Getting a Grip
The Question of Dollarware Handle Design

Sarah Bedard
Department of Anthropology, McGill University

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Abstract: This study aimed to determine the practicality of handle design in dollarware specimens and to compare the results to the practicality of handle design in a comparative collection of higher quality mugs. Three tests involving metric and temperature data of mug bodies and mug handles were performed to determine the functionality of handle design. Statistical analyses were then applied to the data, the results of which indicated that neither dollarware nor the comparative collection is practically well designed. Since there is no difference in practical design between mugs of lower and higher quality, it is reasonable to believe that the merits of a mug and its quality are judged not on the basis of functional design but on some other criterion or criteria.

Introduction

There does not seem to be an extensive amount of research on ceramics with regards to practicality. Ceramics of various descriptions have undergone extensive study with regards to aesthetic properties and the significance of ceramic aesthetic design within a given culture (Bray 2003). However, while the function of many other artifacts has been intensely studied, there seems to be a limited amount of literature on the purely functional properties of ceramics (Bray 2003). There have been some efforts to study food related artifacts as tools (Braun 1983, Skibo and Schiffer 1995), but the list is hardly extensive. In the past, many cooking related artifacts have been viewed as pertaining only to household and women's activities and consequently as having limited bearing on societies in general (Bray 2003). However, some scholars believe that the issue of function and design in food related artifacts, such as dollarware, can provide important information that can be extrapolated to indicate trends in societies and cultures more generally (Bray 2003). It is hopeful that this study can provide as starting point for a larger discussion about the contemporary urban context from which dollarware has come by determining the practicality and functionality of dollarware mugs in comparison to mugs considered to be of higher quality. The aim of this study is to determine whether mugs are designed with practicality as the chief aim. Furthermore, this study will establish if practicality is a factor that leads consumers to rate a mug as of high or low quality. By investigating the motivations for producers to create mugs in a certain way, this study will extrapolate to discuss cultural realities about the society from which they came.

Methods

Mug handle practicality was judged based on three assessments relating to the basic function of handles. The purpose of a handle is both to make the mug easier to grasp and to protect the user's hand from the heat of the mug body if it contains a hot beverage. The first assessment was intended to measure the ease with which a mug may be grasped and held. The mass of the mug when filled with water was determined by adding the mass of each mug and its capacity. This was compared with the maximum length of the handle of each mug. The mass and capacity of each mug were part of the basic measurements taken jointly by other students. The sum of these two measurements will be referred to as total mass. To determine handle length, mugs were divided into two categories: those with half-heart shaped handles and those with C-shaped handles. Those with half-heart shaped handles were measured from the point farthest from the body of the mug to the opposite corner (attached to the mug body) to get longest possible measurement. Mugs with C-shaped handles were measured vertically, in these cases the longest possible measurement. These measurements were then compared to each other to determine if there was any correlation between total mass and handle length.

The second and third assessments evaluated the handle in relation to temperature. To measure temperature, a 10% sample of the dollarware collection and a 35% sample of the Value Village collection was filled with boiling water. First the temperature of the outer surface of the body of the mug, taken in the middle between the two handle attachment sites, was taken. Then the handle temperature (after a time delay to facilitate heat transfer) was measured at the point farthest from the body of the mug on the inner surface of the handle. Both temperatures were measured using a digital thermometer. For the second assessment, the width of handle was compared to body temperature of the mug. Maximum handle width, like handle length, was taken using a calliper.

The third and final assessment involved the temperature of the handle and the body of the mug. To determine if there was a statistically significant difference between the dollarware and the Value Village collections, t-tests were applied to the mean difference between body temperature and handle temperature from both collections, and the mean handle temperature of each collection.

Results

For assessment 1, it was hypothesized that if mugs were indeed designed practically, there would be a positive correlation between total mass and maximum length. The longer the maximum length of the handle, the easier the mug is to hold since the mug's weight can be more evenly distributed across the hand. A ratio of total mass to maximum handle length allowed for effective comparisons between the dollarware collection and Value Village comparative collection. In the dollarware collection, there was a positive correlation between total mass and handle length (figure 1). The linear regression showed R^2 = 0.3921, indicating a statistically significant relationship between the two variables. In the Value Village collection, there was no statistically significant relationship between total mass and handle length, as demonstrated by a linear regression with R^2 = 0.166 (figure 2).

In assessment 2, it was hypothesized that if mugs were designed for maximum functionality, there would be a positive correlation between body temperature of mug when filled with boiling water and the width of the handle. The greater the width of the handle, the farther the user's fingers are placed away from the hot mug body. There was no correlation between these two variables in the dollarware collection (figure 3). The linear regression for the scatter plot of body temperature vs. handle width had R^2 = 0.0137, indicating no statistically significant relationship. The linear regression on the graph for Value Village body temperature vs. handle width similarly indicated no statistically significant results with R^2 = 0.0054 (figure 4).

For the third assessment handle temperature was used to determine practicality in two ways: firstly, the temperature of the handle when the mug is in use was measured and compared with handle temperature of other mugs; secondly, how the handle performed its function of remaining cooler than the body of the mug to which it is attached was examined. On this first criterion, the lower the temperature of the handle the more effective the handle is; on the second criterion, the greater the difference between mug body and mug handle the better. The temperature of the handle allows one to examine the objective properties of the handle, while the difference in temperatures facilitates a study of the handle in the context of the mug to which it is attached. The dollarware mean handle temperature was found to be 27.5 °C (figure 5), while the Value Village mean handle temperature was found to be 28.2 °C (figure 6). First an f-test (figure 7) then a t-test (figure 8) were performed on the data, and from this it was determined that there was no statistically significant difference between the mean handle temperatures of the dollarware and Value Village collections (t= 2.01802, p= 0.116177). The dollarware mean difference of temperature between body of mug and handle was 30.0 °C (figure 9), while the Value Village mean difference of temperature between body of mug and handle was 28.2 °C (figure 10). First an f-test (figure 11) then a t-test (figure 12) were performed on the data, and from this it was determined that there was no statistically significant difference between the mean difference of temperature between body of mug and handle of the dollarware and Value Village collections (t= 2.01802, p= 0.378607).

Discussion

After conducting the three different assessments, it may be said that neither dollarware nor Value Village ceramic drinking vessel handles are designed with the chief aim of being practical for the user. In the first assessment, results demonstrated that in the dollarware collection there was a statistically significant relationship between total mass and handle length. However, the Value Village collection showed no meaningful relationship between total mass and handle length. The second assessment showed that there was no statistically significant difference between the mean difference between body and handle temperature in dollarware and Value Village vessels. The third assessment demonstrated that there is no correlation between mug body temperature and handle width in either the dollarware or the Value Village collections.

Based on the first assessment, it would seem as though dollarware mugs are designed more practically than Value Village vessels. It would seem that ceramic drinking vessels of a higher quality – those of the Value Village collection – are not considered higher quality because of a positive correlation between total mass and handle length. Rather, it is on some other basis that the comparative collection is considered higher quality. However, it is possible that an insufficient number of Value Village specimens were tested to establish a meaningful representation of the properties of mugs of higher quality than the dollarware collection, although it should be noted that 84% of the Value Village collection was evaluated. It could be that the mugs donated to Value Village from various individual collections were given away precisely because they are of undesirably low quality and practicality. It is also possible that the more practical and higher quality mugs were removed from the site prior to this excavation by customers who sought to buy mugs with the most practical handle design. Additionally, there is no way to determine that the Value Village collection is not itself comprised of drinking vessels that were originally dollarware. It is unlikely that all the mugs purchased from Value Village originated in dollar stores, but there is no way to determine how many, if any, are essentially dollarware removed from its original location.

In the second assessment, no statistically significant relationship appeared between the two variables of temperature of the main body of the vessel and the width of the handle, indicating that manufacturers do not account for exposure of the user's fingers to heat when designing handles for their products. Indeed, there was no evidence of a trend or correlation between the two variables in either collection. Since both collections were composed of vessels with similar body temperatures (figures 14-17); all the mugs, regardless of assumed quality, were equally poorly designed; consequently, handle width would affect the practicality of all mug regardless the collection which they belonged. The reliability of this third assessment depends upon the same factors as the first.

The third assessment, which contrasted the practicality of handle design in dollarware and Value Village specimens, demonstrated that there was no statistically significant difference between the mean difference between body and handle temperature in the two collections. There was no statistically significant difference in either mean handle temperature or mean difference between body and handle temperature for the dollarware and Value Village collections. From this data, one could conclude that the comparative collection of seemingly higher quality mugs is not designed more pragmatically than those from dollarware assemblages. This test, like the previous ones, is subject to the same potential for inaccuracy as the previous tests.

As discussed above, there are many potential causes for inaccurate results including methodological error. One potential flaw in methodology was that there was not a standard time after which the handle temperature was measured. Rather, it was measured as soon as the mug body temperature was obtained (that is, after the mug body had reached its maximum temperature). However, if it is assumed that the data and its analysis are correct, some meaningful conclusions can be drawn. In this case, the Value Village mugs were likely more expensive, came from more reputable stores than dollarware, and are considered by consumers to be of higher quality than their dollarware equivalents. However, investigation has revealed that the handles of Value Village mugs are no better functionally designed than dollarware. For the purposes of this discussion, ceramic drinking vessel handle practicality will be taken as representative of mug practicality in general since the addition of a handle to a vessel is ostensibly for the purpose of increasing its practicality. Although the Value Village mugs are considered better quality, they are not functionally superior to supposedly inferior quality mugs. This begs the question, is quality determined on a different basis than functionality, or are customers being deceived? Perhaps the consumer assumes that a more expensive mug will be more practical and deems it to be of better quality on the sole basis that it is more expensive. If this is the case, the issue of mug handle practicality raises important issues about the disjunction between the consumer and the producer. In this scenario, he consumer knows little about the products he or she is purchasing; this allows the producer and vendor to sell vessels of identical quality for different prices, hereby taking advantage of the consumers' ignorance and trust. Another possibility is that the consumer does not judge the quality of mug based on practical concerns. Rather, the appearance of the mug causes the consumer to rate one mug of a higher quality than another. The validity of this statement is beyond the scope of this study. Additional information about the aesthetic attractiveness of dollarware mugs and of mugs considered higher quality could be used in a more comprehensive study to determine whether appearance determines a quality mug and is the chief motivation for mug design.

References

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Appendix A

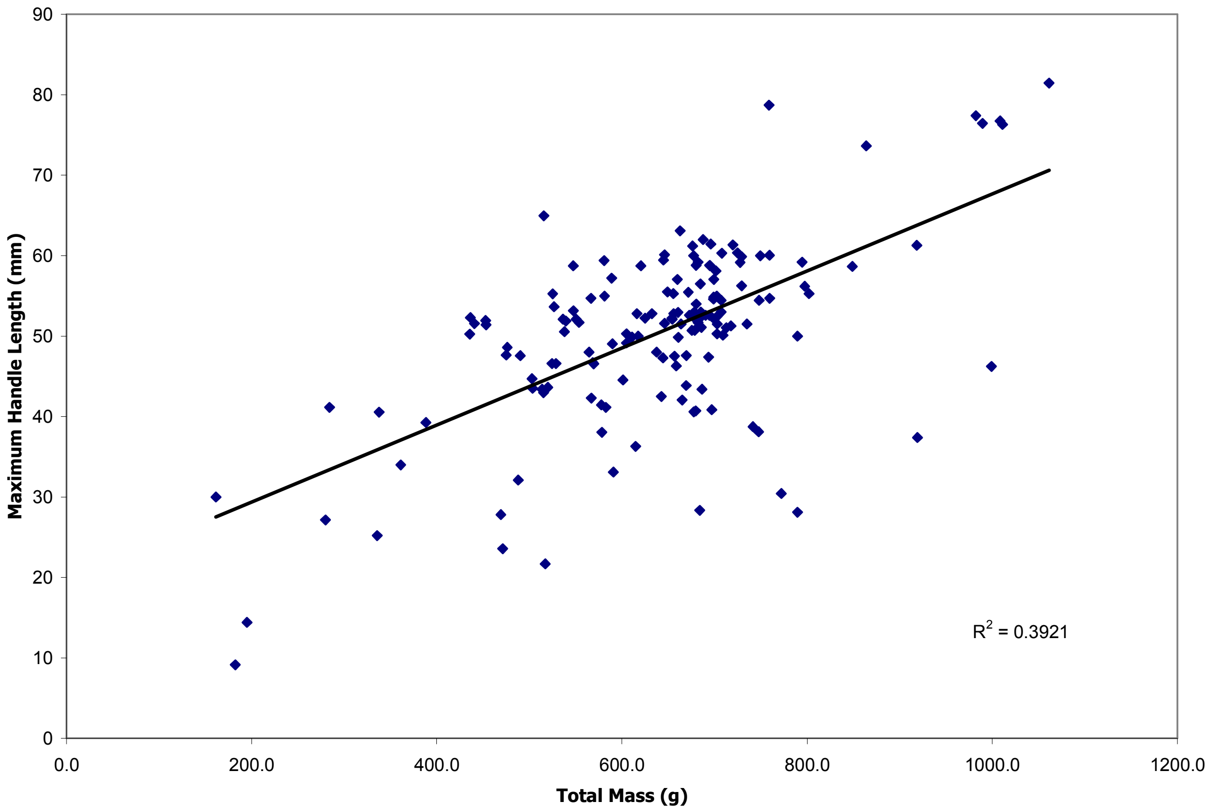

Figure 1: Dollarware Total Mass vs. Maximum Handle Length

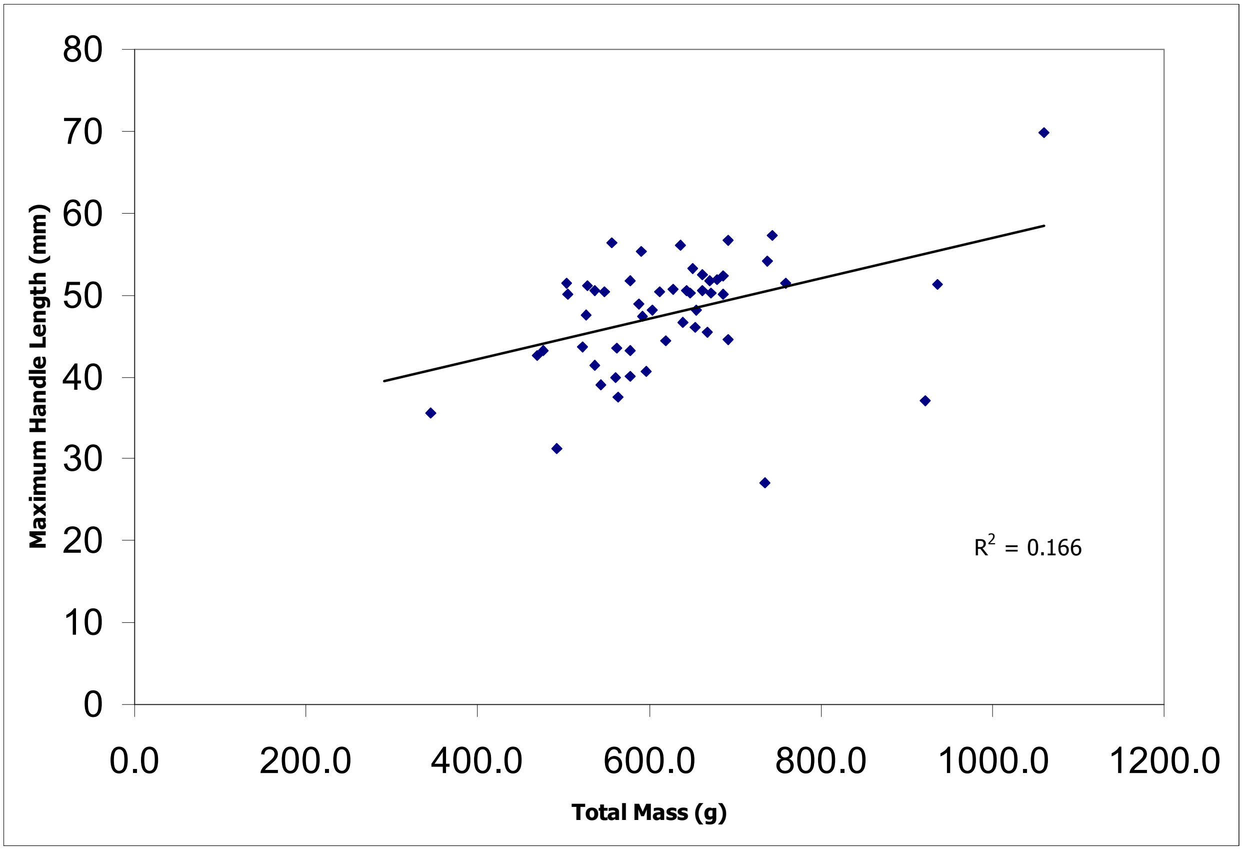

Figure 2: Value Village Total Mass vs. Maximum Handle Length

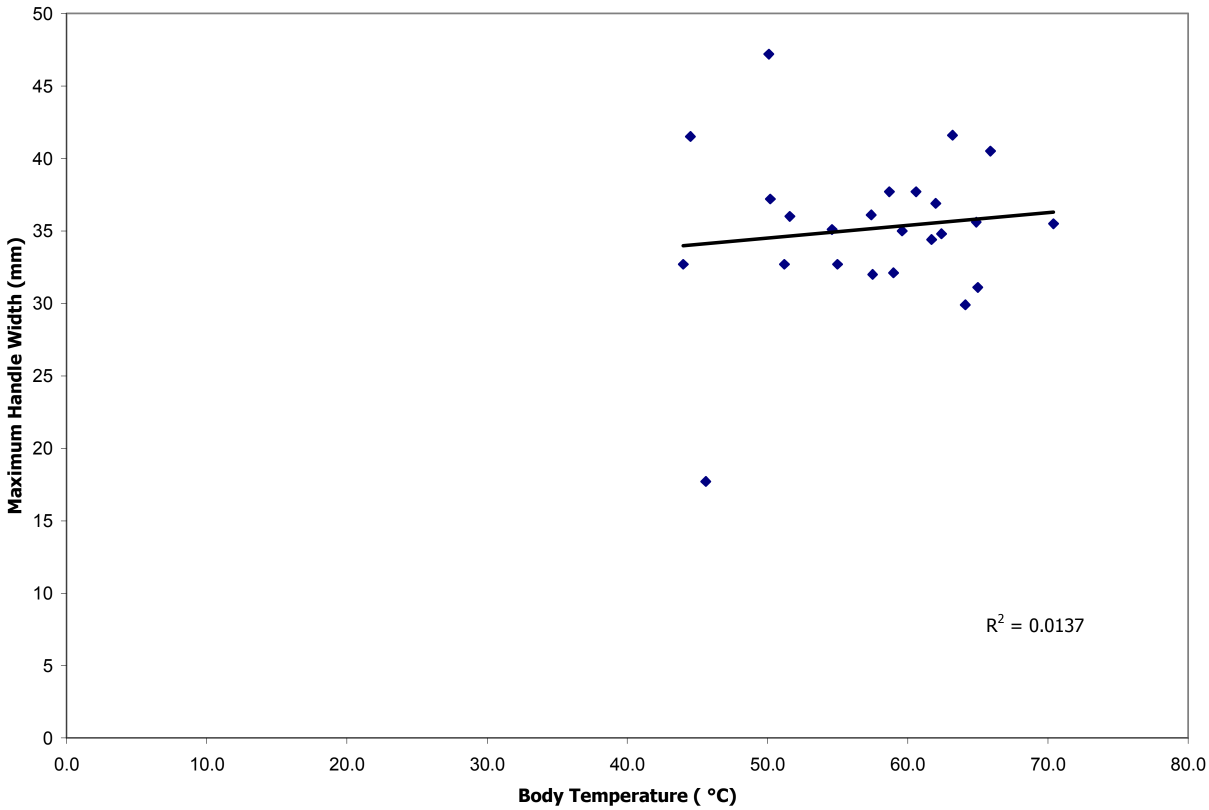

Figure 3: Dollarware Body Temperature vs. Maximum Handle Width

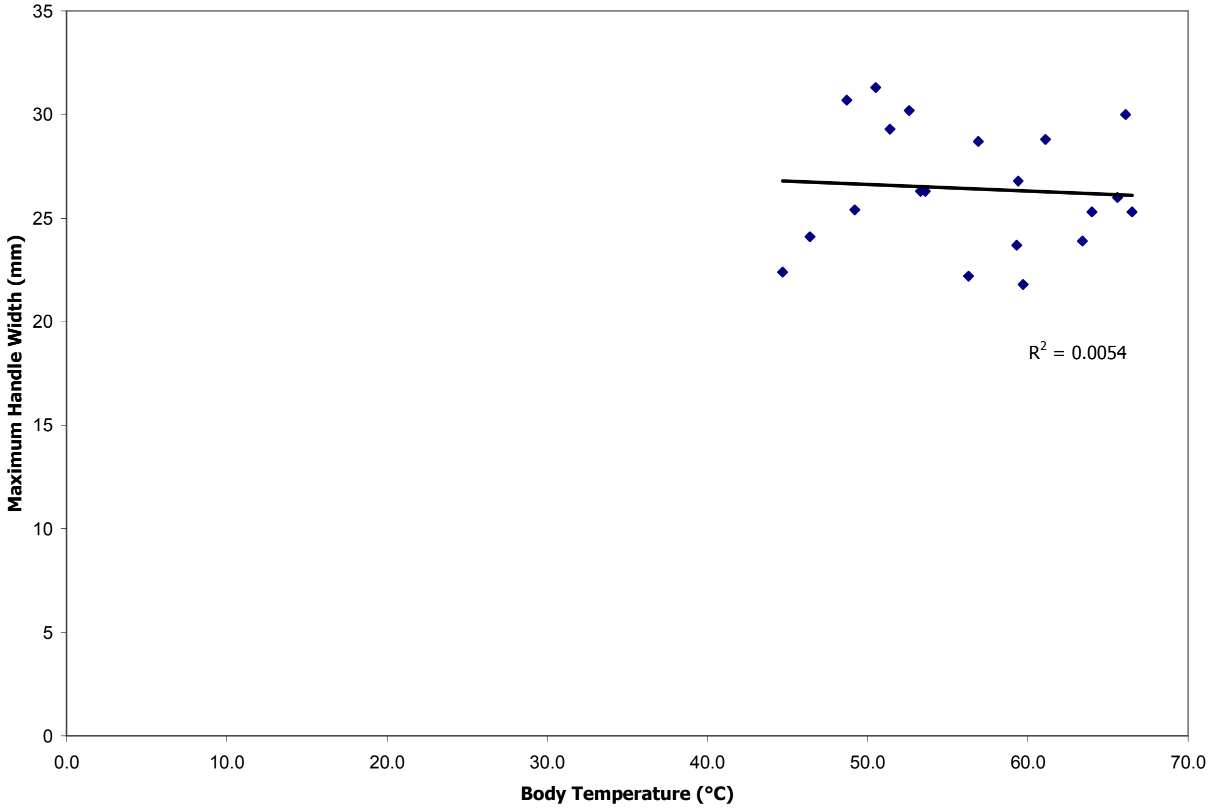

Figure 4: Value Village Body Temperature vs. Maximum Handle Width

Dollarware Specimens	**Handle Temperature (°C)**
A-11	26.5
A-13	26.5
B-07	27.4
B-16	27.7
C-08	32.2
C-09	27.7
D-10	25.9
D-13	30.2
E-04	27.0
E-06	26.8
F-18	26.4
F-21	29.6
G-01	26.3
H-06	27.1
I-13	25.9
I-14	27.1
J-11	28.1
J-13	27.3
K-11	26.1
K-13	26.7
L-11	26.8
L-15	26.5
M-10	26.9
M-14	30.3

Figure 5: Dollarware Handle Temperatures Mean: 27.5 °C

Value Village Specimens	Handle Temperature (°C)
N-01	26.8
N-02	27.6
N-04	26.8
N-05	31.7
N-06	27.1
N-07	27.1
N-14	28.2
N-17	27.4
N-20	26.9
N-21	27.6
N-23	26.2
N-25	30.8
N-30	28.4
N-39	30.7
N-44	27.6
N-46	30.3
N-48	27.6
N-49	28.5
N-54	29.0
N-59	28.0

Figure 6: Value Village Handle Temperatures Mean: 28.2 °C

F-Test Two-Sample for Variances

	Variable 1	*Variable 2*
Mean	27.45833	28.215
Variance	2.493841	2.346605
Observations	24	20
df	23	19
F	1.062744	
P(F<=f) one-tail	0.451054	
F Critical one-tail	2.123263	

Figure 7: F-test for Mean Handle Temperature

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	27.45833	28.215
Variance	2.493841	2.346605
Observations	24	20
Pooled Variance	2.427234	
Hypothesized Mean Difference	0	
df	42	
t Stat	-1.60414	
P(T<=t) one-tail	0.058089	
t Critical one-tail	1.681952	
P(T<=t) two-tail	0.116177	
t Critical two-tail	2.018082	

Figure 8: T-test for Mean Handle Temperature

Dollarware Specimen	**Body Temperature**	**Handle Temperature**	**Difference between Body and Handle Temperature (°C)**
A-11	57.4	26.5	30.9
A-13	51.6	26.5	25.1
B-07	59.0	27.4	31.6
B-16	62.0	27.7	34.3
C-08	64.1	32.2	31.9
C-09	50.2	27.7	22.5
D-10	44.5	25.9	18.6
D-13	64.9	30.2	34.7
E-04	55.0	27.0	28.0
E-06	60.6	26.8	33.8
F-18	44.0	26.4	17.6
F-21	70.4	29.6	40.8
G-01	62.4	26.3	36.1
H-06	54.6	27.1	27.5
I-13	51.2	25.9	25.3
I-14	63.2	27.1	36.1
J-11	45.6	28.1	17.5
J-13	65.0	27.3	37.7
K-11	58.7	26.1	32.6
K-13	65.9	26.7	39.2
L-11	61.7	26.8	34.9
L-15	59.6	26.5	33.1
M-10	50.1	26.9	23.2
M-14	57.5	30.3	27.2

Figure 9: Dollarware Body and Handle Temperature Differences Mean: 30.0 °C

Value Village Specimen	Body Temperature (°C)	Handle Temperature (°C)	Difference between Body and Handle Temperature (°C)
N-01	48.7	26.8	21.9
N-02	66.5	27.6	38.9
N-04	44.7	26.8	17.9
N-05	59.4	31.7	27.7
N-06	46.4	27.1	19.3
N-07	65.6	27.1	38.5
N-14	49.2	28.2	21.0
N-17	66.1	27.4	38.7
N-20	50.5	26.9	23.6
N-21	64.0	27.6	36.4
N-23	52.6	26.2	26.4
N-25	59.7	30.8	28.9
N-30	56.9	28.4	28.5
N-39	56.3	30.7	25.6
N-44	61.1	27.6	33.5
N-46	63.4	30.3	33.1
N-48	51.4	27.6	23.8
N-49	59.3	28.5	30.8
N-54	53.6	29.0	24.6
N-59	53.3	28.0	25.3

Figure 10: Value Village Body and Handle Temperature Differences Mean: 28.2 (°C)

F-Test Two-Sample for Variances

	Variable 1	*Variable 2*
Mean	30.00833	28.22
Variance	45.3921	42.44589
Observations	24	20
df	23	19
F	1.069411	
P(F<=f) one-tail	0.445491	
F Critical one-tail	2.123263	

Figure 11: F-test for Mean Body and Handle Temperature Differences

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	30.00833	28.22
Variance	45.3921	42.44589
Observations	24	20
Pooled Variance	44.05929	
Hypothesized Mean Difference	0	
df	42	
t Stat	0.889865	
P(T<=t) one-tail	0.189304	
t Critical one-tail	1.681952	
P(T<=t) two-tail	0.378607	
t Critical two-tail	2.018082	

Figure 12: T-test for Mean Body and Handle Temperature Differences

Appendix B: Additional Data

Specimen	Mass (g)	Volume (ml)	Total Mass (g)	Maximum Handle Width (mm)	Maximum Handle Length (mm)
A-01	371.6	323.7	695.3	39.4	59.5
A-02	405.1	335.7	740.8	37.3	58.15
A-03	374.8	311.3	686.1	40	58.25
A-04	391.1	352.2	743.3	40	58.25
A-05	371.0	328.2	699.2	40	58.25
A-06	370.2	327.3	697.5	41.1	57.4
A-07	164.4	109.6	274.0	22.2	29.9
A-08	124.8	70.2	195.0	20	15.35
A-09	275.1	274.2	549.3	25.2	21
A-10	412.9	381.4	794.3	32.2	32.1
A-11	351.9	333.2	685.1	36.1	63.05
A-12	228.3	259.1	487.4	34	51.65
A-13	288.1	260.8	548.9	36	38.15
A-14	291.3	266.6	557.9	36	39.25
A-15	479.6	455.7	935.3	41.1	75
A-16	381.4	358.1	739.5	42.7	63.1
A-17	263.7	338.6	602.3	35	53.15
A-18	364.1	343.1	707.2	36.6	59.2
A-19	254.2	331.9	586.1	34.4	44.5
A-20	274.5	296.2	570.7	30.5	46.35
A-21	386.5	459.1	845.6	39.9	60
B-01	269.2	283.6	552.8	30	44
B-02	344.7	327.5	672.2	42.2	55.1
B-03	365.1	330.9	696.0	42.7	54.25
B-04	511.6	581.7	1093.3	36.1	36.85
B-05	314.5	353.6	668.1	48.3	60.5
B-06	370.6	311.0	681.6	32.2	51
B-07	288.6	312.5	601.1	32.1	55.95
B-08	295.9	337.6	633.5	37.6	58.15
B-09	276.9	373.1	650.0	34.9	53.35
B-10	373.0	324.3	697.3	41.6	51.1
B-11	330.7	329.9	660.6	35.5	43.8
B-12	379.0	334.6	713.6	36.1	60.5
B-13	267.3	299.9	567.2	31.1	46
B-14	340.4	341.0	681.4	35	43.4
B-15	403.9	340.4	744.3	36	60.05
B-16	298.1	350.6	648.7	36.9	49.6
B-17	295.5	223.5	519.0	34.3	60.05
B-18	464.9	463.5	928.4	36.1	38
B-19	399.1	331.9	731.0	39	51.4
B-20	346.5	330.8	677.3	33.8	41.8
C-01	261.0	320.9	581.9	33	54

C-02	154.9	203.5	358.4	31.7	27.5
C-03	306.8	317.6	624.4	39.2	55.6
C-04	274.9	273.8	548.7	26.1	27.7
C-05	305.7	249.6	555.3	32.7	41.4
C-06	384.3	329.9	714.2	40	62.05
C-07	231.5	387.0	618.5	35	51.95
C-08	266.3	307.1	573.4	29.9	49
C-09	238.7	238.2	476.9	37.2	31
C-10	254.1	297.8	551.9	32	43
C-11	255.7	302.6	558.3	31.1	43.3
C-12	264.8	336.6	601.4	34	52.4
C-13	115.0	97.8	212.8	21.1	18.65
C-14	279.8	332.2	612.0	32.2	61.4
C-15	307.5	328.0	635.5	38.8	57
C-16	106.6	89.6	196.2	27.7	32.25
C-17	313.6	237.7	551.3	38.4	67.4
C-18	319.1	278.1	597.2	27.2	55.05
C-19	194.6	265.6	460.2	29.4	57.1
C-20	259.0	303.2	562.2	37.2	59.4
D-01	374.4	347.6	722.0	41.1	55.4
D-02	338.5	345.9	684.4	42	52.55
D-03	438.8	399.2	838.0	37.2	68.75
D-04	343.7	348.1	691.8	38.8	51.6
D-05	251.4	277.2	528.6	39.9	46.05
D-06	364.1	348.3	712.4	37.6	53.9
D-07	325.4	400.0	725.4	39	54
D-08	266.4	355.3	621.7	32.2	49.35
D-09	365.8	330.8	696.6	40.5	54.1
D-10	400.9	322.9	723.8	41.5	25.2 / 24.85
D-11	145.6	215.4	361.0	35.5	34
D-12	362.2	337.0	699.2	41.6	54.85
D-13	327.6	316.6	644.2	35.6	47.3
D-14	329.3	351.0	680.3	37.2	54
D-15	357.1	326.9	684.0	32	28.35
D-16	311.4	334.6	646.0	36.1	51.6
D-17	321.3	398.5	719.8	35	61.35
D-18	322.6	331.2	653.8	36	52.2
D-19	368.7	390.7	759.4	37.3	60.05
D-20	291.5	177.8	469.3	36.6	27.8
E-01	412.0	436.8	848.8	40	58.65
E-02	560.7	450.4	1011.1	41	76.3
E-03	356.9	345.8	702.7	38	52.45
E-04	301.6	386.1	687.7	32.7	62
E-05	339.9	419.0	758.9	41.1	78.7
E-06	366.9	311.5	678.4	37.7	52.3
E-07	347.9	337.9	685.8	39.9	51.1
E-08	522.1	467.3	989.4	40	76.45
E-09	356.0	322.2	678.2	39.9	53

E-10	343.7	385.6	729.3	38	59.85
E-11	341.5	340.7	682.2	37.6	51.7
E-12	365.1	362.6	727.7	36.1	59.15
E-13	561.7	446.8	1008.5	42.2	76.75
E-14	357.4	322.9	680.3	37.2	52.2
E-15	354.0	326.6	680.6	40	52
E-16	265.1	263.7	528.8	31.5	46.6
E-17	326.1	398.7	724.8	39.4	60.35
E-18	358.9	335.6	694.5	36.6	52.6
E-19	256.3	263.7	520.0	30.5	43.65
E-20	576.3	485.0	1061.3	45	81.45
F-01	231.9	283.2	515.1	42	43
F-02	168.4	115.7	284.1	25.3	41.15
F-03	341.4	336.1	677.5	41.7	60
F-04	327.8	379.4	707.2	35	53
F-05	362.3	385.9	748.2	39.8	54.45
F-06	230.1	286.9	517.0	25	21.7
F-07	403.5	394.0	797.5	52.7	56.2
F-08	376.7	382.8	759.5	40	54.7
F-09	340.1	353.5	693.6	33.3	47.4
F-10	451.7	466.8	918.5	37	61.3
F-11	219.4	371.3	590.7	41.1	33.1
F-12	211.3	339.2	550.5	36.6	52.1
F-13	344.1	385.3	729.4	38.8	56.25
F-14	416.7	385.4	802.1	39	55.3
F-15	371.6	400.7	772.3	34.9	30.45
F-16	447.0	417.0	864.0	38	73.65
F-17	358.6	349.4	708.0	39.4	60.3
F-18	323.7	254.7	578.4	32.7	38.05
F-19	306.8	362.8	669.6	34.4	47.6
F-20	312.0	325.3	637.3	48.3	48
F-21	215.7	331.8	547.5	35.5	53.15
G-01	294.4	321.8	616.2	34.8	52.8
G-02	307.8	324.5	632.3	34.2	52.8
G-03	321.3	334.7	656.0	34.4	52.8
G-04	288.0	292.8	580.8	34.4	59.4
H-01	326.6	351.9	678.5	35.6	50.7
H-02	329.9	345.6	675.5	37.7	50.7
H-03	295.5	305.8	601.3	30.5	44.55
H-04	301.8	303.1	604.9	36.6	49.15
H-05	304.5	313.2	617.7	35.5	50
H-06	322.7	341.1	663.8	35.1	51.5
I-01	371.8	327.6	699.4	33.9	57.05
I-02	338.5	333.2	671.7	40.1	55.45
I-03	269.7	294.9	564.6	29.4	48
I-04	111.5	70.9	182.4	19.4	9.15
I-05	456.6	462.6	919.2	36.1	37.4
I-06	361.9	332.9	694.8	40	58.8
I-07	373.8	327.7	701.5	40	58.1

I-08	321.2	351.7	672.9	38.9	52.6
I-09	266.3	382.7	649.0	53.7	55.5
I-10	274.2	295.3	569.5	29.4	46.55
I-11	266.6	301.9	568.5	30	46.7
I-12	516.5	482.6	999.1	38.3	46.25
I-13	369.6	325.6	695.2	32.7	58.75
I-14	368.6	420.9	789.5	41.6	50
I-15	380.1	332.5	712.6	40.5	51.05
I-16	319.0	357.3	676.3	37.7	61.2
I-17	210.8	304.8	515.6	31.9	64.95
I-18	362.3	336.6	698.9	39.4	54.6
I-19	356.7	325.5	682.2	40	59.2
I-20	338.3	307.7	646.0	39	60.1
J-01	370.9	364.2	735.1		51.5
J-02	237.5	252.8	490.3	37	47.55
J-03	338.4	315.8	654.2	32.2	52.1
J-04	235.4	239.5	474.9	39	47.65
J-05	285.2	329.5	614.7	32.2	36.3
J-06	362.8	340.1	702.9	36.1	51.5
J-07	366.3	341.0	707.3	39.3	54.45
J-08	204.8	183.5	388.3	39.4	39.25
J-09	208.1	228.2	436.3	32.2	52.3
J-10	133.6	146.3	279.9	32.2	27.15
J-11	210.9	260.2	471.1	17.7	23.6
J-12	268.1	256.3	524.4	21.1	46.6
J-13	346.0	314.6	660.6	31.1	52.95
J-14	380.4	414.3	794.7	37.7	59.2
J-15	254.3	233.7	488.0	35.5	32.1
J-16	139.0	196.5	335.5	28.8	25.2
J-17	193.0	373.9	566.9	24.4	42.3
J-18	329.6	327.1	656.7	43.4	47.5
J-19	238.9	237.3	476.2	31.5	48.6
J-20	219.5	216.1	435.6	32.7	50.25
K-01	372.9	317.7	690.6	34	52.6
K-02	367.2	332.4	699.6	38	52.15
K-03	295.5	315.1	610.6	37.2	49.9
K-04	382.9	319.6	702.5	42	55
K-05	355.0	222.9	577.9	29.4	41.45
K-06	375.9	304.2	680.1	39.9	58.8
K-07	351.2	311.8	663.0	39.9	63.1
K-08	345.0	299.8	644.8	38.8	59.45
K-09	256.4	246.4	502.8	34.8	44.7
K-10	309.2	280.5	589.7	33	49.05
K-11	387.5	297.7	685.2	37.7	53
K-12	347.8	257.3	605.1	39.4	50.3
K-13	375.2	327.4	702.6	40.5	50.3
K-14	342.6	317.3	659.9	38.3	57.05
K-15	371.9	253.1	625.0	38	52.25
K-16	323.2	335.5	658.7	33.8	46.3

K-17	326.6	369.5	696.1	38	61.45
K-18	124.2	70.9	195.1	17.2	14.4
K-19	151.6	186.1	337.7	26	40.55
K-20	365.7	423.9	789.6	34.4	28.1
L-01	359.7	325.2	684.9	39.8	56.5
L-02	335.3	320.3	655.6	38.8	55.3
L-03	260.2	193.1	453.3	33.6	51.4
L-04	259.4	193.5	452.9	34.7	51.95
L-05	249.2	191.4	440.6	35.5	51.55
L-06	402.6	306.4	709.0	36.1	50.1
L-07	349.5	311.5	661.0	38.8	49.85
L-08	348.2	316.9	665.1	32	42.05
L-09	321.0	321.6	642.6	32.2	42.5
L-10	365.1	321.4	686.5	32.2	43.4
L-11	368.0	301.2	669.2	34.4	43.85
L-12	243.5	260.0	503.5	32	43.5
L-13	247.0	266.8	513.8	32	43.4
L-14	286.8	294.5	581.3	35	55
L-15	297.5	291.4	588.9	35	57.2
L-16	273.8	292.9	566.7	35	54.7
M-01	272.4	281.1	553.5	33.3	51.7
M-02	371.0	312.9	683.9	39.8	52.2
M-03	312.3	308.1	620.4	33.3	58.75
M-04	241.2	306.2	547.4	34	58.75
M-05	390.7	350.8	741.5	30.5	38.75
M-06	406.6	343.1	749.7	40	60
M-07	247.4	279.2	526.6	29.9	53.65
M-08	352.4	327.3	679.7	32.2	40.7
M-09	355.9	341.0	696.9	32	40.85
M-10	481.6	500.8	982.4	47.2	77.4
M-11	264.3	260.8	525.1	30	55.25
M-12	282.6	253.8	536.4	29.4	52.1
M-13	274.8	264.6	539.4	31.1	51.9
M-14	395.6	352.1	747.7	32	38.1
M-15	270.5	267.3	537.8	31.1	50.55
M-16	282.0	300.6	582.6	31.1	41.15
M-17	336.2	341.5	677.7	33.3	40.6
M-18	393.5	324.2	717.7	35.5	51.25
M-19	79.1	82.3	161.4	37.2	30
M-20	370.9	311.7	682.6	29.4	52.4
N-01	326.5	353.2	679.7	39.4	51.9
N-02	349.8	317.9	667.7	37.3	45.4
N-03	304.6	298.5	603.1	40	48.1
N-04	322.0	256.2	578.2	40	43.2
N-05	254.4	437.3	691.7	40	44.5
N-06	257.1	300.0	557.1	41.1	56.3
N-07	254.8	272.8	527.6	22.2	51.2
N-08	396.7	347.5	744.2	20	
N-09	312.6	272.8	585.4	25.2	

N-10	298.5	344.4	642.9	32.2	50.6
N-11	286.0	375.9	661.9	36.1	52.5
N-12	390.4	488.0	878.4	34	
N-13	306.7	290.4	597.1	36	40.6
N-14	264.6	283.2	547.8	36	50.4
N-15	336.2	311.7	647.9	41.1	50.3
N-16	273.5	231.5	505.0	42.7	50.1
N-17	296.6	316.0	612.6	35	50.4
N-18	93.0	197.4	290.4	36.6	
N-19	570.7	489.8	1060.5	34.4	69.8
N-20	378.0	313.7	691.7	30.5	56.7
N-21	285.9	258.2	544.1	39.9	39.1
N-22	249.1	226.8	475.9	30	43.2
N-23	373.9	311.8	685.7	42.2	52.4
N-24	312.7	264.8	577.5	42.7	40.1
N-25	275.1	286.4	561.5	36.1	43.5
N-26	356.1	262.7	618.8	48.3	44.4
N-27	317.7	318.2	635.9	32.2	56.1
N-28	255.3	305.5	560.8	32.1	39.9
N-29	373.8	311.9	685.7	37.6	50.1
N-30	282.1	309.0	591.1	34.9	55.4
N-31	319.4	319.6	639.0	41.6	46.7
N-32	227.5	294.7	522.2	35.5	
N-33	329.0	321.8	650.8	36.1	53.3
N-34	395.3	342.5	737.8	31.1	54.2
N-35	458.3	398.9	857.2	35	
N-36	256.5	269.5	526.0	36	47.5
N-37	247.8	255.4	503.2	36.9	51.5
N-38	338.3	317.1	655.4	34.3	48.1
N-39	247.4	275.2	522.6	36.1	43.7
N-40	386.5	348.7	735.2	39	27.1
N-41	361.8	329.5	691.3	33.8	
N-42	309.5	282.3	591.8	33	47.4
N-43	331.0	331.7	662.7	31.7	50.6
N-44	411.5	524.5	936.0	39.2	51.3
N-45	358.1	313.8	671.9	26.1	50.3
N-46	307.2	256.7	563.9	32.7	37.5
N-47	479.9	442.1	922.0	40	37.1
N-48	332.9	320.6	653.5	35	46.1
N-49	235.5	234.2	469.7	29.9	42.6
N-50	281.6	354.0	635.6	37.2	
N-51	302.6	324.9	627.5	32	50.7
N-52	390.1	353.2	743.3	31.1	
N-53	271.9	264.0	535.9	34	41.4
N-54	386.0	373.3	759.3	21.1	51.4
N-55	315.1	272.6	587.7	32.2	48.9
N-56	301.7	276.6	578.3	38.8	51.8
N-57	257.9	277.9	535.8	27.7	50.6
N-58	383.8	359.6	743.4	38.4	57.3

N-59	129.5	215.9	345.4	27.2	35.6
N-60	324.6	345.4	670.0	29.4	51.7
N-61	253.8	238.8	492.6	37.2	31.3

Figure 13: Additional Metrical Measurements. Please note that the handle of specimen D-10 was irregular and could not be measured using the same technique as the other handles, but was not included in data analysis.

Dollarware Specimen	**Body Temperature (°C)**
A-11	57.4
A-13	51.6
B-07	59.0
B-16	62.0
C-08	64.1
C-09	50.2
D-10	44.5
D-13	64.9
E-04	55.0
E-06	60.6
F-18	44.0
F-21	70.4
G-01	62.4
H-06	54.6
I-13	51.2
I-14	63.2
J-11	45.6
J-13	65.0
K-11	58.7
K-13	65.9
L-11	61.7
L-15	59.6
M-10	50.1
M-14	57.5

Figure 14: Dollarware Body Temperatures Mean: 57.5 °C

Value Village Specimen	**Body Temperature (°C)**
N-01	48.7
N-02	66.5
N-04	44.7
N-05	59.4
N-06	46.4
N-07	65.6
N-14	49.2
N-17	66.1
N-20	50.5
N-21	64.0
N-23	52.6
N-25	59.7
N-30	56.9
N-39	56.3
N-44	61.1
N-46	63.4
N-48	51.4
N-49	59.3
N-54	53.6
N-59	53.3

Figure 15: Value Village Body Temperatures Mean: 56.8 °C

F-Test Two-Sample for Variances

	Variable 1	*Variable 2*
Mean	57.46667	56.435
Variance	51.89971	46.20239
Observations	24	20
df	23	19
F	1.123312	
P(F<=f) one-tail	0.402257	
F Critical one-tail	2.123263	

Figure 16: F-test for Mean Body Temperatures

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	57.46667	56.435
Variance	51.89971	46.20239
Observations	24	20
Pooled Variance	49.32235	
Hypothesized Mean Difference	0	
df	42	
t Stat	0.48519	
P(T<=t) one-tail	0.315031	
t Critical one-tail	1.681952	
P(T<=t) two-tail	0.630063	
t Critical two-tail	2.018082	

Figure 17: T-test for Mean Body Temperatures