Kripke's characterization of names as rigid designators [Kripke (1970/1980)]. I think they are wrong. Some philosophers have indeed pointed out that the conception of names as tags and the idea of rigidity are very different. And they have pointed in a different direction, making Ruth Barcan Marcus' ideas early precursors of direct reference theory as characterized by David Kaplan: the view that proper names contribute their referents to the determination of truth conditions, by furnishing just their referents to the propositions expressed by sentences containing them.[10] But I think that this is wrong too. Ruth Barcan Marcus' ideas are extremely important for semantic theory, but they are different from both the ideas that gave rise to the notion of rigidity and the ideas that gave rise to the notion of direct reference.

In spite of all the differences between the notion of rigidity and the notion of direct reference, most of the fundamental considerations summoned to characterize names as rigid, and practically all the fundamental considerations summoned to characterize names as directly referential, have to do with the conditions that must obtain for truth.

The examples that Kripke and Kaplan use to illustrate their claims aim at eliciting the judgment that the truth of a sentence such as 'Aristotle was fond of dogs' depends on Aristotle, the man we refer to when we use 'Aristotle', no matter what the world is like, and no matter which descriptions apply or fail to apply to him. Even if we as speakers attach the description 'the tutor of Alexander' to 'Aristotle,' 'Aristotle was fond of dogs' would be true if the world were such that Aristotle loved dogs and disliked children enough to turn down the job offered by Philip of Macedon. And David Kaplan uses similar considerations to argue that it is the object designated by a use of a demonstrative that figures in the determination of truth conditional content.[11]

The powerful intuitions that generate the conviction that those terms are rigid, or directly referential, often have to do with truth in a circumstance and with what determines truth in a circumstance.[12]

Ruth Barcan Marcus' remarks about how names function and how definite descriptions, in their standard uses, function are entirely independent of considerations about truth conditional behaviour. Her remarks focus on the *mode of connection* between names and their referents, and they aim at distinguishing sharply a name's form of connection from the way in which a definite description selects its denotation. The considerations used to establish such a stark distinction are pre-truth-conditional. In this regard, the characterization of Ruth Barcan Marcus as a Millian is entirely on target, for the kinds of considerations prompted by Mill's famous 'Dartmouth' example focus on how names are linked to their bearers. Mill's and Marcus' reflections involve essentially pre-sentential considerations and they operate at a level that is prior to questions about truth conditions.[13]

Now, it is easy to miss how different that take on reference is. Starting with the claim that a name refers without the association with a mechanism that singles out the referent (the Millian idea), we infer that in such cases the referent is the entity that enters the determination of truth conditions, the constituent of the proposition (the official direct reference idea), and we mistakenly presume that truth-conditional contribution of the referent is all there is as a special mark of the semantic function of names, without noticing that not all uses of expressions that contribute an object to truth conditions (and to propositions) are free of associated mechanisms. Indexicals and demonstratives are the prime example. Uses of indexicals and demonstratives designate via a character rule, a rule of meaning that works as a mechanism of selection of the designatum in a context of use. Indexicals and demonstratives are not Millian, or Marcusian, tags.

The conception of reference that Ruth Barcan Marcus was focusing on is a stranger to the idea of designation via an associated character rule. What she highlights is that there are terms that perform the semantic function of standing for an object without being associated with mechanisms that select the object the term applies to. Definitely indexicals are not the paradigmatic example of that type of expression; proper names are. Where Kaplan, and other proponents of direct reference, see a category that encompasses names, indexicals and demonstratives (based on the type of contribution to truth conditional content that uses of these expressions make), Millians, like Marcus, see the difference in the way in which names, on the one hand, and indexicals and demonstratives, on the other, connect to the objects they designate.

The two approaches to reference are indeed different and the difference for semantic theory is, I think, extremely important. It is a difference as to how reference, genuine reference, is theoretically understood: as a truly *direct* relation, or as a mechanism-mediated word-thing connection. The ques-

tion is which of the two is the right conception of reference. But that is an-
other story, one that, in being developed and defended, finds its origins in
Ruth Barcan Marcus.[14]

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NOTES

[1] According to Google Scholar, whose numbers are not always entirely accu-
rate, that paper is cited 225 times, followed by Marcus (1961) (141 citations) and the
1946 paper that started it all (136 citations).

[2] Carnap's paper [Carnap (1946)] appeared in *The Journal of Symbolic Logic*
just a few months after the Barcan paper.

[3] A strict conditional, a formula of the form $p \Rightarrow q$, is defined as the necessita-
tion of the material conditional: $\Box(p \rightarrow q)$. Lewis had introduced the strict conditional
in Lewis (1918) in order to capture a stronger and, in his view, more natural notion of
implication than that afforded by the material conditional.

[4] The strict conditional is used in (3) because that is the version Ruth Barcan
Marcus used in 1946.

[5] This assumes that none of the actual individuals could be Wittgenstein's child.

[6] For a recent discussion of the views of Linsky and Zalta (1994), and Williamson
(1998), unsympathetic to the Barcan Formulas, see Pérez Otero (2010). For an in
depth discussion and defense of necessitism see Williamson (forthcoming a).

[7] And also, saying that things that exist could have failed to be is interpreted,
from this point of view, as the claim that concrete things could be non-concrete.

[8] This worry springs from the actualist stance about grounding possibility in ac-
tuality, and there is no denying that the notion of grounding is extremely unclear.

[9] Putting aside some discussions about material constitution.

[10] See Timothy Williamson's *Laudatio* on occasion of the award of the Lauener
Prize to Prof. Marcus, in 2008 and Føllesdal (forthcoming).

[11] See for instance the case discussed in section IX of 'Demonstratives,' Kaplan
(1989), pp. 512-3.

[12] The difference between *truth value in a circumstance* and *what determines
truth value in a circumstance* is not trivial. The former does not distinguish names
from rigid definite descriptions. The latter does. The assignment of truth values rela-
tive to indices of 'N is P' and 'the F is P' (where 'the F' rigidly designates the referent
of 'N') will be the same. But the contributions to the determination of truth value by
'N' and 'the F' are different: the former contributes an object, the latter contributes a
denotative complex.

[13] It should be remarked, though, that some of the early anti-descriptivist argu-
ments by Kripke, in particular the ignorance and error arguments in *Naming and Ne-*

cessity, and similar arguments by Donnellan (the non-necessity, non-sufficiency of the backup of descriptions arguments) are also pre-truth-conditional and thus closer to a characterization of the semantic function of names that is in line with the form of Millianism espoused by Marcus. See Donnellan (1970).

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