RADIO WEIGHTING

RADIO ADVISORY COUNCIL
MARCH 1986
CLAIRE KUMMER

ARBITRON RATINGS
RADIO

WHY WEIGHT THE IN-TAB SAMPLE?

● RETURNED SAMPLE NOT IN PERFECT PROPORTION TO THE
  UNIVERSE

                              AND

● DIFFERENT BEHAVIOR PATTERNS AMONG DIFFERENT
  SEGMENTS OF THE UNIVERSE

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RETURNED SAMPLE NOT IN PROPORTION TO UNIVERSE...

● SAMPLE FRAME

● DIFFERENTIAL USABILITY, CONSENT, RETURN THAT CAN'T
   BE PERFECTLY FORECASTED AND/OR CONTROLLED UP FRONT

● DISPROPORTIONAL SAMPLING

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● DIFFERENT BEHAVIOR PATTERNS AMONG DIFFERENT
UNIVERSE SEGMENTS:

  ● GEOGRAPHY

  ● AGE

  ● SEX

  ● ETHNICITY

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WHAT IS SAMPLE BALANCING?

● A MEANS OF WEIGHTING SURVEY DATA TO A SET OF
  CONTROLS WHICH YIELDS THE LEAST EXTREME IN
  WEIGHTS FOR APPLICATION TO EACH INTERVIEW

● WEIGHTING IS PERFORMED "ON THE MARGIN," RATHER
  THAN TO EACH INDIVIDUAL CELL

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● WHY IS IT IMPORTANT TO KEEP THE WEIGHTING TO THE
LOWEST LEVEL POSSIBLE?

BECAUSE WEIGHTING LOWERS THE EFFECTIVE SAMPLE BASE
-- THERE IS A TRADE-OFF BETWEEN REMOVAL OF BIAS
AND MAINTENANCE OF ESB. WEIGHTING CONTROLS THAT
ARE "TOO TIGHT" MAY PRODUCE SUCH EXTREME WEIGHTS
THAT THEY PUSH TOO MUCH "BOUNCE" INTO THE RESULTS
-- THE BIAS REMOVAL FUNCTION THEY PERFORM CAN
BECOME ACADEMIC.

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SOME SAMPLE BALANCING TERMS

MODEL = ONE COMPLETE SET OF DATA UPON WHICH SAMPLE

BALANCING IS PERFORMED

EXAMPLE:

MODEL 1 METRO SURVEY AREA	MODEL 2 NON-METRO TOTAL SURVEY AREA

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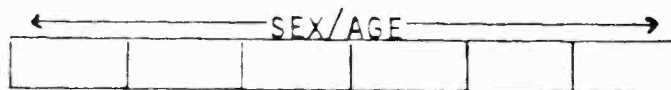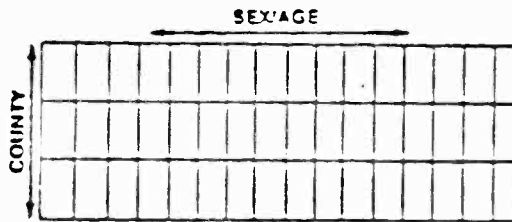## RADIO

TERMS

MARGINAL = A CHARACTERISTIC CHOSEN FOR USE IN
WEIGHTING A MODEL; EACH WEIGHTING
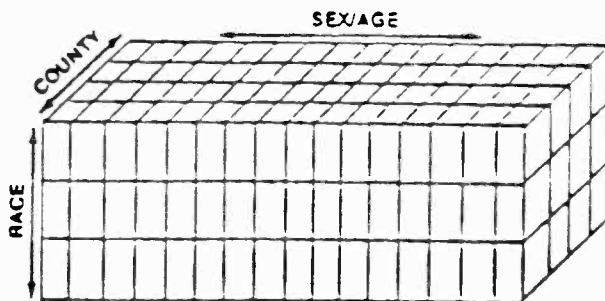CHARACTERISTIC WITHIN A MODEL IS A
DIMENSION

EXAMPLE:

ONE
MARGINAL
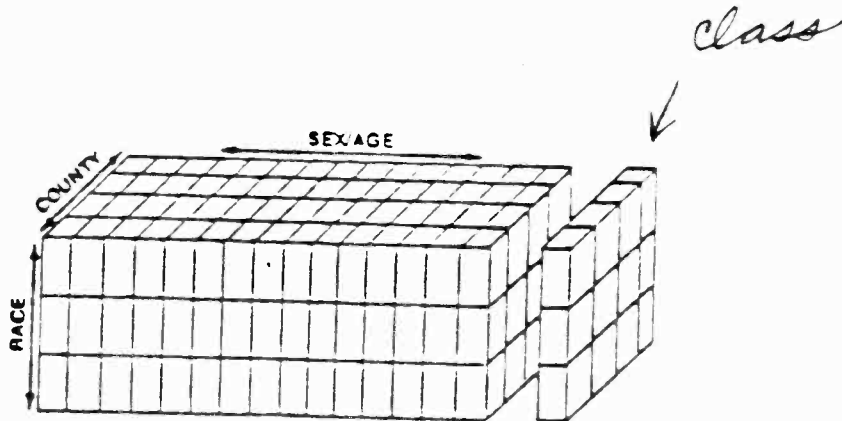

TWO
MARGINALS

THREE
MARGINALS

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TERMS

CLASS   =   A SPECIFIC, DEFINED SUBSET OF A GIVEN
            MARGINAL

EXAMPLE:
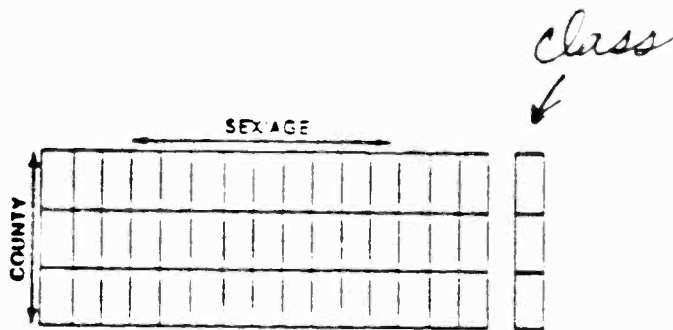
TERMS

CELL = THE COMBINATION OF CLASSES FROM TWO OR MORE MARGINALS

EXAMPLE:

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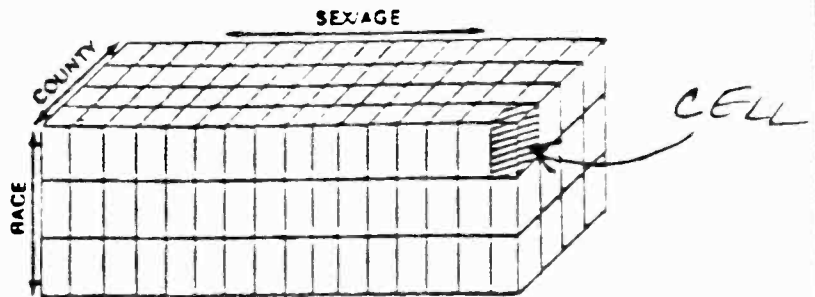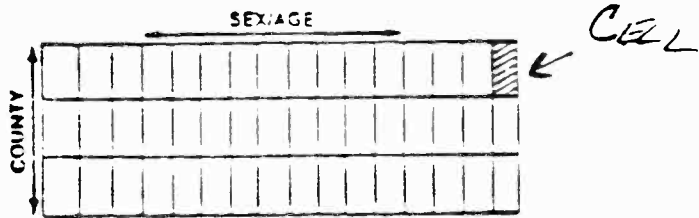
HOW DOES SAMPLE BALANCING WORK?

● ASSUME A MODEL MADE UP OF TWO MARGINALS WITH TWO CLASSES EACH

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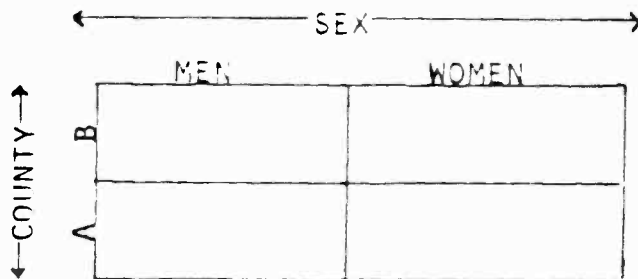
MARGINAL DATA

MARGINAL	CLASS	IN-TAB	POPULATION
SEX	MEN	25	50,000
	WOMEN	75	50,000
	TOTAL	100	100,000
COUNTY	B	60	90,000
	A	40	10,000
	TOTAL	100	100,000

CELL DATA

POPULATION

	SEX → MEN	WOMEN	
COUNTY → B	49	41	90
A	1	9	10
	50	50	

IN-TAB

	SEX → MEN	WOMEN	
COUNTY → B	15	45	60
A	10	30	40
	25	75	

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1. ADJUST FIRST MARGINAL TO CONTROL FIGURE BY CALCULATING
    A WEIGHT FOR EACH CLASS

$$\text{CLASS WEIGHT} = \frac{\text{CONTROL}}{\text{IN-TAB}}$$

		SEX	
		MEN	WOMEN
COUNTY	B	15	45
	A	10	30
	IN-TAB	25	75
	CONTROL	50	50
CLASS	WEIGHT	2.0	0.67

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2. NOW MULTIPLY THE IN-TAB IN EACH CELL BY ITS CLASS WEIGHT

SEX

		MEN	WOMEN
COUNTY	B	15 x 2.0	45 x .67
	A	10 x 2.0	30 x .67

=

SEX

		MEN	WOMEN
COUNTY	B	30	30
	A	20	20
IN-TAB		50	50
CONTROL		50	50

Percentages

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3. ADJUST SECOND MARGINAL TO CONTROL FIGURE BY
   CALCULATING A WEIGHT FOR EACH CLASS

		SEX				
		MEN	WOMEN	IN-TAE	CONTROL	WEIGHT
COUNTY	B	30	30	60	90	1.5
	A	20	20	40	10	.25
	IN-TAE	50	50			
	CONTROL	50	50			

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4. NOW REPEAT STEP 2: MULTIPLY THE "IN-TAB" IN EACH CELL
   BY ITS CLASS WEIGHT

SEX

		MEN	WOMEN
COUNTY	B	30 x 1.5	30 x 1.5
	A	20 x .25	20 x .25

SEX

		MEN	WOMEN	IN-TAB	CONTROL
COUNTY	B	45	45	90	90
	A	5	5	10	10
IN-TAB		50	50		
CONTROL		50	50		

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5. THE FIRST "PASS" IS COMPLETE. TEST FOR "CONVERGENCE" BY COMPARING ADJUSTED IN-TAB AND CONTROL MARGINAL VALUES FOR AGREEMENT.

   IN THIS SIMPLE EXAMPLE. AGREEMENT WAS REACHED IN ONE PASS. THIS IS USUALLY NOT THE CASE.

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RESULTS

MARGINAL (RIM) WEIGHTS:

MEN	2.0
WOMEN	.67
B	1.5
A	.25

CELL WEIGHTS ARE CALCULATED BY MULTIPLYING THE RIM WEIGHTS ASSOCIATED WITH EACH CELL:

$$2.0 \times 1.5 = 3.0$$

COUNTY	SEX — MEN	WOMEN
B	3.0	1.0
A	.5	.17

SAMPLE BALANCING IS COMPLETE.

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TO CALCULATE THE PPDV FOR EACH CELL:

1. CALCULATE THE AVERAGE PPDV:

$$\frac{\text{TOTAL POPULATION}}{\text{TOTAL IN-TAB}} = \text{AVERAGE PPDV}$$

$$\frac{100,000}{100} = 1,000$$

2. CALCULATE CELL PPDV:

AVERAGE PPDV X CELL WEIGHT = CELL PPDV

$$1000 \quad X \quad 3.0 \quad = 3,000$$

| | SEX | |
	MEN	WOMEN
COUNTY B	3,000	1,000
COUNTY A	500	170

EACH USABLE DIARY TAKES ON THE CALCULATED PPDV FOR ITS CELL.

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COMPARISON OF CELLS FOR THE POPULATION AND THE
WEIGHTED IN-TAB:

POPULATION

← SEX →

	MEN	WOMEN	
COUNTY B	49,000	41,000	90,000
A	1,000	9,000	10,000
	50,000	50,000	

WEIGHTED IN-TAB

← SEX →

	MEN	WOMEN	
COUNTY B	45,000	45,000	90,000
A	5,000	5,000	10,000
	50,000	50,000	

MARGINALS AGREE...CELLS DO NOT BECAUSE WE DID NOT
WEIGHT ON THEM.

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HOW DOES ARBITRON APPLY SAMPLE BALANCING?

1. GEOGRAPHIC WEIGHTING UNIT:

   USUALLY INDIVIDUAL COUNTIES

2. SEX AND AGE IN 16 GROUPS:

MEN	WOMEN
12-17	12-17
18-24	18-24
25-34	25-34
35-44	35-44
45-49	45-49
50-54	50-54
55-64	55-64
65+	65+

3. RACE/NATIONALITY:

   BLACK/OTHER

   HISPANIC/OTHER

   BLACK/HISPANIC/OTHER

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HOW DOES ARBITRON APPLY SAMPLE BALANCING?

- MODELS ARE USUALLY MAJOR GEOGRAPHIC
  REPORTING AREAS:

        METRO
        NON-METRO/NON-TSA ADI
        NON-METRO/NON-ADI TSA

- OTHER USES OF MODELS:

   RACE/NATIONALITY (WHERE SAMPLE SIZE
    IS LARGE ENOUGH)

   "EMBEDDED" METROS

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CALENDAR WEIGHTING -- CONTROLLING FOR DIFFERENTIAL
RETURNS BY MONTH

- EACH 4-WEEK PERIOD OF A 12-WEEK SURVEY PERIOD WILL
  BE CONTROLLED TO REPRESENT ITS FAIR ONE-THIRD SHARE
  OF THE TOTAL

- CALENDAR WEIGHTING WILL BE ANOTHER MARGINAL AND
  WILL ADD ANOTHER DIMENSION TO EACH MODEL:

TWO
DIMENSIONS
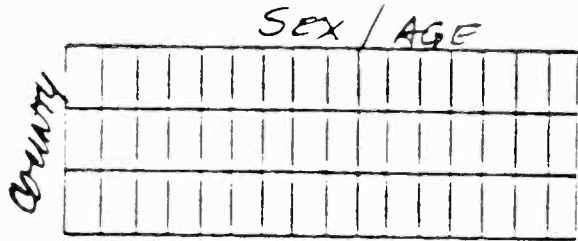
THREE
DIMENSIONS

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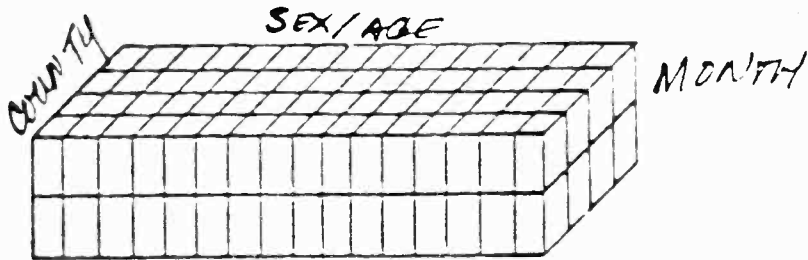
WEIGHTING LOWERS ESB...HOW MUCH WILL THIS ADDED
WEIGHTING FOR CALENDAR TIME LOWER ESB?

A VERY SMALL AMOUNT -- WE ESTIMATE LESS
THAN 5% FOR MOST REPORTING AREAS

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WHAT IMPACT WILL THIS HAVE ON REPORTED ESTIMATES?

MINIMAL...

● SAMPLES FAIRLY WELL-DISTRIBUTED MOST OF THE TIME,
  SO LITTLE WEIGHTING TO BE DONE

● ON PERSONS 12+, WE EXPECT NO DIFFERENCE IN AQH
  RATING 95% OF THE TIME, $\pm$ .1 RATING POINT 5% OF THE
  TIME

● ANY IMPACT WILL HAVE NO SYSTEMATIC EFFECT BY
  STATION TYPE OR FORMAT, BECAUSE SAMPLE IMBALANCE BY
  MONTH IS NOT SYSTEMATIC

  ...NO DISRUPTIVE EFFECT ON TRENDS

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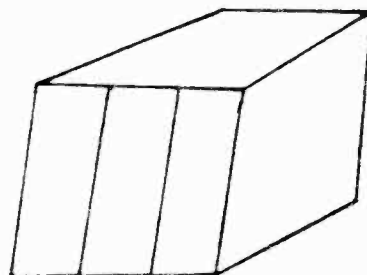## RADIO

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WHAT ABOUT ARBITRENDS?

- THE INTRODUCTION OF CALENDAR TIME WEIGHTING ON THE
  MARGIN ALLOWS US TO ALIGN THE METHODOLOGY FOR
  PRODUCING ARBITRENDS ROLLING AVERAGES WITH THAT OF
  THE QUARTERLY REPORTS

CURRENTLY:

$$\frac{\boxed{\text{MONTH 2}} \quad \boxed{\text{MONTH 3}} \quad \boxed{\text{MONTH 1}}}{3}$$

AFTER THE CHANGE:

MONTH 2 MONTH 3 MONTH 1

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WHY CAN'T ARBITRON PROCESS ARBITRENDS ROLLING
AVERAGES "LIKE THE QUARTERLY" NOW?

● BECAUSE SAMPLE SIZES CAN AND DO CHANGE BY DESIGN
ACROSS SURVEY PERIODS:

- MARKET DEFINITION CHANGES
- EMBEDDED METROS WITH DIFFERENT REPORTING
FREQUENCY THAN PARENT

● SOME FORM OF MONTHLY CONTROL NEEDED TO ADJUST

● SAMPLE SIZE CHANGES ACROSS MONTHS WITHIN SURVEY
PERIODS OCCUR BY CHANCE, NOT BY DESIGN AND ARE
RARELY EXTREME

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WHAT IMPACT WILL THIS HAVE ON THE ARBITRENDS
ROLLING AVERAGES ESTIMATES?

MINIMAL...

- DIFFERENCE BETWEEN CURRENT MARKET REPORT (NO
  WEIGHTING ON CALENDAR MONTH) AND CURRENT ARBITRENDS
  (RIGOROUS MODEL CONTROL ON MONTH) PRODUCES NO
  DIFFERENCE 80% OF THE TIME AND ± .1 20% OF THE TIME

- THIS WILL ADD SOME WEIGHTING TO THE MARKET REPORT
  AND REDUCE SOME OF THE WEIGHTING ON THE ARBITRENDS
  ROLLING AVERAGE ESTIMATES SO THAT BOTH ARE TREATED
  CONSISTENTLY

- THERE WILL BE LITTLE IMPACT ON EITHER

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