An approach to blending information into domestic proofs

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A simple method for using foreign information in the computation of genetic evaluations of imported animals is described. The method is based on the separate modification of the parent, individual and progeny components of an animal' breeding value after iterations. The foreign and domestic contribution to each of these components are combined based on the amount of information that they represent, and the result is used to modify the breeding value of the animal. The weight given to foreign information takes into account the accuracy of the conversion from the foreign to the importing country for the trait in question. In practice, this means that the weight of the foreign evaluation decreases more rapidly when the amount of domestic information becomes large. Conversion formulas for the foreign information can be derived from any selected approach, such as MACE, ACE, WILMINK'S or GODDARD's methods for example.

When blending cow information, yield deviations and daughter yield deviations are usually not available. Therefore, an approximation is suggested which only requires breeding values, parent averages, accuracy figures and the cow's diagonal elements in both countries.

The proposed blending can be limited to foreign animals and their progeny or it can be carried out iteratively to spread the effect across generations. Alternatively, the blending can be applied before iterations, through a modification of the diagonals and RHS of foreign animals. It is not clear, however, whether the benefits of these procedures is worth their greater complexity.

Generally, a more comprehensive approach to blending would consist in running multi-country evaluation such as ACE or MACE. However, these do not permit the blending of female information. In addition, ACE does not take into account the lower accuracy introduced by conversions. A simple blending method such as that proposed can then provide an adequate response to industry needs until a more comprehensive approach is developed and accepted internationally.

Options for computing Canadian evaluations for imported animals and their progeny

- Canadian information only (no blending)
- Foreign information only (convert and use)
- Both of the above
- "Blend" of Canadian and foreign information

Options for blending foreign information into domestic genetic evaluations

- Multi-country evaluations
  - size of data set
  - standardization of measurements, recording, etc.
  - could use MT to account for accuracy of use of foreign info.

- ACE
  - with progeny of imported bulls, i.e. blending of all info
  - without progeny of imported bulls, i.e. blending of info on male relatives only
  - male info only
  - no weighting for accuracy of use of foreign info.

Options for blending foreign information into domestic genetic evaluations

- MACE
  - 2 options also: with or without progeny of imported bulls
  - males info only
  - accuracy of use of foreign info can be factored in

- BLENDING
  - easy to implement
  - for both males and females
  - can be based on any conversion method
  - before or after iterations
  - can provide practical approximations until better methods are clearly identified and accepted

Practical considerations for blending

- Canadian industry wants predictions of the genetic value of foreign bulls which use information from Canadian daughters when it becomes available

- Canadian industry wants the blended proof of foreign bulls to reflect mostly the domestic information when the bull becomes proven in Canada.

Current blending

- done since 1989
- parent information only (sires and dams)
- done after iterations
- restrictions for application

	Sires	Dams
R_{CAN}	$< .60$	$< .30$
R_{US}	$> .70$	$> .40$

Proposed blending

Parental information

- Same principle as current blending
- Use DE approach taking into account differences in h^2 across countries

Daughter equivalent approach

$$DE_A = DE_{PA} + DE_Y + DE_{PC}$$

$$DE_{CAN} = \frac{4-2h^2{}_C}{h^2{}_C} \times \frac{R_C}{1-R_C}$$

$$DE_{US} = \frac{4-2h^2{}_{US}}{h^2{}_{US}} \times \frac{R_{US} x r^2}{1-R_{US} x r^2}$$

Production

$h^2_{CAN} = 0.33$

$h^2_{US} = 0.25$

r (conversion) = 0.92

WEIGHTING OF PARENT INFORMATION

WEIGHTING OF SIRE INFORMATION WHEN R_{US} = 0.99

R_{CAN}*100	%CAN	%US	R_W*100
10	1.49	98.51	88.17
20	3.29	96.71	88.36
30	5.51	94.49	88.60
40	8.32	91.68	88.90
50	11.98	88.02	89.30
60	16.96	83.04	89.84
70	24.11	75.89	90.63
80	35.26	64.74	91.90
85	43.55	56.45	92.86
90	55.06	44.94	94.23
95	72.12	27.88	96.34
99	93.09	6.91	99.07

WEIGHTING OF PARENT INFORMATION

WEIGHTING OF SIRE INFORMATION WHEN R_{US} = 0.90

R_{CAN}*100	%CAN	%US	R_W*100
10	30.14	69.86	26.93
20	49.26	50.74	33.66
30	62.47	37.53	40.69
40	72.14	27.86	48.03
50	79.52	20.48	55.70
60	85.35	14.65	63.73
70	90.06	9.949	72.15
80	93.95	6.054	80.98
85	95.65	4.355	85.56
90	97.22	2.784	90.25
95	98.66	1.348	95.06
99	99.74	0.26	99.00

WEIGHTING OF PARENT INFORMATION

WEIGHTING OF DAM INFORMATION WHEN R_{US} = 0.60

R_{CAN}*100	%CAN	%US	R_W*100
10	7.164	92.84	60.80
20	14.79	85.21	62.82
30	22.94	77.06	65.14
40	31.65	68.35	67.81
50	40.99	59.01	70.93
60	51.02	48.98	74.62
70	61.84	38.16	79.05

Blending of progeny information (for bulls only)

- Principle is to blend DYD's based on the corresponding amount of information for domestic and foreign progeny
- Can be done independently from the blending of parent information

Blending of progeny information for bulls

- $D^{PC} = \Sigma\, q_{prog}\, W2_{prog}$
- Weight Canadian DYD by D^{PC}
- Weight US DYD by $D^{PC} \times \dfrac{DE^{conv.}{}_{US}}{DE_{US}}$
- $$\frac{DE^{conv}{}_{US}}{DE_{US}} = \frac{r^2}{1 + (1 - r^2)\left[\dfrac{R_{US}}{1-R_{US}} - \dfrac{R_{PA}}{1-R_{PA}}\right]}$$

WEIGHTING OF PROGENY INFORMATION FOR BULLS

WHEN R_{US} =0.99

R_{CAN}*100	%CAN	%US	%PI	R_{NEW}
20	0.05	99.95	0.14	88.36
25	1.50	98.50	0.14	88.48
30	3.11	96.89	0.14	88.60
35	4.90	95.10	0.14	88.74
40	6.90	93.10	0.13	88.90
45	9.16	90.84	0.13	89.09
50	11.74	88.26	0.13	89.30
55	14.69	85.31	0.12	89.55
60	18.12	81.88	0.12	89.84
65	22.14	77.86	0.11	90.20
70	26.93	73.07	0.11	90.63
75	32.72	67.28	0.10	91.19
80	39.86	60.14	0.09	91.90
85	48.91	51.09	0.08	92.86
90	60.72	39.28	0.06	94.23
95	76.81	23.19	0.04	96.34
99	94.58	5.42	0.01	99.07

FOR THIS: $R^{PA}{}_{CAN} = (0.80 + 0.00)/4 = 0.20$

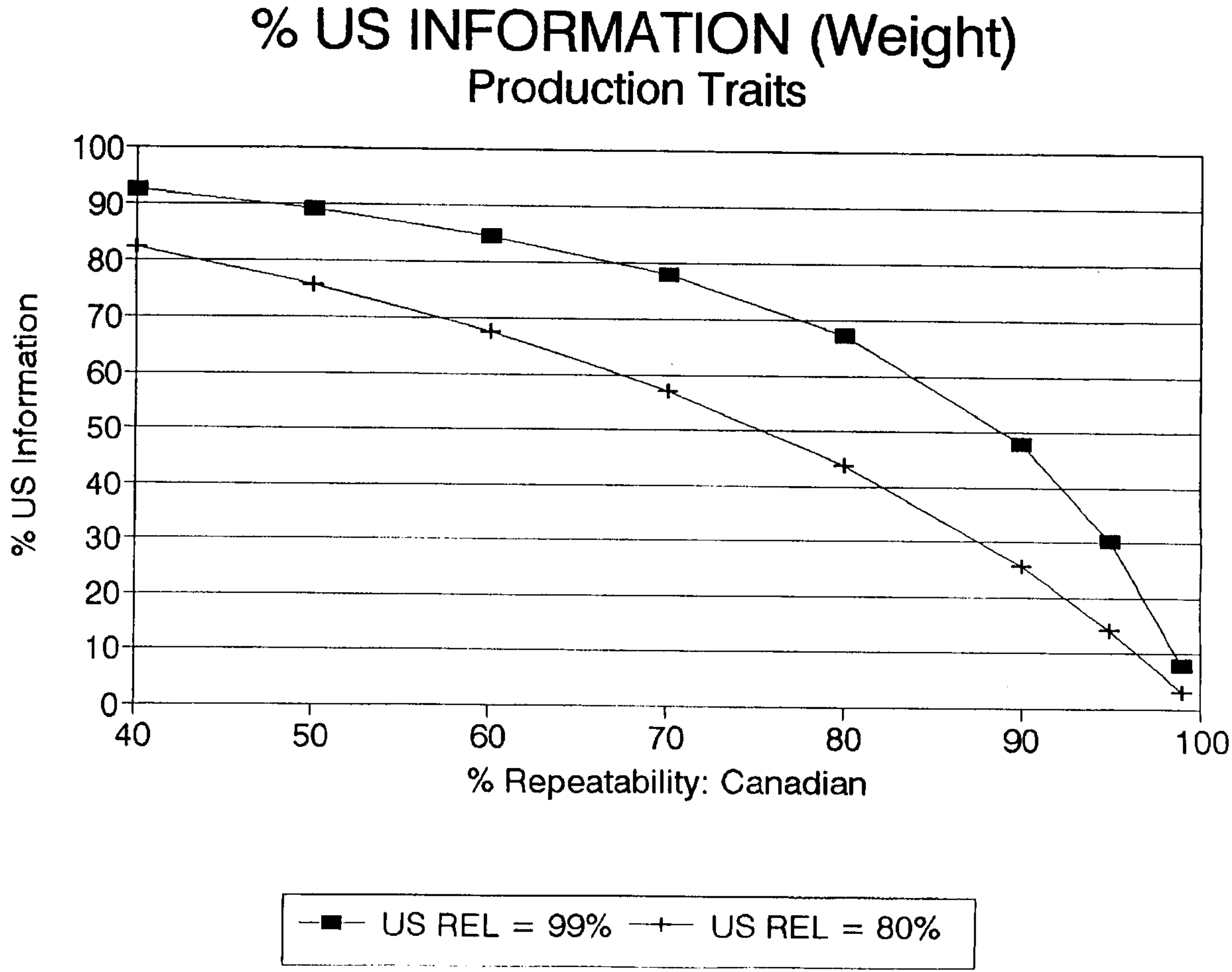
EXAMPLE $R^{PA}{}_{US} = (0.99 + 0.50)/4 = 0.37$

$r_{CONVERSION} = 0.92$

WEIGHTING OF PROGENY INFORMATION FOR BULLS

WHEN R_{US} = 0.90

R_{CAN}*100	%CAN	%US	%PI	R_{NEW}
20	0.09	99.91	0.22	81.94
25	2.54	97.46	0.22	82.21
30	5.21	94.79	0.21	82.51
35	8.10	91.90	0.21	82.84
40	11.26	88.74	0.20	83.21
45	14.73	85.27	0.19	83.62
50	18.55	81.45	0.19	84.10
55	22.78	77.22	0.18	84.64
60	27.48	72.52	0.17	85.27
65	32.75	67.25	0.16	86.01
70	38.69	61.31	0.15	86.88
75	45.44	54.56	0.13	87.94
80	53.17	46.83	0.12	89.23
85	62.11	37.89	0.10	90.87
90	72.59	27.41	0.07	93.00
95	85.01	14.99	0.04	95.88
99	96.76	3.24	0.01	99.04


% US INFORMATION (Weight)
Production Traits
% US Information
100
90
80
70
60
50
40
30
20
10
0
40
50
60
70
80
90
100
% Repeatability: Canadian
US REL = 99%
US REL = 80%

Blending of individual cow information (own records and progeny)

- DYD's are generally not available for cows

- As an approximation, ETA's can be adjusted for PA's and weighted by the corresponding amount of domestic and foreign information.

- Can be done independently from blending of parent information

- If diagonal elements for cow solutions are unavailable, approximations can be obtained by making assumptions on the number of contemporaries, known parents, etc.. for the cow or its progeny.

Blending of cow information
- own records and progeny -

- $ETA^{*} = ETA - \frac{2kq}{D} \times PA$

- Weight by $(D^{C} - 2kq)$ for Canada

- Weight by $(D^{US} - 2kq) \times \frac{DE^{conv}{}_{US}}{DE_{US}}$ for US

WEIGHTING OF COW INFORMATION

WITH 1 US RECORD

NUMBER OF RECORDS	R_{CAN}	R_{US}	%CAN	%US	%PI	R_{NEW}
1	0.43	0.52	48.27	51.73	0.50	0.56
2	0.49	0.52	56.76	43.24	0.45	0.60
3	0.52	0.52	60.60	39.40	0.43	0.62
4	0.54	0.52	63.02	36.98	0.41	0.63
5	0.55	0.52	64.20	35.80	0.40	0.64

FOR THIS EXAMPLE: $R^{PA}{}_{CAN} = (0.80 + 0.00)/4 = 0.20$

$R^{PA}{}_{US} = (0.99 + 0.50)/4 = 0.37$

ONE US RECORD AND THREE US DAUGHTERS WITH ONE RECORD EACH RESULTING IN $R_{US} = 0.52$

WEIGHTING OF COW INFORMATION

WITH 3 US RECORD

NUMBER OF RECORDS	R_{CAN}	R_{US}	%CAN	%US	%PI	R_{NEW}
1	0.43	0.59	36.32	63.68	0.44	0.62
2	0.49	0.59	44.52	55.48	0.40	0.65
3	0.52	0.59	48.46	51.54	0.38	0.66
4	0.54	0.59	51.03	48.97	0.37	0.67
5	0.55	0.59	52.30	47.70	0.36	0.68

FOR THIS EXAMPLE: $R^{PA}{}_{CAN} = (0.80+0.00)/4 = 0.20$

$R^{PA}{}_{US} = (0.99+0.50)/4 = 0.37$

THREE US RECORDS AND THREE US DAUGHTERS WITH ONE RECORD EACH RESULTING IN $R_{US} = 0.59$

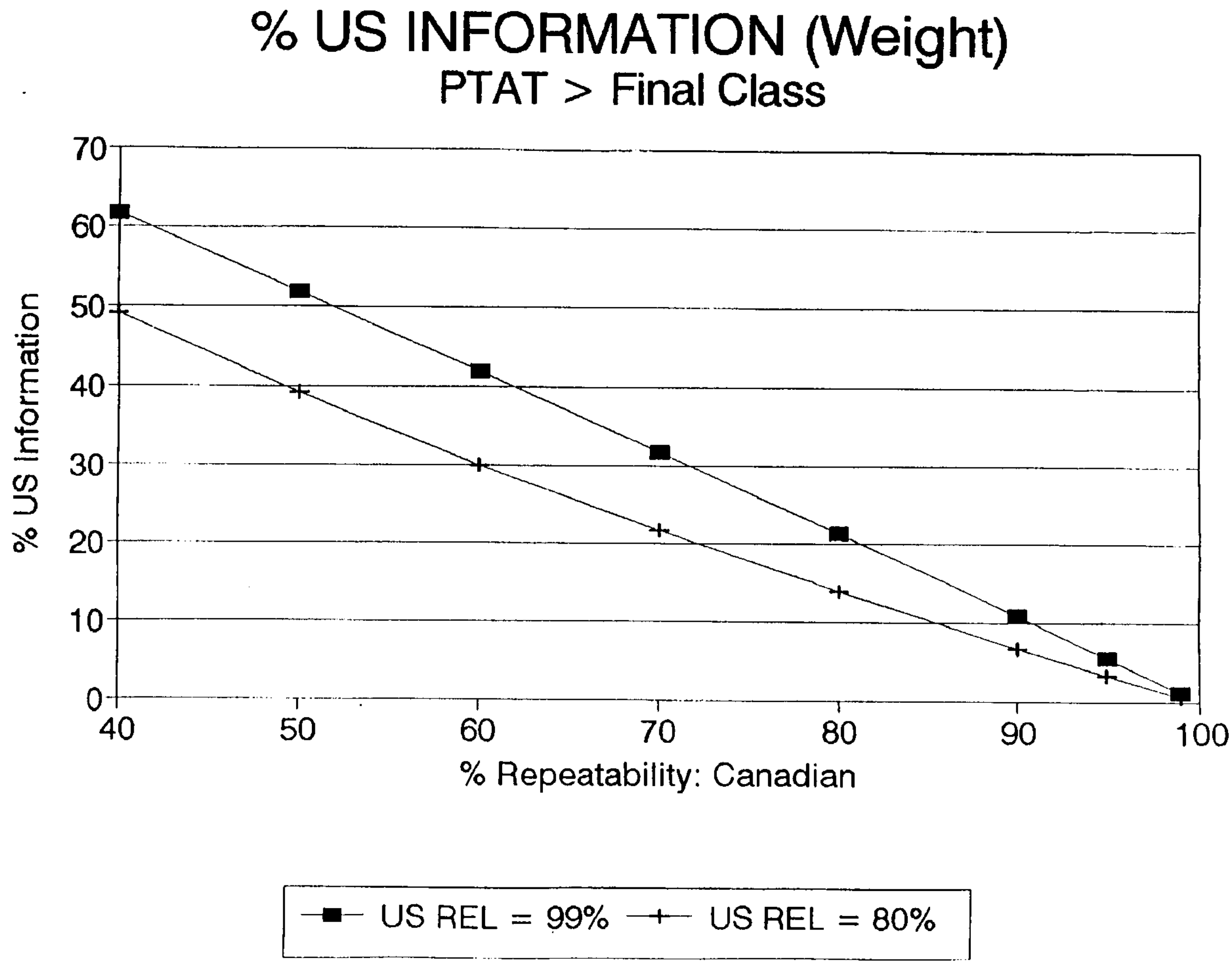
Type

(final class)

$h^2_{CAN} = 0.18$

h^2_{US} - 0.29

r (conversion) = 0.81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PTAT > Final Class
% US Information
70
60
50
40
30
20
10
0
40
50
60
70
80
90
100
% Repeatability: Canadian
US REL = 99%
US REL = 80%