Philosophy 240: Symbolic Logic
Fall 2008
Mondays, Wednesdays, Fridays: 9am - 9:50am

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Class 39: Identity Theory, Translation I (§8.7)

I. **The identity predicate is a special predicate, with a special logic**

Consider the following logical derivation:

1. Superman can fly.	Fs
2. Superman is Clark Kent.	???
So, Clark Kent can fly.	Fc

Identity, as in premise 2, is a relation among individuals.
We could write it 'Esc'.
But, identity has special logical properties, so we give it its own symbol, '='.
Identity sentences thus look a little different from other dyadic relations.

Clark Kent is Superman	c=s
Mary Ann Evans is George Eliot	m=g

But, they are just two-place relations.

To deny an identity, we can write either '~a=b' or 'a≠b'.
Negation applies to the identity predicate, and not to the objects related by that predicate.

We will discuss the special properties of the identity predicate on Monday.
Today, we will learn a bit of translating, using a group exercise called a jigsaw.

II. The jigsaw

Overview:

Organize your base groups and divide tasks. (5 minutes)
Go to work groups and learn something. (10 minutes)
Go back to base groups and teach what you learned in the work groups to the other members of your base group. (25 minutes, 5 minutes per topic)

II. **The Group Worksheets**

Identity Theory Jigsaw Lesson
Workgroup: Only

I. Examine the following translations:

1. Jim loves Pam.	Ljp
2. Jim only loves Pam.	Ljp • (x)(Ljx ⊃ x=p)
3. Only Jim loves Pam.	Ljp • (x)(Lxp ⊃ x=j)
4. Two is the only even prime number.	Et • Pt • Nt • (x)[(Ex • Px • Nx) ⊃ x=t]
5. There is only one applicant for the job.	(∃x)[Ax • (y)(Ay ⊃ x=y)]

II. Try these:

6. Michael is the only regional manager. (m, Rx)

7. Dwight only farms beets. (d, b, Fxy: x farms y)

8. Only Michael gives someone a prize. (m, p, Px, Gxyz: x gives y to z)

Identity Theory Jigsaw Lesson
Workgroup: Except

I. Examine the following translations:

1. Everyone loves Pam.	(x)(Px ⊃ Lxp)
2. Everyone except Jim loves Pam.	~Ljp • (x)[(Px • x≠j) ⊃ Lxp]
3. All but the champion lose their last match.	~Lc • (x)(x≠c ⊃ Lx)
4. All prime numbers are odd except the number two.	(x)[(Px • Nx • ~x=t) ⊃ Ox]

5. Everyone deems all Beatles' records except *Let It Be* to be classics.

~(∃x)(Px • Dxl) • (x){Px ⊃ (y)[(By • Ry • y≠l) ⊃ Dxy]}

II. Try these:

6. Everyone at Dunder-Mifflin except Pam lives in Scranton. (p, Px, Dx, Sx)

7. No one except Michael tolerates Jan. (j, m, Px, Txy: x tolerates y)

8. Some students enroll in all courses except Semiotics. (s, Sx, Cx, Exy: x enrolls in y)

Identity Theory Jigsaw Lesson
Workgroup: Superlatives

I. Examine the following translations:

1. Degas is a better impressionist than Monet. Bdm (Bxy: x is a better impressionist than y)
2. Degas is the best impressionist. $(x)(x \neq d \supset Bdx)$
3. Syracuse is the nearest major city. $(x)[(Mx \bullet x \neq s) \supset Nsx]$
4. Adriana is a bigger mouse than Rene. $Ma \bullet Mr \bullet Bar$ (Bxy: x is bigger than y)
5. Adriana is the biggest mouse. $Ma \bullet Mr \bullet (x)[(Mx \bullet {\sim}x=a) \supset Bax]$

II. Try these:

6. Rene is the smallest mouse.
7. Bill Gates is the geek with the most money. (g, Gx, Mxy: x has more money than y)
8. Goliath is the tallest human. (g, Hx, Txy: x is taller than y)

Identity Theory Jigsaw Lesson
Workgroup: At Least

I. Examine the following translations:

1. There is at least one applicant for the job. $(\exists x)Ax$
2. There are at least two applicants for the job. $(\exists x)(\exists y)[Ax \bullet Ay \bullet x \neq y]$
3. There are at least three applicants for the job.

   $(\exists x)(\exists y)(\exists z)[Ax \bullet Ay \bullet Az \bullet x \neq y \bullet x \neq z \bullet y \neq z]$
4. There are at least two odd prime numbers.

   $(\exists x)(\exists y)(Ox \bullet Px \bullet Nx \bullet Oy \bullet Py \bullet Ny \bullet {\sim}x=y)$
5. There is at least one mouse bigger than Rene. $(\exists x)(Mx \bullet Bxr)$
6. There are at least two mice bigger than Rene. $(\exists x)(\exists y)(Mx \bullet My \bullet Bxr \bullet Byr \bullet x \neq y)$

II. Try these:

7. There are at least three mice bigger than Rene.
8. There are at least four students in the course. (Sx, Cx)

Identity Theory Jigsaw Lesson
Workgroup: At Most

'At most' statements make no existential commitments.

I. Examine the following translations:

1. At most one person is Michael's assistant. $(x)(y)[(Px \bullet Axm \bullet Py \bullet Aym) \supset x{=}y]$
2. At most two people are Michael's assistants.
$$(x)(y)(z)[(Px \bullet Axm \bullet Py \bullet Aym \bullet Pz \bullet Azm) \supset (x{=}y \lor x{=}z \lor y{=}z)]$$
3. At most two persons invented the airplane.
$$(x)(y)(z)[(Px \bullet Ix \bullet Py \bullet Iy \bullet Pz \bullet Iz) \supset (x{=}y \lor x{=}z \lor y{=}z)]$$
4. Some people like Angela, but at most two.
$$(\exists x)(Px \bullet Lxa) \bullet (x)(y)(z)[(Px \bullet Lxa \bullet Py \bullet Lya \bullet Pz \bullet Lza) \supset (x{=}y \lor x{=}z \lor y{=}z)]$$

II. Try these:

5. There is at most one applicant for the job. (Ax)
6. There are at most two applicants for the job.
7. There are at most three applicants for the job.

III. **Solutions to the 'Try these' examples on each worksheet**

Only

6. $Rm \bullet (x)(Rm \supset x{=}m)$
7. $Fdb \bullet (x)(Fdx \supset x{=}b)$
8. $(\exists x)[Px \bullet Gmpx \bullet (y)(Gypx \supset y{=}m)]$

Except

6. $\sim Sp \bullet (x)[(Px \bullet Dx \bullet x \neq p) \supset Sx]$
7. $Tmj \bullet (x)[(Px \bullet x \neq m) \supset \sim Txj]$
8. $\sim(\exists x)Exs \bullet (x)[Cx \bullet x \neq s) \supset (\exists y)(Sy \bullet Eyx)]$

Superlatives

6. $(x)[(Mx \bullet \sim x{=}r) \supset Bxr]$
7. $Gg \bullet (x)[(Gx \bullet x \neq g) \supset Mgx]$
8. $Hg \bullet (x)[(Hx \bullet \sim x{=}g) \supset Tgx]$

At least

7. $(\exists x)(\exists y)(\exists z)(Mx \bullet My \bullet Mz \bullet Bxr \bullet Byr \bullet Bzr \bullet x \neq y \bullet x \neq z \bullet y \neq z)$
8. $(\exists x)(\exists y)(\exists z)(\exists w)(Sx \bullet Cx \bullet Sy \bullet Cy \bullet Sz \bullet Cz \bullet Sw \bullet Cw \bullet x \neq y \bullet x \neq z \bullet x \neq w \bullet y \neq z \bullet y \neq w \bullet z \neq w)$

At most

5. $(x)(y)[(Ax \bullet Ay) \supset x{=}y]$
6. $(x)(y)(z)[(Ax \bullet Ay \bullet Az) \supset (x{=}y \vee x{=}z \vee y{=}z)]$
7. $(x)(y)(z)(w)[(Ax \bullet Ay \bullet Az \bullet Aw) \supset (x{=}y \vee x{=}z \vee x{=}w \vee y{=}z \vee y{=}w \vee z{=}w)]$