# IPUMS
## Working Papers

# Weighting the IPUMS CPS Public Arts Supplement

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**Abstract**

The Current Population Survey (CPS) is the primary source for U.S. labor force data. In addition to its monthly coverage of demographic and employment information, the CPS contains occasional supplemental data on various topics including participation in and engagement with the arts. IPUMS CPS offers the Public Participation in the Arts and the Annual Arts Benchmarking surveys together under the name "Public Arts." In this paper, we describe the challenges in weighting the CPS Public Participation in the Arts samples due to a complex survey design that varies across years, discuss our strategy for taking differences in weighting schemes into account when harmonizing Public Participation in the Arts and Annual Arts Benchmarking data, and provide guidance for researchers to tailor IPUMS CPS Public Arts supplement weights to their specific needs when necessary.

**Introduction**

The Current Population Survey (CPS) is one of the most important data sets for studying U.S. labor force participation, poverty, health-insurance coverage, and other topics of interest to social scientists. In addition to the regular questions covering employment, occupation, industry, and demographic information included every month in the CPS basic monthly survey (BMS), some months include supplements with information on various topics such as tobacco use, food security, and fertility. IPUMS CPS is a leading source for CPS data, making BMS data and most topical supplements from 1976 to the present easily accessible to researchers.

Data on arts participation are collected in two separate CPS supplements, the Public Participation in the Arts and Annual Arts Benchmarking surveys. The Public Participation in the Arts supplement asks respondents about their training in, exposure to, and participation in various artistic activities during the past 12 months. This survey was fielded in August 2002, May 2008, July 2012, and July 2017. The Annual Arts Benchmarking Survey is a shorter survey that covers many of the same topics as the Public Participation in the Arts supplement and was included in the CPS as a supplement in February of 2013, 2014, 2015, 2016, 2018, and 2020. IPUMS CPS offers data from these two supplemental surveys together under the name "Public Arts."

Though they cover many of the same subjects, the Public Participation in the Arts and the Annual Arts Benchmarking Survey vary substantially in their sample and survey design. We summarize these details in Table 1. A single set of Annual Arts Benchmarking Survey questions is asked of a subset of CPS respondents aged 18 and older from between one quarter and one half of surveyed households, depending on the year. The Public Participation in the Arts surveys are often more complex within a given year and vary more in their design across years. Several Public Participation in the Arts surveys divide supplement respondents among one or more core question sets and several modules that cover specific topics. In years with two core questionnaires, roughly half of the supplement respondents answer each core and no

respondent is included in both core surveys. In years with only one core questionnaire, all supplement respondents are included in that single core. Only a fraction of supplement respondents answers questions in any given module; no module is answered by all supplement respondents.

[Table 1]

The complex structure of the Public Participation in the Arts supplements makes proper weighting a challenge. Weights are assigned to respondents based on which parts of the survey they are asked. As a result, researchers must pay careful attention to which weight to use with which variables, and further adjustment is required to study variables from different groups together. In addition to within-year complexity, inconsistent survey design and weighting schemes across years of the Public Participation in the Arts supplement makes analysis over time difficult, especially in 2008, 2012, and 2017, and between the Public Participation in the Arts and Annual Arts Benchmarking supplements. Ambiguous Census Bureau documentation compounds these difficulties in the 2012 data.

To save researchers time and to reduce redundant effort, IPUMS CPS has clarified Census Bureau documentation, harmonized these varied weighting schemes where possible, and provided instruction to data users for proper weighting when a harmonized weight is not available. In this paper, we detail the complexities of weighting data within years of the Public Participation in the Arts supplement, challenges in weighting Public Participation in the Arts and Arts Benchmarking Survey data across years, and our solutions to these challenges. In addition, we explain our methodology for determining the correct weighting adjustments for the 2012 Public Participation in the Arts data when these are incorrect or missing from the original CPS documentation.

Throughout this paper, we reference both original Census Bureau variable names and IPUMS CPS variable names. Original Census Bureau variable names are italicized to avoid confusion.

**Weighting Public Participation in the Arts Data within Year**

Due to a complex supplement design, original Public Participation in the Arts supplement weights must be adjusted based on which supplement variables are included in the analysis. While the Census Bureau provides weighting adjustment factors for all years with a complex design (2008, 2012, and 2017), the adjustment factors provided for the 2012 data do not yield plausible weighted totals, and adjustment factors for analyzing different cores and modules together in this year are missing from the documentation altogether. This section describes the designs of the Public Participation in the Arts samples included in the IPUMS CPS Public Arts supplement, discusses the Census Bureau-recommended procedures for weighting the original Public Participation in the Arts data, and our procedures for arriving at correct adjustment factors for the 2012 data.

*Structure of the Public Participation in the Arts Supplement*

The Public Participation in the Arts supplement was fielded in 2002, 2008, 2012, and 2017. While the design of the 2002 survey is simple, the supplement became more complex in later years (U.S. Census Bureau, 2003). In 2008, 2012, and 2017, the supplement is made up of one or more cores and several modules with questions devoted to specific areas of the arts such as music or fine arts. Unlike in the Arts Benchmarking Survey, eligibility criteria for selection into the Public Participation in the Arts supplement are slightly different in each year (see Table 1 above).

In August of 2002, the Public Participation in the Arts supplement contains one set of questions that was asked of all individuals aged 18 or older from households in months-in-sample[1] four and eight (U.S. Census Bureau, 2003).

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[1] The CPS is a rotating panel household-level survey. Households are interviewed for four consecutive months, rotate out of the CPS sample for the next eight months, and are then interviewed for another four months before exiting the sample for good. A household's "month-in-sample" value indicates its place in this 4-8-4 rotation pattern and is available in the IPUMS CPS variable MISH.

In May 2008, the Public Participation in the Arts supplement was asked of "two randomly selected household members, aged 18 or older from about one-fourth the sampled CPS households (U.S. Census Bureau, 2009)." Examination of the data reveals that all supplement participants were from households in months-in-sample four and eight. The 2008 Public Participation in the Arts supplement contains one set of core questions, and six modules, one of which is called the "special core." If the randomly selected household members had a spouse or partner in the household, these individuals were also asked the core questionnaire and included in the "special core" and module C. Each module contains only a portion of the selected supplement participants, but the original CPS documentation does not describe how supplement respondents are assigned to modules.

The July 2012 supplement respondents were chosen in a similar way to 2008; however, in 2012, randomly selected respondents and their spouses and partners were chosen from about one half of the sampled CPS households in that month (U.S. Census Bureau, 2012). Examination of the data reveals that these households were in months-in-sample three, five, seven, and eight. The 2012 Public Participation in the Arts supplement consists of two cores and six modules (Modules A1, A2, B, C, D, and E). Each core contained half of all supplement respondents. As in 2008, all supplement respondents are not included in all modules, and spouses and partners of originally randomly selected respondents are only included in the core questionnaire, module A1, and module D. The original CPS documentation does not describe how original randomly-selected respondents are assigned to modules.

In July 2017, one civilian household member aged 18 or older was randomly selected to participate in the supplement; these respondents were chosen from one half of the CPS households in that month (U.S. Census Bureau, 2017). Examination of the data reveals that these households are in months-in-sample three, four, seven, and eight. In this year, the Census Bureau documentation states that all respondents were randomly assigned to one of two cores and two of five modules.

These complex survey designs have implications for weighting. The numbers of cores and modules, rotation groups eligible for selection into the Public Participation in the Arts supplement, and how selected supplement respondents are assigned to modules vary across years (see Table 1). As a result, instructions for proper weighting also differ across years. Figures 1, 2, and 3 show lists of supplement weights for each core, module, and combination of modules in the original CPS documentation for 2008, 2012, and 2017, respectively (recall that the 2002 Public Participation in the Arts supplement does not have a complex survey design). The 2008 data contain two supplement weights and an extensive list of adjustment factors to be used with the given weight for each core and module individually and for each possible combination of supplement core and module variables. In the 2012 data, there are five different supplement weight variables, each corresponding to a core or group of modules. The weighting documentation for this year appears to contain errors (see the *Problematic 2012 Documentation* section below). There is only one supplement weight variable in the 2017 data, and a table of simple adjustment factors required for different types of variable combinations.

[Figure 1: 2008 Codebook Weighting Factors]

[Figure 2: 2012 Codebook Weighting Factors]

[Figure 3: 2017 Codebook Weighting Factors]

*Problematic 2012 Documentation*

The original CPS documentation accompanying the 2012 Public Participation in the Arts data is problematic in three ways. First, it indicates that single-module weighting adjustment factors should be used for cross-module analysis. Second, it pairs the incorrect adjustment factors with single modules. Finally, it does not include any weighting adjustment factors for cross-module analysis. In this section we correct the single-module weighting adjustment factor errors. In the following section we describe our calculation of the omitted cross-module weighting adjustment factors.

In 2008, 2012, and 2017, weighted population counts using appropriate supplement weights and adjustments should reflect the U.S. civilian non-institutionalized population age 18 and over. For 2008 and 2017 data, when the adjustment factors are applied to the supplement base weights as the documentation instructs, weighted totals are correct (See Table 3 below). In the 2012 data, however, weighted totals based on the documented weighting adjustments do not come close to the correct figure (See Table 2). There are two problems with the adjustment factors in the 2012 documentation. First, it seems that the adjustment factors included in the original documentation (see Fig. 2) are intended to be used for modules in isolation, not for cross-module analysis as the documentation suggests. Second, these adjustment factors appear to be paired with the incorrect modules.

The 2012 Census Bureau documentation offers the following example for cross-module analysis: "For example, multiply the *[PW]NWGT* by 1.75 to determine the final weight when cross analyzing variables from module B and module C (U.S. Census Bureau, 2012)."[2] However, when the *PWNWGT* values for those records that respond to both module B and module C are multiplied by 1.75, weighted totals are far too small. The weighted total arrived at by following these instructions results in a little over 45 million people. The total U.S. population age 18 and over in 2012 was around 235 million. Even applying the adjustment factors for a module in isolation yields implausible population totals, as the documented adjustment factors appear to be paired with the wrong weights. That is, those modules using *PWSWGT* should be adjusted using 1.75 and those modules using *PWNWGT* should be adjusted using 2.25. Table 2 shows that the original weight adjustment factors for modules A1 and D produce population totals that are too high; population totals are too low for modules B, C, E.

[Table 2]

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[2] Emphasis added.

We also show that if we switch the weight adjustment factors and use the adjustment factor assigned to modules A1 and D by the Census Bureau to modules B, C, and E and vice versa, we arrive at expected population totals. This arrangement is more intuitive, as modules A1 and D include spouses and partners and thus contain more people than modules B, C, and E. As a result, the weight values of respondents to these modules need to be larger than those for respondents in the larger modules in order for their weighted totals to match the total U.S. population age 18 and over.

*Calculating Cross-Module Adjustment Factors for 2012*

There are no official weighting adjustment factors for cross-module analysis included in the 2012 documentation. In this section we calculate the missing cross-module weighting adjustment factors for the 2012 data. Using the Census Bureau documentation for all Public Participation in the Arts supplements with the core-and-module design as a guide, we developed a method to calculate these adjustments. To test the validity of our method, we first reproduced the Census Bureau's single-module adjustment factors from 2008, 2012, and 2017 and the documented cross-module adjustment factors from 2008 and 2017. We then applied this same methodology to the 2012 data to calculate correct cross-module weighting adjustment factors. These are presented in Table 6 below.

Regarding the calculation of weighting adjustments for the 2008, 2012, and 2017 data, the original CPS documentation states that "[t]hese factors are determined by summing the proportion of cases that were asked the module or combination of modules of interest. The factor is the inverse of the proportion of cases receiving the module or combination of modules (U.S. Census Bureau, 2009; U.S. Census Bureau, 2012; U.S. Census Bureau, 2017)." Only the documentation from 2017 gives sufficient information about how supplement respondents were assigned to cores and modules to accurately reproduce the proportion of supplement respondents that were assigned to a given core or module. In this year, one half of the

respondents were assigned to each core and each supplement respondent was assigned to two modules (U.S. Census Bureau, 2017). The 2008 documentation does not give details about how supplement participants were assigned to modules; it only indicates that the documented weighting adjustment factors account for "an error in selection of respondents" that caused the fraction of supplement respondents in each module to be unequal (U.S. Census Bureau, 2009). Similarly, the original 2012 documentation indicates that half of the supplement respondents were assigned to each core and "40% would receive each module" (U.S. Census Bureau, 2012); however, this module apportionment is not borne out in the data (see Table 3).

In addition to the nebulous documentation, there are no variables in the data from any of these three years that tell us which respondents were assigned to which core or module. All that we know for sure is who actually responded to which cores and modules. The original documentation does not give reliable selection probabilities into each core and module for 2008 and 2012, so we are unable to account for nonresponse. To address this omission, we attempted to determine 2012 cross-module weighting adjustment factors empirically. We calculated the inverse of the ratio of actual respondents to a given set of modules to those who could have been included in that set of modules. To account for variation in calculated weighting adjustment factors introduced by module nonresponse, we averaged these inverse proportions across module sets with similar proportions of actual to potential respondents.

To assess the validity of this method, we first used our two-stage process to reproduce the documented single-core and single-module weighting adjustment factors in 2008, 2012, and 2017. To calculate these adjustment factors, we first take the inverse of the ratio of respondents who answered any question in the given core or module of interest (i.e. actual respondents) to the total number of supplement respondents who had a non-zero value for the supplement base weight given in the Census Bureau documentation (i.e. possible respondents). For example, in 2008, *CWGT* is the base weight for module C and 18,444 persons have a *CWGT* value that is greater than 0. There are 10,294 persons in the 2008 data who respond to any questions in

module C. The inverse proportion of persons who could have been asked module C (in this case, all randomly chosen supplement respondents and their spouses and or partners) to those that did respond to module C in 2008 is 1/(10,294/18,444), which is roughly equal to 1.792. Table 3 shows the Census Bureau's single module adjustment factors alongside our calculated single-module adjustment factors for 2008, 2012, and 2017. The Census Bureau's published adjustment for module C in 2008 is 1.818182. As this example illustrates, this technique results in adjustment factors that are close to the published ones but not exact; the weighted totals achieved when using these calculated adjustment factors are also a bit off (see Table 3).

We took the additional step of averaging our calculated adjustment factors across cores and modules with the same groups of potential respondents to correct for differing nonresponse rates between cores and modules. After averaging, we exactly reproduce the known correct weighting adjustment factors in most cases. The first stage calculation does not account for core- or module-specific non-response and thus does not exactly reproduce the Census Bureau's published weighting adjustment factors. However, we observed that our calculated adjustment factors vary across cores and modules that have been assigned the same adjustment factor by the Census Bureau, some being higher than and others lower than the published adjustment in all years in which we perform these calculations. This variation suggests that supplement non-response rates differ across cores and modules. To reduce the effect of uneven non-response across modules, we averaged our calculated weighting factors across modules that share approximately the same proportion of actual respondents to total potential respondents. After this final step, our results are much nearer to the Census Bureau's documented adjustment factors.

Our efforts to reproduce Census Bureau adjustment factors are shown in Table 3. We found that averaging our calculated adjustment factors for 2017 and rounding that average to the nearest 10th reproduced the published adjustment factors exactly. This procedure achieves the exact single module adjustment factors for 2012 (after accounting for the switch described

above in the *Problematic 2012 Documentation* section above). Using this method produced adjustment factors that were close, but not exact, in 2008. The exact source of discrepancy between Census Bureau-provided adjustment factors and the adjustment factors we calculated for 2008 is unclear. However, the fact that we were able to ultimately reproduce the documented adjustment factors in 2017, for which the probability of an individual's assignment to a core or module is documented and the published adjustment factors yield correct totals, gives us confidence in the overall validity of our approach.

[Table 3]

Satisfied that our method worked for single-module adjustment factors, we then applied the same technique to reproduce the cross-module adjustment factors in the Census Bureau documentation for 2008 and 2017. We first reproduced the cross-module adjustment factors in 2008 and 2017 to increase our confidence that our method would work to calculate the missing cross-module weighting adjustment factors from 2012.  In calculating cross-module adjustment factors, the number of actual respondents is the number of supplement respondents that appear in both cores or modules of interest, and the number of potential respondents is the number of respondents with a non-zero value for the relevant supplement base weight. The 2008 file contains two supplement weight variables, one for core variables and modules that include the randomly selected CPS respondent and their spouse/partner (*CWGT*), and one for modules that only include the randomly selected CPS respondent (*MWGT*). The 2017 file contains only one supplement weight variable to be used with all cores and modules. With the 2008 data, as with our efforts to reproduce single-module adjustment factors, we achieved adjustment factors that were close to those found in the Census Bureau documentation; but none of our calculated figures matched the published ones exactly, even after averaging across similar core-and-module combinations. With the 2017 data, we again found that averaging our calculated adjustment factors over groups with similar actual-respondent-to-potential-respondent ratios and

rounding to the nearest tenth did reproduce the Census Bureau adjustment factors exactly.

Tables 4 and 5 show the Census Bureau's published cross-module adjustment factors and our calculated cross-module adjustment factors for 2008 and 2017, respectively.

[Table 4]

[Table 5]

Because our efforts to reproduce correct documented weighting adjustment factors gave plausible results in 2008 and 2017, we then applied the procedure to all possible core and module combinations in 2012. As 2012 has five original supplement weights (see Table 3), which weight should be adjusted for a given combination of cores or modules is not obvious. We observed that the table of adjustment factors in 2008 assigns the same base weight to individual modules based on their universe - that is, whether or not the module includes spouses. The same is true for the combinations of modules. Based on the example of 2008, the base weight should be the prescribed weight for the module with the most restrictive universe, and the numerator of the adjustment factor should be the total records to which the base weight applies.

Table 6 shows base weights and calculated weighting adjustment factors for all combinations of cores and modules in 2012 and thus fills in a gap in the official CPS documentation for this dataset and lowers a barrier to use of this complicated survey. When analyzing variables from modules B and C in 2012 together, the base weight *PWNWGT* should be used, as both of these modules have the same universe (both modules B and C contain those selected as supplement respondents only, and not their spouses and partners). Because *PWNWGT* applies to more people than responded to modules B and C, we must inflate *PWNWGT* to make the respondents of modules B and C representative of the population. The adjustment factor is calculated by dividing the sum of all persons who responded to module B, C, or E (all of which have *PWNWGT* as a base weight) by the number of persons who actually responded to both modules B and C.

When examining variables from module B (base weight *PWNWGT*) and module D (base weight *PWSWGT*), *PWNWGT* should again be used as the base weight, as module B has the most restrictive universe of the two modules of interest (module D includes spouses and partners, module B does not). The adjustment factor is calculated by dividing the sum of all persons who responded to module B, C, or E by the number of persons who responded to modules B and D.

As with the cross-module adjustment factors in 2017, rounding our calculated 2012 cross-module adjustment factors to the nearest tenth achieved the correct weighted totals. There are two exceptions to this: both combinations that include both module A1 and D. For cross-module combinations that include both of these modules, rounding the calculated conversion factor to the nearest whole number rather than the nearest tenth achieves the correct weighted total.

[Table 6]

**Weighting Public Arts Data across Years**

Properly weighting the original Public Participation in the Arts data within years is already challenging. Proper weighting when studying engagement in the arts across time is particularly difficult, as the survey designs differ across years, as do the number of original weight variables and adjustment factors. If any variables of interest come from a module in the Public Participation in the Arts samples, adding Arts Benchmark Survey samples into the mix adds yet another layer of complexity to studying participation in the arts across time. IPUMS CPS has worked to reduce researcher burden by offering ready-to-use harmonized weights where possible while also providing clear documentation for scenarios in which these harmonized weights do not apply and researchers must make their own adjustments. This section describes IPUMS CPS Public Arts supplement weights and includes instructions for researchers to create their own weights when necessary using IPUMS CPS weight variables.

*IPUMS CPS Harmonized Public Participation in the Arts Weights*

For 2008, 2012, and 2017, IPUMS CPS provides core- and module-specific weights that apply to that core or module both within years and across time. Table 7 shows the contents of IPUMS CPS harmonized Public Arts supplement weight variables for 2008, 2012, and 2017. Fortunately for those interested in studying public participation in the arts across time, variables that appear in multiple years usually appear in the same core or module in all three years that have this design. In these instances, researchers may use IPUMS CPS harmonized weights as they are offered, with no further adjustment. For example, the IPUMS CPS variable PASUPPWTB is to be used with IPUMS CPS Public Arts supplement variables from module B in 2008, 2012, and 2017. As described previously, some modules share original Census Bureau base weights. This is the case in the 2017 supplement. In the harmonized weight variables, IPUMS CPS has adjusted these weights such that respondents not included in the module or core of interest have a value of 0. Accordingly, 2017 supplement respondents who did not participate in module B are thus assigned a value of 0 in PASUPPWTB. These weights can be used for their given core or module as-is; any year-specific adjustments have already been made.[3]

[Table 7]

*IPUMS CPS Public Arts Supplement Weighting Examples*

The number of possible core and module combinations within the 2008, 2012, and 2017 Public Participation in the Arts supplements is large. Therefore, offering harmonized weight variables for the purpose of cross-module analysis is not practical. Researchers who want to

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[3] Note that IPUMS CPS does not currently offer harmonized variables from all cores or modules.

analyze variables that appear in different cores or modules across years should create new harmonized weight variables tailored to their research questions. These new weight variables can be easily constructed using the harmonized IPUMS CPS Public Arts supplement weight variables as a starting point. Table 8 lists every harmonized Public Participation in the Arts variable currently available through IPUMS CPS along with the relevant weights from each year with the core and module design (2008, 2012, and 2017). For example, the IPUMS CPS variable PHOURTV (hours of TV on an average day), is in module C in 2008 and module B in 2012. Researchers wishing to use this variable across both years will need to generate their own weight variable that is equal to the IPUMS CPS variables PASUPPWTC in 2008 and PASUPPWTB in 2012.[4]

[Table 8]

To maximize the availability of variables across time, IPUMS CPS offers the Public Participation in the Arts and the Annual Arts Benchmarking supplement together as the Public Arts supplement. The Arts Benchmarking Survey is simple compared to the Public Participation in the Arts supplement, containing only one set of questions and, therefore, only one supplement weight, PASUPPWT. Including an Arts Benchmark Survey sample in analyses with one or more of the Public Participation in the Arts samples may add another weight to the list of weights to reconcile. If the variables of interest from the Public Participation in the Arts supplement appear in Core 1 in all years of interest, no weight adjustment is needed. When combining variables from the 2002 Public Participation in the Arts supplement or the Arts Benchmarking Survey samples with a simple survey design (2013, 2014, 2015, 2016, 2018, and 2020) and from the Public Participation in the Arts supplement with the core-and-module design

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[4] See the Technical Appendix for sample code.

(2008, 2012, and 2017), users must create their own weights if the variables of interest do not appear in Core 1 in all of their core-and-module samples (See Table 3 for a list of Cores and Modules in all years with this survey design). Users should refer to Table 8 to find the core or module in which their variable(s) of interest are located.

We provide three illustrative examples of the process by which a researcher might determine whether they need to make an adjustment to the weights. The IPUMS CPS variable PMOVIES is available in 2002, 2008, 2012, 2013, 2015, and 2017; a straightforward variable recoding is needed to ensure the weights are appropriate for cross-time analyses. From Table 8, we know that PMOVIES has a different weight for each year of the Public Participation in the Arts supplement. However, for the 2002 Public Participation in the Arts supplement and the 2013 and 2015 Arts Benchmark supplement, there is only one supplement weight available, PASUPPWT. Table 9 lists the correct IPUMS CPS Public Arts supplement weights for PMOVIES in each year; the next step is to create a new variable and assign the appropriate weight for each year of interest.

[Table 9]

Other use cases are more complicated, requiring additional manipulation by researchers to create appropriate weights. For scenarios where the harmonized weight variables cannot serve as a basis for a user-generated weight, IPUMS CPS provides the original Census Bureau weights as unharmonized variables to allow users to generate the modified weights required for their specific needs.[5] Table 10 shows which IPUMS CPS unharmonized variables correspond to original Census Bureau weights in the 2008, 2012, and 2017. These unharmonized weight variables must be modified using the appropriate adjustment factors determined by the cores or

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[5] For more information on IPUMS CPS unharmonized variables, see
https://cps.ipums.org/cps/unharmonized_variables.shtml

modules of the variables of interest for each relevant year. Users should refer to Table 8 to determine the core or module location of their variables of interest, to Tables 4 and 5 to find the correct weighting adjustment factors for each core and module combination in 2008 and 2017, respectively, and to Table 6 to determine the correct adjustment factors for 2012.

[Table 10]

For example, a researcher interested in examining the relationship between PHOURTV and PMOVIES in 2008 and 2012 must construct a weight variable as follows. Table 8 shows that both PHOURTV and PMOVIES are in module C in 2008. However, in 2012, PHOURTV is part of module B and PMOVIES is part of module A1; different weights are assigned to these two modules and different adjustment factors are required for these two modules. This means that a cross-module adjustment must be made to the weights in 2012. For records from 2008, the new weight variable will be equal to PASUPPWTC, but for records from 2012, some calculation is required. Table 6 indicates that the correct weight for a combination of module B and module A1 variables is the original Census Bureau weight *PWSWGT* (the IPUMS unharmonized variable UH_PWNWGT_S1, according to Table 10) multiplied by 9. This will be the value of the new weight variable for records from 2012.

## Conclusion

The within-year complexity of the Public Participation in the Arts supplement and the variation in complexity across years pose an enormous barrier to studying participation in the arts using these data, both within a given year and over time. When working with the original data, researchers need to be aware of the differing structure of the data in their years of interest and the accompanying year-specific weighting scheme in order to ensure that they are using correct weight values for the correct variables in the correct years. IPUMS CPS has significantly

lowered the barrier to using these data by creating harmonized weight variables where possible that can be used as-is in many scenarios. In this paper we described the difficulties in weighting these data both within years and over time as well as our methods for correcting errors and omissions in the original CPS documentation for this supplement. We also demonstrated correct usage of IPUMS CPS harmonized and unharmonized weights.

Correctly weighting even a single year of the CPS Public Participation in the Arts supplements from 2008, 2012, and 2017 is complicated due to the core-and-module survey design. Original Census Bureau weights must be adjusted to arrive at the correct population totals, and this adjustment varies with respect to which part of the survey contains the variable(s) of interest and whether or not all variables being analyzed are from the same part of the survey. Arriving at correct weighted totals is even more difficult with the 2012 data, as the documentation for the supplement data is both incorrect and incomplete where weighting is concerned.

We corrected the errors of the original 2012 documentation and detailed the method we used to calculate weighting adjustment factors for cross-module analysis that were missing from the documentation in this year. When verifying our method using the 2008 and 2017 data, we found that the calculated weighting adjustments were not identical to the given weighting adjustment factors in these years. Our examination of the data from 2017, the most completely documented Public Participation in the Arts supplement, suggested that differing nonresponse rates across modules were the reason for the discrepancy. By averaging our calculated weight adjustments among modules with approximately the same proportion of supplement respondents, we reduce the effect of the varying nonresponse across modules.

Due to the variation in sample design of the Public Participation in the Arts components of the IPUMS CPS Public Arts supplement across years, IPUMS CPS does not create harmonized weights for all possible use cases of the Public Arts supplement data. Instead, we deliver the variables (i.e. harmonized and/or unharmonized) and provide the documentation

needed to generate appropriate weights. These variables give researchers flexibility to use the harmonized weights when possible and to generate their own weights based on harmonized and unharmonized variables as appropriate. In addition, we have calculated cross-module weighting adjustment factors for the 2012 Public Participation in the Arts data that were omitted from the original documentation.

The results of these efforts should benefit the research community in multiple ways. First, they should increase the accurate use of these complex data. Second, they should reduce the time it takes individual researchers to appropriately use these data. Third, it should eliminate redundant effort in instances where harmonized weights are adequate for researcher use.

# References

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U.S. Census Bureau. Current Population Survey, February 2020 Annual Arts Benchmarking Survey Supplement File Technical Documentation [codebook]. 2020.

# Technical Appendix

## User-generated weights examples

This appendix gives example Stata code for generating the appropriate weight variables for the scenarios described in the *IPUMS CPS Public Arts Supplement Weighting Examples* section of this paper.

### PHOURTV

To study the average hours of TV watched per day in 2008 and 2012, the user must assign the weight values from the correct modules in the respective years to a new weight variable for use with both years of data.

```
// reconcile weights to look at PHOURTV in 2008 and 2012
gen phourtv_weight = pasuppwtc if year == 2008
replace phourtv_weight = pasuppwtb if year == 2012
```

`phourtv_weight` now has the correct weight values for observations from both 2008 and 2012.

### PMOVIES

A similar procedure must be followed to study whether or not someone went out to the movies last year in 2002-2017. In this example, the 2002 Public Participation in the Arts and both of the Arts Benchmarking Survey samples do not have the core and module design and are all assigned the same weight variable.

```
// reconcile weights
gen pmovies_weight = pasuppwt if year == 2002 | year == 2013 | year == 2015
replace pmovies_weight = pasuppwtc if year == 2008
replace pmovies_weight = pasuppwta if year == 2012
replace pmovies_weight = pasuppwtd if year == 2017
```

## PHOURTV and PMOVIES together

In this scenario, both PHOURTV and PMOVIES are in module C in 2008. However, things are

slightly more complicated in 2012 where PHOURTV is in module B and PMOVIES is in module

A1. For 2012, we must use the cross-module adjustment factor found in Table 9 with an

unharmonized weight variable to arrive at the appropriate weight values for 2012 observations.

```
// reconcile weights
// both phourtv and pmovies are in module C in 2008
gen crossmod_weight = pasuppwtc if year == 2008
// in 2012, phourtv is in module B and pmovies is in module A1
replace crossmod_weight = uh_pwnwgt_s1 * 9 if year == 2012
```

Fig. 1. 2008 Published Public Participation in the Arts Weighting Adjustment Factors

| Weights and Module Factors to Assign to each Case in Analysis to Calculate the Final Weight | | |
|---|---|---|
| Analysis of Modules | Weight to Use | Module Factor to Assign |
| Core Questions | CWGT | 1.000000 |
| X Questions or<br>Core Questions and X Questions | MWGT | 1.000000 |
| Module A or<br>Module B or<br>Core Question and Module A or<br>Core Question and Module B or<br>Module A and X Questions or<br>Module B and X Questions or<br>Core Questions and Module A and X Questions or<br>Core Questions and Module B and X Questions | MWGT | 2.222222 |
| Module C or<br>Core Question and Module C or<br>Special Core Question or<br>Core Questions and Special Core Question | CWGT | 1.818182 |

| | | |
|---|---|---|
| Module A and Module B or<br>Module A and Module B and Core Questions or<br>Any of these combinations with X Questions | MWGT | 12.00000 |
| Module D or<br>Core Question and Module D or<br>Module C and X Questions or<br>Module D and X Questions or<br>Core Questions and Module C and X Questions or<br>Core Questions and Module D and X Questions or<br>Core Questions and Special Core Question and X Questions | MWGT | 1.818182 |
| Module A and Module C or<br>Module A and Module D or<br>Module B and Module C or<br>Module B and Module D or<br>Module C and Module D or<br>any of these combinations with the Core Questions or<br>any of these combinations with the X Questions or<br>any of these combinations with the Core Questions and X Questions | MWGT | 5.454545 |
| Special Core Question and Module A or<br>Special Core Question and Module B or<br>any of these combinations with the Core Questions or<br>any of these combinations with the X Questions or<br>any of these combinations with the Core Questions and X Questions | MWGT | 4.000000 |
| Special Core Question and Module C or<br>Core Questions and Special Core Question and Module C | CWGT | 3.333333 |
| Special Core Question and Module D or<br>Core Questions and Special Core Question and Module D or<br>Question X questions and Special Core Question and Module D or<br>Core Questions and X Questions and Special Core Question and Module D or<br>X Questions and Special Core Question and Module C or<br>Core Questions and X Questions and Special Core Question and Module C | MWGT | 3.333333 |
| Special Core Question and Module A and Module B or<br>this combination with the Core Questions or<br>this combination with the X Questions or<br>this combination with the Core Questions and X Questions | MWGT | 20.00000 |
| Special Core Question and Module A and Module C or<br>Special Core Question and Module A and Module D or<br>Special Core Question and Module B and Module C or<br>Special Core Question and Module B and Module D or<br>Special Core Question and Module C and Module D or<br>any of these combinations with the Core Questions or<br>any of these combinations with the X Questions or<br>any of these combinations with the Core Questions and X Questions | MWGT | 10.000000 |

*Source: U.S. Census Bureau*

Fig. 2. 2012 Published Public Participation in the Arts Weighting Adjustment Factors

| Table 1. Module Factors to Assign to Each Case in Analysis to Calculate the Final Weight | |
|---|---|
| Core/Module Weight Used | Module Factor to Assign |
| PWOWGT, PWTWGT, or PWAWGT | 1.000000 |
| PWSWGT | 2.25 |
| PWNWGT | 1.75 |

*Source: U.S. Census Bureau*

Fig. 3. 2017 Published Public Participation in the Arts Weighting Adjustment Factors

| SPPA Supplement Weighting Factors | |
|---|---|
| Factor | Description |
| 2 | Estimates involving items from *one* Core |
| 2.5 | Estimates involving items from *one* Module |
| 5 | Estimates involving items from *one* Core and *one* Module |
| 10 | Estimates involving items from *two* different Modules |
| 20 | Estimates involving items from *one* Core and *two* Modules |

*Source: U.S. Census Bureau*

Table 1. Summary of Samples and Survey Designs in the IPUMS CPS Public Arts Supplement

| Month and Year | Original Supplement Name | Eligible Months in Sample | Eligible Household Respondents | Survey Design Elements | Number of original supplement weights | Supplement Respondents |
|---|---|---|---|---|---|---|
| August 2002 | Public Participation in the Arts | 4 and 8 | All persons, 18+ | One set of questions for all supplement respondents | 1 | 17,135 |
| May 2008 | Public Participation in the Arts | 4 and 8 | Two randomly selected persons and their spouses or partners if present, 18+ | One core set of questions given to all supplement respondents and six modules asked of a subset of supplement respondents. The "special core" portion of the survey is counted among the six modules. | 2 | 18,444 |
| July 2012 | Public Participation in the Arts | 3, 4, 7, and 8 | Two randomly selected persons and their spouses or partners if present, 18+ | Two core sets of questions, each assigned to half of the supplement respondents, and six modules asked to a subset of supplement respondents. | 5 | 35,765 |
| February 2013 | Annual Arts Benchmarking Survey | 3 and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 20,156 |
| February 2014 | Annual Arts Benchmarking Survey | 3 and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 20,180 |
| February 2015 | Annual Arts Benchmarking Survey | 3 and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 19,323 |
| February 2016 | Annual Arts Benchmarking Survey | 3 and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 19,426 |
| July 2017 | Public Participation in the Arts | 3, 4, 7, and 8 | One randomly selected person, 18+ | Two core sets of questions, each assigned to half of the supplement respondents. Five modules are asked to a subset of supplement respondents; each supplement respondent is asked two of the five modules. | 1 | 17,611 |
| February 2018 | Annual Arts Benchmarking Survey | 3 and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 18,136 |
| February 2020 | Annual Arts Benchmarking Survey | 2, 3, 6, and 7 | The household's basic monthly survey respondent, a randomly selected person, and spouses or partners if present, 18+ | One set of questions for all supplement respondents | 1 | 24,014 |

Table 2. Corrected Module Weight Adjustment Factors for Public Participation in the Arts Supplement, 2012

| Module | Census Base Weight | Spouses and Partners Eligible | Census Documented Adjustment | Weighted Total using Census Adjustment | Correct Adjustment | Weighted Total using Correct Adjustment |
|---|---|---|---|---|---|---|
| 2012 US population 18+: Approximately 235,000,000 | | | | | | |
| Module A1 | *PWSWGT* | Yes | 2.25 | 302,134,539 | 1.75 | 234,993,536 |
| Module D | *PWSWGT* | Yes | 2.25 | 302,134,539 | 1.75 | 234,993,536 |
| Module B | *PWNWGT* | | 1.75 | 182,772,773 | 2.25 | 234,993,562 |
| Module C | *PWNWGT* | | 1.75 | 182,772,773 | 2.25 | 234,993,562 |
| Module E | *PWNWGT* | | 1.75 | 182,772,773 | 2.25 | 234,993,562 |

Table 3. Published vs Reproduced Public Participation in the Arts Weighting Adjustment Factors, 2008, 2012, and 2017

| | From Census Documentation | | | | Determined Empirically | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Base Weight | Spouses and Partners Eligible | Adjustment Factor | Weighted Totals | N Eligible | N Responded | Calculated Adjustment Factor | Weighted Totals using Calculated Adjustment Factors | Averaged Calculated Adjustment Factors |
| **2008** | | | | | | | | | |
| Core | *CWGT* | Yes | 1 | 224,826,726 | 18,444 | 18,444 | 1 | 224,826,726 | 1 |
| Special Core | *CWGT* | Yes | 1.818182 | 224,826,753 | 18,444 | 10,114 | 1.8236108 | 225,498,051 | |
| Module C | *CWGT* | Yes | 1.818182 | 224,826,753 | 18,444 | 10,294 | 1.7917234 | 221,555,038 | 1.818017767 |
| Module D | *MWGT* | | 1.818182 | 224,826,753 | 12,518 | 6,808 | 1.8387191 | 227,366,273 | |
| Module A | *MWGT* | | 2.222222 | 224,826,726 | 12,518 | 5,542 | 2.2587514 | 228,522,485 | |
| Module B | *MWGT* | | 2.222222 | 224,826,726 | 12,518 | 5,700 | 2.1961403 | 222,187,985 | 2.22744585 |
| Module X | *MWGT* | | 1 | 224,826,753 | 12,518 | 12,518 | 1 | 224,826,753 | 1 |
| **2012*** | | | | | | | | | |
| Core 1 | *PWOWGT* | Yes | 1 | 234,993,536 | 18,051^ | 18,064^ | 0.9992803 | 234,824,427 | 0.99928034 |
| Core 2 | *PWTWGT* | Yes | 1 | 234,993,536 | 17,684^ | 17,701^ | 0.9990396 | 234,767,856 | 0.99903960 |
| Module A2 | *PWAWGT* | | 1 | 234,993,536 | 9,707 | 9,707 | 1 | 234,993,536 | 1 |
| Module A1 | *PWSWGT* | Yes | 1.75 | 234,993,536 | 25,052 | 14,308 | 1.7509086 | 235,115,538 | 1.7526866 |
| Module D | *PWSWGT* | Yes | 1.75 | 234,993,536 | 25,052 | 14,279 | 1.7544646 | 235,593,059 | |
| Module B | *PWNWGT* | | 2.25 | 234,993,562 | 21,971 | 9,671 | 2.2718437 | 237,274,949 | |
| Module C | *PWNWGT* | | 2.25 | 234,993,562 | 21,971 | 9,835 | 2.2339604 | 233,318,357 | 2.249400167 |
| Module E | *PWNWGT* | | 2.25 | 234,993,562 | 21,971 | 9,798 | 2.2423964 | 234,199,423 | |
| **2017** | | | | | | | | | |
| Core 1 | *PWSUPWGT* | -- | 2 | 246,718,267 | 17,611 | 8,844 | 1.9912935 | 245,644,237 | 2.0000382 |
| Core 2 | *PWSUPWGT* | -- | 2 | 246,718,267 | 17,611 | 8,767 | 2.0087829 | 247,801,708 | |
| Module A | *PWSUPWGT* | -- | 2.5 | 246,718,267 | 17,611 | 6,954 | 2.5324993 | 249,925,520 | |
| Module B | *PWSUPWGT* | -- | 2.5 | 246,718,267 | 17,611 | 7,073 | 2.4898911 | 245,720,652 | |
| Module C | *PWSUPWGT* | -- | 2.5 | 246,718,267 | 17,611 | 7,070 | 2.4909477 | 245,824,906 | 2.50015994 |
| Module D | *PWSUPWGT* | -- | 2.5 | 246,718,267 | 17,611 | 7,010 | 2.5122683 | 247,928,979 | |
| Module E | *PWSUPWGT* | -- | 2.5 | 246,718,267 | 17,611 | 7,115 | 2.4751933 | 244,270,157 | |

* Note that the adjustment factors for Module A1 and D are swapped with those for Module B, C, and E in the original documentation.
  The correct adjustment factors are printed here.

^There are 13 records in Core 1 and 17 records in Core 2 that have valid responses but 0 weight values

Table 4. Reproduced Cross-Module Adjustment Factors for Public Participation in the Arts Supplement, 2008

| Core and Module Combinations | Base Weight | Census Adjustment Factor | Calculated Adjustment Factor | Approximate Proportion of Respondents in All Cores and Modules | Averaged Calculated Adjustment Factors |
|---|---|---|---|---|---|
| Core and X | MWGT | 1 | 1.0000 | 1.000 | 1.0000 |
| Core 1 and Module A | MWGT | 2.222222 | 2.2588 | 0.443 | 2.2274 |
| Core 1 and Module B | MWGT | 2.222222 | 2.1961 | 0.455 | |
| Module A and X | MWGT | 2.222222 | 2.2588 | 0.443 | |
| Module B and X | MWGT | 2.222222 | 2.1961 | 0.455 | |
| Core and Module A and X | MWGT | 2.222222 | 2.2588 | 0.443 | |
| Core and Module B and X | MWGT | 2.222222 | 2.1961 | 0.455 | |
| Module A and Module B | MWGT | 12 | 11.5907 | 0.086 | 11.5907 |
| Module A and Module B and Core | MWGT | 12 | 11.5907 | 0.086 | |
| Module A and Module B and X | MWGT | 12 | 11.5907 | 0.086 | |
| Module A and Module B and Core and X | MWGT | 12 | 11.5907 | 0.086 | |
| Core 1 and Module C | CWGT | 1.818182 | 1.7917 | 0.558 | 1.8180 |
| Core and Special Core | CWGT | 1.818182 | 1.8236 | 0.548 | |
| Core 1 and Module D | MWGT | 1.818182 | 1.8387 | 0.544 | |
| Module C and X | MWGT | 1.818182 | 1.7919 | 0.558 | |
| Module D and X | MWGT | 1.818182 | 1.8387 | 0.544 | |
| Core and Module C and X | MWGT | 1.818182 | 1.7919 | 0.558 | |
| Core and Module D and X | MWGT | 1.818182 | 1.8387 | 0.544 | |
| Core and Special Core and X | MWGT | 1.818182 | 1.8288 | 0.547 | |
| Module A and Module C | MWGT | 5.454545 | 5.4855 | 0.182 | 5.4764 |
| Module A and Module D | MWGT | 5.454545 | 5.7422 | 0.174 | |
| Module B and Module C | MWGT | 5.454545 | 5.3313 | 0.188 | |
| Module B and Module D | MWGT | 5.454545 | 5.5097 | 0.181 | |
| Module C and Module D | MWGT | 5.454545 | 5.3132 | 0.188 | |
| Module A and Module C and Core | MWGT | 5.454545 | 5.4855 | 0.182 | |
| Module A and Module D and Core | MWGT | 5.454545 | 5.7422 | 0.174 | |
| Module B and Module C and Core | MWGT | 5.454545 | 5.3313 | 0.188 | |
| Module B and Module D and Core | MWGT | 5.454545 | 5.5097 | 0.181 | |
| Module C and Module D and Core | MWGT | 5.454545 | 5.3132 | 0.188 | |
| Module A and Module C and X | MWGT | 5.454545 | 5.4855 | 0.182 | |
| Module A and Module D and X | MWGT | 5.454545 | 5.7422 | 0.174 | |
| Module B and Module C and X | MWGT | 5.454545 | 5.3313 | 0.188 | |
| Module B and Module D and X | MWGT | 5.454545 | 5.5097 | 0.181 | |
| Module C and Module D and X | MWGT | 5.454545 | 5.3132 | 0.188 | |
| Module A and Module C and Core and X | MWGT | 5.454545 | 5.4855 | 0.182 | |
| Module A and Module D and Core and X | MWGT | 5.454545 | 5.7422 | 0.174 | |
| Module B and Module C and Core and X | MWGT | 5.454545 | 5.3313 | 0.188 | |
| Module B and Module D and Core and X | MWGT | 5.454545 | 5.5097 | 0.181 | |
| Module C and Module D and Core and X | MWGT | 5.454545 | 5.3132 | 0.188 | |
| Special Core and Module A | MWGT | 4 | 4.1016 | 0.244 | 4.0601 |
| Special Core and Module B | MWGT | 4 | 4.0186 | 0.249 | |
| Special Core and Module A and Core | MWGT | 4 | 4.1016 | 0.244 | |
| Special Core and Module B and Core | MWGT | 4 | 4.0186 | 0.249 | |
| Special Core and Module A and X | MWGT | 4 | 4.1016 | 0.244 | |
| Special Core and Module B and X | MWGT | 4 | 4.0186 | 0.249 | |

| | | | | | |
|---|---|---|---|---|---|
| Special Core  and Module A and Core and X | *MWGT* | 4 | 4.1016 | 0.244 | |
| Special Core  and Module B and Core and X | *MWGT* | 4 | 4.0186 | 0.249 | |
| Special Core  and Module C | *CWGT* | 3.333333 | 3.2615 | 0.307 | 3.3239 |
| Core and Special Core  and Module C | *CWGT* | 3.333333 | 3.2615 | 0.307 | |
| Special Core  and Module D | *MWGT* | 3.333333 | 3.3769 | 0.296 | |
| Core and Special Core  and Module D | *MWGT* | 3.333333 | 3.3769 | 0.296 | |
|  X and Special Core  and Module D | *MWGT* | 3.333333 | 3.3769 | 0.296 | |
| Core and X and Special Core  and Module D | *MWGT* | 3.333333 | 3.3769 | 0.296 | |
| X and Special Core  and Module C | *MWGT* | 3.333333 | 3.2804 | 0.305 | |
| Core and X and Special Core  and Module C | *MWGT* | 3.333333 | 3.2804 | 0.305 | |
| Special Core  and Module A and Module B | *MWGT* | 20 | 19.7134 | 0.051 | 19.7134 |
| Special Core  and Module A and Module B and Core | *MWGT* | 20 | 19.7134 | 0.051 | |
| Special Core  and Module A and Module B and X | *MWGT* | 20 | 19.7134 | 0.051 | |
| Special Core  and Module A and Module B and Core and X | *MWGT* | 20 | 19.7134 | 0.051 | |
| Special Core  and Module A and Module C | *MWGT* | 10 | 10.2775 | 0.097 | 10.0937 |
| Special Core  and Module A and Module D | *MWGT* | 10 | 10.4404 | 0.096 | |
| Special Core  and Module B and Module C | *MWGT* | 10 | 9.7416 | 0.103 | |
| Special Core  and Module B and Module D | *MWGT* | 10 | 10.4753 | 0.095 | |
| Special Core  and Module C and Module D | *MWGT* | 10 | 9.5339 | 0.105 | |
| Special Core  and Module A and Module C and Core | *MWGT* | 10 | 10.2775 | 0.097 | |
| Special Core  and Module A and Module D and Core | *MWGT* | 10 | 10.4404 | 0.096 | |
| Special Core  and Module B and Module C and Core | *MWGT* | 10 | 9.7416 | 0.103 | |
| Special Core  and Module B and Module D and Core | *MWGT* | 10 | 10.4753 | 0.095 | |
| Special Core  and Module C and Module D and Core | *MWGT* | 10 | 9.5339 | 0.105 | |
| Special Core  and Module A and Module C and X | *MWGT* | 10 | 10.2775 | 0.097 | |
| Special Core  and Module A and Module D and X | *MWGT* | 10 | 10.4404 | 0.096 | |
| Special Core  and Module B and Module C and X | *MWGT* | 10 | 9.7416 | 0.103 | |
| Special Core  and Module B and Module D and X | *MWGT* | 10 | 10.4753 | 0.095 | |
| Special Core  and Module C and Module D and X | *MWGT* | 10 | 9.5339 | 0.105 | |
| Special Core  and Module A and Module C and Core and X | *MWGT* | 10 | 10.2775 | 0.097 | |
| Special Core  and Module A and Module D and Core and X | *MWGT* | 10 | 10.4404 | 0.096 | |
| Special Core  and Module B and Module C and Core and X | *MWGT* | 10 | 9.7416 | 0.103 | |
| Special Core  and Module B and Module D and Core and X | *MWGT* | 10 | 10.4753 | 0.095 | |
| Special Core  and Module C and Module D and Core and X | *MWGT* | 10 | 9.5339 | 0.105 | |

Table 5. Reproduced Cross-Module Adjustment Factors for Public Participation in the Arts Supplement, 2017

| Core and Module Combinations | Base Weight | Census Adjustment Factor | Calculated Adjustment Factor | Approximate Proportion of Respondents in All Cores and Modules | Averaged Calculated Adjustment Factors |
|---|---|---|---|---|---|
| Core 1 and Module A | PWOWGT | 5 | 5.2429 | 0.191 | 5.0278 |
| Core 2 and Module A | PWOWGT | 5 | 5.1570 | 0.194 | |
| Core 1 Module B | PWOWGT | 5 | 5.0534 | 0.198 | |
| Core 2 Module B | PWOWGT | 5 | 4.9083 | 0.204 | |
| Core 1 Module C | PWOWGT | 5 | 4.9989 | 0.200 | |
| Core 2 and Module C | PWOWGT | 5 | 4.9650 | 0.201 | |
| Core 1 and Module D | PWOWGT | 5 | 4.9539 | 0.202 | |
| Core 2 and Module D | PWOWGT | 5 | 5.0973 | 0.196 | |
| Core 1 and Module E | PWOWGT | 5 | 4.9110 | 0.204 | |
| Core 2 and Module E | PWOWGT | 5 | 4.9904 | 0.200 | |
| Module A and Module B | PWOWGT | 10 | 10.3290 | 0.097 | 10.0040 |
| Module A and Module C | PWOWGT | 10 | 9.9610 | 0.100 | |
| Module A and Module D | PWOWGT | 10 | 10.0290 | 0.100 | |
| Module B and Module C | PWOWGT | 10 | 9.8994 | 0.101 | |
| Module B and Module D | PWOWGT | 10 | 9.9385 | 0.101 | |
| Module C and Module D | PWOWGT | 10 | 10.2628 | 0.097 | |
| Module A and Module E | PWOWGT | 10 | 10.2093 | 0.098 | |
| Module B and Module E | PWOWGT | 10 | 9.6924 | 0.103 | |
| Module C and Module E | PWOWGT | 10 | 9.7460 | 0.103 | |
| Module D and Module E | PWOWGT | 10 | 9.9723 | 0.100 | |
| Module A and Module B and Core 1 | PWOWGT | 20 | 21.1163 | 0.047 | 20.0214 |
| Module A and Module B and Core 2 | PWOWGT | 20 | 20.2193 | 0.049 | |
| Module A and Module C and Core 1 | PWOWGT | 20 | 19.4812 | 0.051 | |
| Module A and Module C and Core 2 | PWOWGT | 20 | 20.3831 | 0.049 | |
| Module A and Module D and Core 1 | PWOWGT | 20 | 19.0802 | 0.052 | |
| Module A and Module D and Core 2 | PWOWGT | 20 | 21.1417 | 0.047 | |
| Module B and Module C and Core 1 | PWOWGT | 20 | 19.9671 | 0.050 | |
| Module B and Module C and Core 2 | PWOWGT | 20 | 19.6332 | 0.051 | |
| Module B and Module D and Core 1 | PWOWGT | 20 | 20.0125 | 0.050 | |
| Module B and Module D and Core 2 | PWOWGT | 20 | 19.7433 | 0.051 | |
| Module C and Module D and Core 1 | PWOWGT | 20 | 21.0910 | 0.047 | |
| Module C and Module D and Core 2 | PWOWGT | 20 | 19.9898 | 0.050 | |
| Module B and Module E and Core 1 | PWOWGT | 20 | 19.8099 | 0.050 | |
| Module B and Module E and Core 2 | PWOWGT | 20 | 18.9774 | 0.053 | |
| Module C and Module E and Core 1 | PWOWGT | 20 | 19.5244 | 0.051 | |
| Module C and Module E and Core 2 | PWOWGT | 20 | 19.4597 | 0.051 | |
| Module A and Module E and Core 1 | PWOWGT | 20 | 20.0581 | 0.050 | |
| Module A and Module E and Core 2 | PWOWGT | 20 | 20.7922 | 0.048 | |
| Module D and Module E and Core 1 | PWOWGT | 20 | 19.2050 | 0.052 | |
| Module D and Module E and Core 2 | PWOWGT | 20 | 20.7432 | 0.048 | |

Table 6. Calculated Cross-Module Adjustment Factors for Public Participation in the Arts Supplement, 2012

| Core and Module Combinations | Base Weight | Numerator (N Potential Respondents) | Denominator (N Responded to Combination) | Calculated Adjustment Factor | Approximate Proportion of Potential Respondents | Averaged Calculated Adjustment Factors |
|---|---|---|---|---|---|---|
| Core Question and Module A1 | PWSWGT | 25,052 | 7,218 | 3.470767 | 0.288 | 3.505564250 |
| Core 2 Question and Module A1 | PWSWGT | 25,052 | 7,090 | 3.533427 | 0.283 | |
| Core Question and Module D | PWSWGT | 25,052 | 7,178 | 3.490109 | 0.287 | |
| Core 2 Question and Module D | PWSWGT | 25,052 | 7,101 | 3.527954 | 0.284 | |
| Module A1 and Module D | PWSWGT | 25,052 | 3,535 | 7.086846 | 0.141 | 7.086846000 |
| Module A1 and Module B | PWNWGT | 21,971 | 2,407 | 9.127960 | 0.110 | 9.001224222 |
| Module A1 and Module C | PWNWGT | 21,971 | 2,462 | 8.924046 | 0.112 | |
| Module A1 and Module E | PWNWGT | 21,971 | 2,456 | 8.945847 | 0.112 | |
| Module B and Module D | PWNWGT | 21,971 | 2,419 | 9.082679 | 0.110 | |
| Module C and Module D | PWNWGT | 21,971 | 2,476 | 8.873587 | 0.113 | |
| Module D and Module E | PWNWGT | 21,971 | 2,418 | 9.086435 | 0.110 | |
| Module B and Module C | PWNWGT | 21,971 | 2,409 | 9.120382 | 0.110 | |
| Module B and Module E | PWNWGT | 21,971 | 2,436 | 9.019294 | 0.110 | |
| Module C and Module E | PWNWGT | 21,971 | 2,488 | 8.830788 | 0.113 | |
| Core Question and Module B | PWNWGT | 21,971 | 4,885 | 4.497646 | 0.222 | 4.499693833 |
| Core 2 Question and Module B | PWNWGT | 21,971 | 4,786 | 4.590681 | 0.218 | |
| Core Question and Module C | PWNWGT | 21,971 | 5,024 | 4.373209 | 0.229 | |
| Core 2 Question and Module C | PWNWGT | 21,971 | 4,811 | 4.566826 | 0.219 | |
| Core and Module E | PWNWGT | 21,971 | 4,923 | 4.462929 | 0.224 | |
| Core 2 and Module E | PWNWGT | 21,971 | 4,875 | 4.506872 | 0.222 | |
| Core and Module A2 | PWAWGT | 9,707 | 4,883 | 1.987917 | 0.503 | 2.0000735 |
| Core 2 and Module A2 | PWAWGT | 9,707 | 4,824 | 2.012230 | 0.497 | |
| Module A2 and A1 | PWAWGT | 9,707 | 9,707 | 1 | 1.000 | 1 |
| Module A2 and D | PWAWGT | 9,707 | 2,382 | 4.075147 | 0.245 | 4.00076475 |
| Module A2 and B | PWAWGT | 9,707 | 2,407 | 4.032821 | 0.248 | |
| Module A2 and C | PWAWGT | 9,707 | 2,462 | 3.942729 | 0.254 | |
| Module A2 and E | PWAWGT | 9,707 | 2,456 | 3.952362 | 0.253 | |
| Module A1 and Module B and Core | PWNWGT | 21,971 | 1,197 | 18.35505 | 0.054 | 18.00740556 |
| Module A1 and Module C and Core | PWNWGT | 21,971 | 1,252 | 17.54872 | 0.057 | |
| Core and Module A1 and Module E | PWNWGT | 21,971 | 1,240 | 17.71855 | 0.056 | |
| Module A1 and Module B and Core 2 | PWNWGT | 21,971 | 1,210 | 18.15785 | 0.055 | |
| Module A1 and Module C and Core 2 | PWNWGT | 21,971 | 1,210 | 18.15785 | 0.055 | |
| Core 2 and Module A1 and Module E | PWNWGT | 21,971 | 1,216 | 18.06826 | 0.055 | |
| Module B and Module C and Core | PWNWGT | 21,971 | 1,239 | 17.73285 | 0.056 | |
| Module B and Module D and Core | PWNWGT | 21,971 | 1,227 | 17.90627 | 0.056 | |
| Core and Module B and Module E | PWNWGT | 21,971 | 1,222 | 17.97954 | 0.056 | |
| Module B and Module C and Core 2 | PWNWGT | 21,971 | 1,170 | 18.77863 | 0.053 | |
| Module B and Module D and Core 2 | PWNWGT | 21,971 | 1,192 | 18.43205 | 0.054 | |
| Core 2 and Module B and Module E | PWNWGT | 21,971 | 1,214 | 18.09802 | 0.055 | |
| Module C and Module D and Core | PWNWGT | 21,971 | 1,265 | 17.36838 | 0.058 | |
| Core and Module C and Module E | PWNWGT | 21,971 | 1,268 | 17.32729 | 0.058 | |
| Module C and Module D and Core 2 | PWNWGT | 21,971 | 1,211 | 18.14286 | 0.055 | |
| Core 2 and Module C and Module E | PWNWGT | 21,971 | 1,220 | 18.00902 | 0.056 | |
| Core and Module D and Module E | PWNWGT | 21,971 | 1,193 | 18.41660 | 0.054 | |
| Core 2 and Module D and Module E | PWNWGT | 21,971 | 1,225 | 17.93551 | 0.056 | |
| Module A1 and Module D and Core | PWSWGT | 25,052 | 1,788 | 14.01119 | 0.071 | 14.1756 |
| Module A1 and Module D and Core 2 | PWSWGT | 25,052 | 1,747 | 14.34001 | 0.070 | |
| Module A2 and Module D and Core | PWAWGT | 9,707 | 1,194 | 8.129816 | 0.123 | 8.1503455 |
| Module A2 and Module D and Core 2 | PWAWGT | 9,707 | 1,188 | 8.170875 | 0.122 | |

Table 7. IPUMS CPS Public Arts Supplement Weight Construction, 2008, 2012, 2017

| Core or Module | IPUMS CPS Weight | 2008 | 2012 | 2017 |
|---|---|---|---|---|
| Core 1 | PASUPPWT | *CWGT* | *PWOWGT* | *PWSUPPWT* * 2 |
| Core 2 | PASUPPWT2 | -- | *PWTWGT* | *PWSUPPWT* * 2 |
| Special Core | PASUPPWT2 | *CWGT* * 1.818182 | -- | -- |
| Module A | PASUPPWTA | *MWGT* * 2.22222 | -- | N/A^ |
| Module A1 | PASUPPWTA | -- | *PWSWGT* * 1.75 | -- |
| Module A2 | PASUPPWTA2 | -- | *PWAWGT* | -- |
| Module B | PASUPPWTB | *MWGT* * 2.22222 | *PWNWGT* * 2.25 | *PWSUPPWT* * 2.5 |
| Module C | PASUPPWTC | *CWGT* * 1.818182 | *PWNWGT* * 2.25 | *PWSUPPWT* * 2.5 |
| Module D | PASUPPWTD | *MWGT* * 1.818182 | *PWSWGT* * 1.75 | *PWSUPPWT* * 2.5 |
| Module E | PASUPPWTE | -- | *PWNWGT* * 2.25 | *PWSUPPWT* * 2.5 |
| Module X | PASUPPWTX | *MWGT* | -- | -- |

^ IPUMS CPS does not currently offer harmonized variables from these cores and modules.

Table 8. IPUMS CPS Public Arts Variable Locations and Weights by Year

| Variable | 2008 | | 2012 | | 2017 | | Cross-time weight |
|---|---|---|---|---|---|---|---|
| | location | weight | location | weight | location | weight | |
| PAAPRLYR | Module D | PASUPPWTD | -- | -- | -- | -- | User-generated |
| PBALLET | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PBALLETN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PBOOK | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PBOOKN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PCHILDATTN12M | Module X | PASUPPWT | Module E | PASUPWTE | Module E | PASUPWTE | User-generated |
| PCLASS | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PCLASSN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PCRAFT | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PCRWRT | Module C | PASUPPWTC | Module C | PASUPPWTC | Module C | PASUPPWTC | PASUPPWTC |
| PDANCE | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PDANCEN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PFESTIVAL | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PGARDEN | Module C | PASUPPWTC | Module D | PASUPPWTD | Module D | PASUPPWTD | User-generated |
| PHIS | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PHOURTV | Module C | PASUPPWTC | Module B | PASUPPWTB | -- | -- | User-generated |
| PINTERNET | Module B | PASUPPWTB | Module B | PASUPPWTB | -- | -- | PASUPPWTB |
| PINTERNETO | Module B | PASUPPWTB | Module B | PASUPPWTB | -- | -- | PASUPPWTB |
| PJAZZ | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PJAZZN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PLIKEBGRAS | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKEBLUES | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKECLASS | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKECNTRY | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKECROCK | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKEFOLK | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKEGSPL | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKEJAZZ | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKELATIN | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PLIKEMUS | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKEOP | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PLIKERAP | Module A | PASUPPWTA | Module A2 | PASUPPWTA2 | -- | -- | User-generated |
| PMOVIES | Module C | PASUPPWTC | Module A1 | PASUPPWTA | Module D | PASUPPWTD | User-generated |
| PMUSEUM | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PMUSEUMN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PMUSICAL | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PMUSLYR | Module D | PASUPPWTD | Module E | PASUPPWTE | -- | -- | User-generated |
| PNMUS | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PNMUSN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PNOVEL | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| POPERA | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| POPERAN | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| POUTDOOR | Module C | PASUPPWTC | Module D | PASUPPWTD | Module D | PASUPPWTD | User-generated |
| POWNART | Module C | PASUPPWTC | Module D | PASUPPWTD | -- | -- | User-generated |
| PPAINT | Module C | PASUPPWTC | Module C | PASUPPWTC | Module C | PASUPPWTC | PASUPPWTC |
| PPHOTO | Module C | PASUPPWTC | Module C | PASUPPWTC | Module C | PASUPPWTC | PASUPPWTC |
| PPLAY | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PPOETRY | Core | PASUPPWT | Core 1 | PASUPPWT | Core 1 | PASUPPWT | PASUPPWT |
| PPOTTERY | Module C | PASUPPWTC | Module D | PASUPPWTD | Module C | PASUPPWTC | User-generated |
| PPRIVLESS | Module X | PASUPPWTX | Module E | PASUPPWTE | Module E | PASUPPWTE | User-generated |
| PSALSA | Special Core | PASUPPWT2 | Core 1 | PASUPPWT | Core 1 | PASUPPWT | User-generated |
| PSALSAN | Special Core | PASUPPWT2 | Core 1 | PASUPPWT | Core 1 | PASUPPWT | User-generated |
| PSPACT | Module C | PASUPPWTC | Module D | PASUPPWTD | Module D | PASUPPWTD | User-generated |
| PSPORT | Module C | PASUPPWTC | Module A1 | PASUPPWTA | Module D | PASUPPWTD | User-generated |
| PVISLYR | Module D | PASUPPWTD | Module E | PASUPPWTE | Module E | PASUPPWTE | User-generated |
| PVOLUNTEER | Module C | PASUPPWTC | Module D | PASUPPWTD | -- | -- | User-generated |
| PWEAVE | Module C | PASUPPWTC | Module D | PASUPPWTD | Module C | PASUPPWTC | User-generated |
| PWRTLYR | Module D | PASUPPWTD | Module E | PASUPPWTE | Module E | PASUPPWTE | User-generated |
| PLIVMUS | -- | -- | Core 2 | PASUPPWT2 | Core 2 | PASUPPWT2 | PASUPPWT2 |

Table 9. IPUMS CPS harmonized
weights for PMOVIES across time

| Year | IPUMS CPS Weight |
|------|------------------|
| 2002 | PASUPPWT |
| 2008 | PASUPPWTC |
| 2012 | PASUPPWTA |
| 2013 | PASUPPWT |
| 2015 | PASUPPWT |
| 2017 | PASUPPWTD |

Table 10. Census Bureau and IPUMS CPS Unharmonized Weight Crosswalk, Public Participation in the Arts, 2008, 2012, and 2017

| Core or Module | 2008 | | 2012 | | 2017 | |
|---|---|---|---|---|---|---|
| | Census Bureau Base Weight | IPUMS Unharmonized Base Weight | Census Bureau Base Weight | IPUMS Unharmonized Base Weight | Census Bureau Base Weight | IPUMS Unharmonized Base Weight |
| Core 1 | *CWGT* | UH_CWGT_S1 | *PWOWGT* | UH_PWOWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Core 2 | -- | -- | *PWTWGT* | UH_PWTWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Special Core | *CWGT* | UH_CWGT_S1 | -- | -- | -- | -- |
| Module A | *MWGT* | UH_MWGT_S1 | -- | -- | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Module A1 | -- | -- | *PWSWGT* | UH_PWSWGT_S1 | -- | -- |
| Module A2 | -- | -- | *PWAWGT* | UH_PWAWGT_S1 | -- | -- |
| Module B | *MWGT* | UH_MWGT_S1 | *PWNWGT* | UH_PWNWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Module C | *CWGT* | UH_CWGT_S1 | *PWNWGT* | UH_PWNWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Module D | *MWGT* | UH_MWGT_S1 | *PWSWGT* | UH_PWSWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Module E | -- | -- | *PWNWGT* | UH_PWNWGT_S1 | *PWSUPWGT* | UH_PWSUPWGT_S1 |
| Module X | *MWGT* | UH_MWGT_S1 | -- | -- | -- | -- |