UNDERSTANDING CONSUMER PREFERENCES FOR ARCHITECTURAL PAINTS USING **APPLICATION READER TECHNOLOGY (ART) DEVICE**

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While paint color can transform the way a room looks, how a paint "feels" is critical to those applying the paint—whether they are professional painters or do-it-yourselfers (DIY). Market research has confirmed this time and again. Manufacturers recognize that the ease or effort of paint application is responsible for the first, and possibly longest lasting, consumer impression and will strongly influence the consumer's perception of product quality. Test methods for evaluating application feel have been limited in accuracy and reproducibility. Moreover, they rely heavily on the subjective judgment of the evaluator.

Recently, a device called Application Reader Technology™ (ART) has been introduced. The ART device generates and records real-time spatial and force data during the paint roll-out process, objectively measuring application feel. The ART device helps fulfill the need for reliable, reproducible, quantitative data that subjective evaluation techniques have left unmet.

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APPLICATION READER TECHNOLOGY (ART) DEVICE

Driving the patent-pending ART device is the understanding that the changes in paint formulation cause subtle changes in the paint rollout process. By recording special and force data generated during application, the ART device objectively records the changes from paint formulation differences and provides direct information and insight into consumer preferences.

In a study using the ART device, 11 participants tested 16 commercially available architectural paints. The research showed that, on average, the panel preferred paints manufactured for the DIY market over those sold as contractor paints.

Equally important, the study found that neither paint rheology nor applied properties produce significant correlations with consumer preferences and, therefore, offer no basis for an a priori prediction of consumer preference. The ART device, on the other hand, produced a number of statistically significant and strong correlations between ART device-measurable parameters and consumer preferences. The strong correlations validate the tool's ability to predict consumer preference, and warrant further advancement and development of the ART device technology.

TABLE 1—Paints Used in the Study

MFR. ID	MARKET	$/GAL	ID
A	CONTRACTOR	15.0	Ac15
A	CONTRACTOR	17.5	Ac17
A	DIY	25.0	Ad25
A	DIY	42.0	Ad42
B	CONTRACTOR	22.5	Bc22
B	CONTRACTOR	42.0	Bc42
B	DIY	42.1	Bd42
B	DIY	44.8	Bd44
C	CONTRACTOR	12.6	Cc12
C	CONTRACTOR	20.6	Cc20
C	DIY	21.6	Cd21
C	DIY	55.4	Cd55
D	CONTRACTOR	40.4	Dc40
D	CONTRACTOR	41.6	Dc41
D	DIY	40.6	Dd40
D	DIY	69.8	Dd69

EVALUATION BACKGROUND

Paints (all eggshell) from the leading four paint manufacturers were used in the study. Each manufacturer was represented with four paints, two intended for the DIY market and two intended for the contractor market. Each pair consisted of one "premium" paint and one "economy" paint, as designated by the manufacturer. All 16 paints were purchased in retail stores in 5-gal pails.

Since applied hiding is an important consideration affecting the painting process, the DIY paints were tinted light blue. DIY paints were applied on top of contractor paints or vice versa.

EXPERIMENTAL

Table 1 lists the paints by manufacturer, intended market, price point ($/gal), and name, by paint ID. The last column of *Table 1* contains the code for each paint according to the following convention: the first letter represents the manufacturer, the second letter represents DIY or contractor, and the numbers represent the retail price per gallon.

PAINT APPLICATION

The participants painted on a commercially available section of drywall divided into four 7.5 ft x 10 ft sections. Each section was painted with a single paint listed in *Table 1*.

To provide color contrast between the paints, researchers tinted the DIY paints at 0.5 oz/gal with Phthalo Blue. Painting participants alternated randomly selected sets of four DIY or contractor paints.

The painters used 9 in. rollers with 3/8 in. nap. Research assistants did the initial roller breaking and loading to ensure that the painters, with their varying levels of skill, did not impact the process.

Paint loading and spread rate were measured by a scale. Upon completion of the experiment, each participant filled out an evaluation form, described in the next section.

THE EVALUATION

Table 2 contains the paint evaluation form, which was used to survey participants at the end of each paint application. Participants responded to statements about various aspects of the paint and the application by expressing the extent of their agreement, where "Strongly Disagree" equaled 1 and "Strongly Agree" equaled 9.

ART

The ART device digitally records the painting process, including the position of the roller as a function of time, along with the forces exerted during the painting process. The collected data was used to calculate parameters summarized in *Table 3*.

To consistently describe dependencies among the various data in this report, *Table 4* defines the correlations. Both "Strong" and "Significant" correlations refer to statistically significant correlations.

DISCUSSION OF RESULTS

Table 5 shows the results of the painting experience evaluation, which address various attributes of the painting process.

- *Steady Release* describes the ease of paint transfer from roller to the substrate.
- *Ease of Transfer* describes the painter's physical effort to transfer paint to the substrate.
- *Roller Pickup* describes the amount of paint a roller cover can carry, thus providing for an efficient painting experience.
- *Wet Film* rating covers the combination of wet film hiding and smoothness,
- *Minimum Reworking* refers to the need to go over the same area to deliver better surface finish.

The last two attributes address the user's perception of paint quality and if he or she would choose the paint.

TABLE 2—Painting Experience Evaluation

DEFINITION		STRONGLY DISAGREE		DISAGREE		NEUTRAL		AGREE		STRONGLY AGREE
STEADY RELEASE	1. This paint exhibits **steady release** from the roller to the wall	1	2	3	4	5	6	7	8	9
EASE OF TRANSFER	2. This paint **transfers easily** from the roller to the wall	1	2	3	4	5	6	7	8	9
ROLLER PICKUP	3. When dipping and reloading in the tray, this paint showed **good roller pickup**	1	2	3	4	5	6	7	8	9
WET FILM APPEARANCE	4. This paint provided excellent **wet film appearance**	1	2	3	4	5	6	7	8	9
REWORKING	5. This paint required **minimal reworking**	1	2	3	4	5	6	7	8	9
QUALITY	6. This paint is **high quality**	1	2	3	4	5	6	7	8	9
PERSONAL PREFERENCE	7. I would **paint my home** with this paint	1	2	3	4	5	6	7	8	9

FIGURE 1—Price per gallon vs the average personal preference rating.

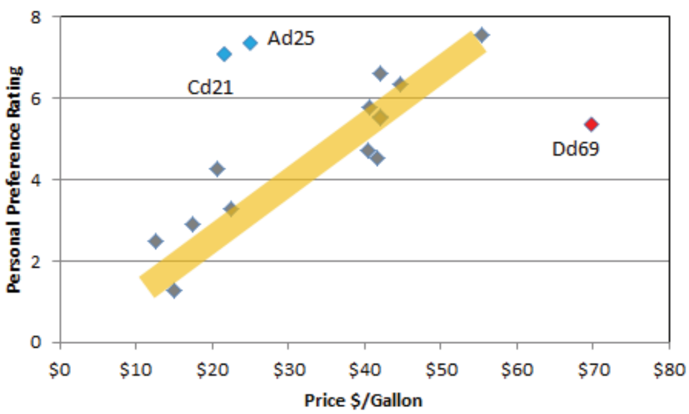

TABLE 3—List of ART Device-Based Parameters with Corresponding Definitions

DIPS	The number of times the roller loaded with paint during the evaluation process
PAINT APPLIED, gm	Weight applied, reported as overall and as per dip[a]
STROKES	The number of unidirectional motions of the roller along the wall
DISTANCE ROLLED, m	Distance traveled by the roller while in contact with the wall
PAINTING TIME, s	Sum of the time intervals when the roller was in contact with the wall
VELOCITY, m/s	Average roller velocity while painting
Fz, N	Average pressing force exerted during painting
EFFORT	Sum total of all the forces exerted during painting

(a) This is the only parameter not measured by the ART device, but with a scale.

TABLE 4—Significant Correlation Criteria Definitions

CHARACTERIZATION	CORRELATION VALUE
STRONG CORRELATION	>0.8; <–0.8
SIGNIFICANT CORRELATION	0.5 to 0.8; –0.8 to –0.5
WEAK CORRELATION	0.4 to 0.5; –0.5 to –0.4
NO CORRELATION	–0.4 to 0.4

Participants assigned each attribute a value from 1 to 9. *Table 5* contains the painting attribute values averaged over 11 volunteers. The table is color-coded; the lowest values are highlighted red and the highest values green.

Figure 1 shows a correlation between paint price and personal preference. The data follows a clear trend that closely correlates price and the average personal preference score. The data shows three outliers: Ad25, Cd21, and Dd69. The high personal preference scores and low prices indicate that both Ad25 and Cd21 are underpriced. By contrast, Dd69 could be considered overpriced due to its high price and relatively low personal preference score.

This study also sought to define which paint perception attributes most impact overall preference. *Table 6* shows the correlations between personal preference and all other perception evaluation parameters. The parameters are arranged by decreasing correlation significance, from most to least. A value above 0.8 is considered statistically very significant. As expected, quality and personal preference are the most highly correlated. This is followed by reworking and wet film appearance. Roller pickup, on the other hand, although demonstrating a strong correlation with personal preference, showed the lowest correlation among the parameters.

APPLICATION READER TECHNOLOGY (ART) DEVICE

PAINT CHARACTERIZATION: APPLIED PROPERTIES AND RHEOLOGY

All 16 paints have been characterized using standard paint characterization procedures. The results of paint characterization are summarized in *Table 7.* These included KU, ICI, and Brookfield viscosities, leveling, sag, and open time. As expected, paint KU viscosities are near 100KU, ranging between 86KU (Bc42) and 111.2KU (Bd42). ICI viscosities range between 0.60P (Ac17) and 1.43P (Cd21).

Leveling values range between 3 and 9. Bd42 and Dc40 measured leveling of 3. A significant number of paints measured leveling of 9. (In fact, 50% of all paints had leveling values of 9.) Sag values varied between 6 (Ad42) and 40 for Dc41.

Finally, open time ranged between 0 and 8 min. The longest open time, 8 min, was observed with Ad25 paint.

Table 7 offers a unique opportunity to observe similarities and differences between paints intended for the contractor and DIY markets. There is no difference in KU viscosities. Several properties tend to be higher in DIY formulations compared to the contractor formulations, including ICI viscosity, leveling, and open time.

Rheological characterization of the paints was carried out using 40 mm

TABLE 5—Average Painting Ratings Reported by 11 Volunteers

PAINT ID	$/GAL	STEADY RELEASE	EASE OF TRANSFER	ROLLER PICK UP	WET FILM APPEARANCE	REWORKING	QUALITY	PERSONAL PREFERENCE
Ac15	$15	3.4	4.3	4.1	2.5	1.7	1.5	1.3
Ac17	$17.50	4.5	4.3	5.4	3.6	3.0	3.3	2.9
Ad25	$25	7.4	7.2	7.3	7.2	7.4	7.4	7.4
Ad42	$42	6.7	7.2	6.7	6.4	6.5	7.0	6.6
Bc22	$22.50	5.5	5.1	5.4	4.3	3.6	4.2	3.3
Bc42	$42	6.5	7.0	6.4	6.0	5.8	6.0	5.5
Bd42	$42.10	5.6	5.9	5.7	6.8	6.2	6.0	5.5
Bd44	$44.80	6.6	6.7	6.7	6.7	6.5	6.4	6.4
Cc12	$12.60	4.3	3.6	4.4	3.2	2.8	2.9	2.5
Cc20	$20.60	4.8	4.8	6.2	5.3	3.9	5.0	4.3
Cd21	$21.60	7.4	7.0	7.5	7.1	7.3	7.2	7.1
Cd55	$55.40	7.2	7.3	7.5	7.3	7.5	7.3	7.5
Dc40	$40.40	5.8	5.3	6.5	5.6	5.0	5.7	4.7
Dc41	$41.60	5.8	6.0	6.5	5.8	4.9	5.0	4.5
Dd40	$40.60	6.9	7.1	7.4	7.3	6.7	6.7	5.8
Dd69	$69.80	6.4	5.9	5.3	6.8	6.4	6.0	5.4

TABLE 6—Statistical Correlation between the Personal Preference Rating and All Others

	ATTRIBUTE	CORRELATION	LOWER 95%	UPPER 95%
1	QUALITY	0.9779	0.9358	0.9925
2	REWORKING	0.9719	0.9189	0.9904
3	WET FILM APPEARANCE	0.9515	0.8628	0.9834
4	STEADY RELEASE	0.9451	0.8456	0.9812
5	EASE OF TRANSFER	0.898	0.725	0.9644
6	ROLLER PICKUP	0.8557	0.6252	0.9489

TABLE 7—Applied Paint Properties

PAINT ID	KU	ICI (P)	BROOKFIELD, cP	LEVELING	SAG	OPEN TIME
Ac15	109.0	0.758	9238	9	14	2
Ac17	99.6	0.604	8848	6	30	2
Ad25	102.8	1.069	6359	9	12	8
Ad42	94.5	1.112	725.8	9	6	6
Bc22	105.9	0.769	7228	4	30	0
Bc42	86.4	0.635	3839	9	14	0
Bd42	111.2	0.758	11218	3	35	4
Bd44	105.4	0.827	------	9	12	4
Cc12	105.4	0.769	7228	7	18	0
Cc20	96.8	0.973	4949	5	18	2
Cd21	98.7	1.433	3059	9	10	6
Cd55	104.6	0.81	5849	9	18	2
Dc40	99.4	0.983	5339	3	30	2
Dc41	100.3	0.858	9508	4	40	0
Dd40	96.5	0.885	5069	5	20	4
Dd69	103.5	1.414	4559	9	12	4

parallel plates. Steady shear viscosity was measured between the shear rates of 0.01 and 1000 s^{-1}. Slope values of viscosity vs shear rate on log scale were calculated between 0.1 and 100 s^{-1}. Dynamic properties of the paints have been measured in linear viscoelastic region between frequencies 0.1 and 100 rad/s. For statistical analysis, the data set was trimmed to include only values corresponding to the rates at each order of magnitude (i.e., at 0.01, 0.1 s^{-1}, etc.). The compilation of rheology data can be found in *Tables 8 and 9*.

CORRELATIONS WITH PERSONAL PREFERENCE

Understanding the relationships between personal preferences and the applied and rheological characteristics of paints can help develop predictive tools for consumer perception. This may reduce or eliminate the industry's reliance on subjective panel testing.

PERSONAL PREFERENCE CORRELATIONS WITH APPLIED PAINT CHARACTERISTICS

Applied paint properties, such as leveling or ICI viscosity, are commonly used as targets in formulating paints. It is, therefore, important to explore how these parameters correlate with consumer preference.

Table 10 shows pairwise correlations between the average personal preference and the various applied paint properties. The data show that open time is the only parameter yielding significant positive correlation with personal preference.

Open time is the measure of how long the paint remains sufficiently fluid to allow the painter to correct or smooth out imperfections during the painting process. Since the painters in our panel steadily painted each 10-ft section from edge to edge without engaging in any touch-ups or paint smoothing, it is difficult to understand the importance and relevance of the open time to personal preference.

One possible explanation could be that all DIY formulations have higher open time values. Since DIY paints are generally preferred by our panel over the contractor formulations (*Table 4*), the observed correlation with the open time could be circumstantial.

Table 10 also shows several weak correlations between personal preference and applied paint properties. There is a weak positive correlation with ICI viscosities, suggesting that higher ICI measurements positively affect consumer preference. There is also a weak negative correlation with Brookfield low shear viscosity.

PERSONAL PREFERENCES VS PAINT RHEOLOGY

Next, we consider the correlation between personal preference and rheological paint data, as summarized in *Table 11*. The data yield no strong statistical correlations. Note that the rheological characterization consists of both dynamic and steady shear data. Furthermore, rheological data also contains the slope in log-log representation of viscosity vs shear rate and is the measure of paint pseudoplasticity.

TABLE 8—Compilation of Dynamic Rheological Data

	DYNAMIC DATA											
	STORAGE MODULUS, G'				LOSS MODULUS, G"				tan (delta)			
ID	100 rad/s	10 rad/s	1 rad/s	0.1 rad/s	100 rad/s	10 rad/s	1 rad/s	0.1 rad/s	100 rad/s	10 rad/s	1 rad/s	0.1 rad/s
Ac15	60.71	22.7	7.467	2.487	63.08	22.02	7.219	2.583	1.039	0.9699	0.9667	1.039
Ac17	431.3	298.6	136	65.91	227.5	113.6	93.3	39.44	0.5275	0.3803	0.6859	0.5983
Ad25	45.53	26.25	11.21	3.628	102.7	24.85	8.648	3.841	2.256	0.9469	0.7718	1.059
Ad42	103.8	17.85	4.39	0.773	83.96	21.51	6.541	1.734	0.8088	1.205	1.49	2.243
Bc22	126.7	88.6	52.71	42	110.8	46.61	20.23	12.87	0.8745	0.526	0.3838	0.3064
Bc42	169.1	70.09	24.79	7.751	122.2	50.94	22.51	8.665	0.723	0.7268	0.9081	1.118
Bd42	301	126.9	62.28	39.87	227.2	86.68	33.8	21.03	0.7546	0.6832	0.5428	0.5276
Bd44	151.3	53.8	10.05	1.272	155.3	60.86	17.28	3.552	1.026	1.131	1.719	2.791
Cc12	168.9	52.76	28.23	20.6	125.2	36.65	12.31	5.902	0.7414	0.6948	0.4361	0.2865
Cc20	411.7	214.9	142.9	112.7	216.9	90.3	44.76	35.82	0.5268	0.4203	0.3131	0.318
Cd21	205.9	52.43	25.62	17.24	209.9	50.45	14.5	7.087	1.019	0.9621	0.5661	0.4111
Cd55	155.1	80.42	47.69	33.56	211.1	53.87	19.5	11.96	1.361	0.6698	0.4089	0.3565
Dc40	333.5	180.9	110.9	68.47	156.6	67.53	41.39	27.46	0.4697	0.3734	0.3734	0.401
Dc41	208.9	156.2	83.13	68.12	153.8	69.17	33.25	13.52	0.7362	0.4427	0.4	0.1985
Dd40	262.7	165	115.7	94.43	119.6	56.11	30.61	24.42	0.4555	0.3402	0.2646	0.2586
Dd69	89.05	33.73	12.12	2.836	135.2	36.58	11.78	4.32	1.518	1.085	0.9723	1.523

Table 11 shows only weak correlations between personal preference and rheological characteristics of the paints. There is a positive weak correlation with tanδ at 100 rad/s, suggesting the preference for paints with higher elastic characteristics at higher frequency. There is also a weak negative correlation with the shear viscosity at 1 s^{-1}, an intermediate shear rate. Understanding the nature of these relationships is difficult. Surprisingly, there is no correlation between personal preference and a paint's shear thinning characteristics, where the correlation parameter is only −0.38.

PERSONAL PREFERENCE VS ART DEVICE DATA

Table 12 summarizes the correlations between the mean personal preference and various measured ART device parameters arranged in the order of the decreasing value of the correlation parameter. Unlike applied paint characteristics and rheology data, ART device data show stronger statistical correlations with the personal preference.

Table 12 shows strong negative correlations between the personal preference and the total number of dips (−0.88, not shown in the table) and length rolled. The negative correlation indicates that the shorter the distance, the fewer dips are required to cover the substrate, and the more likely the paint is going to be liked by a consumer.

TABLE 9—Compilation of Steady Shear Rheological Data

	STEADY SHEAR VISCOSITY (Pa.s)						
	STEADY SHEAR VISCOSITY (Pa.s)						SLOPE
ID	0.01 1/s	0.1 1/s	1 1/s	10 1/s	100 1/s	1000 1/s	
Ac15	61.71	45.29	17.26	4.72	1.367	0.386	-0.52547
Ac17	300.9	100.5	26	4.138	0.844	0.2199	-0.72477
Ad25	90.03	53.11	13.58	3.54	1.241		-0.55675
Ad42	26.27	12.11	4.644	1.903	0.8525		-0.38331
Bc22	388.3	83.7	12.14	2.489	0.8504	0.3626	-0.67263
Bc42	102.8	28.93	7.115	1.932	0.6507	0.2432	-0.55546
Bd42	580	150.5	24.41	4.842	1.379	0.4288	-0.695
Bd44	41.16	20.7	8.653	3.431	1.398		-0.39262
Cc12	143.2	32.47	8.082	2.638	1.164	0.4054	-0.48663
Cc20	345.3	50.97	9.732	2.658	1.057	0.341	-0.56059
Cd21	91.69	17.15	4.288	1.729	1.12		-0.39327
Cd55	227.1	40.7	8.792	2.788	1.217	0.4947	-0.50325
Dc40	307.1	70.08	11.82	2.579	0.9656		-0.63411
Dc41	707.5	134.2	25.02	4.161	0.877	0.3757	-0.75375
Dd40	423.1	66.53	10.77	2.465	0.8317	0.2762	-0.63636
Dd69	52.82	18.62	6.429	2.906	1.298	0.5138	-0.37095

TABLE 11—Pairwise Correlations between Personal Preference and Paint Rheology

CORRELATIONS	MEAN (PERSONAL PREFERENCE)
MEAN (PERSONAL PREFERENCE)	1.0000
MEAN(G′ @100R/S)	−0.2142
MEAN(G′ @10R/S)	−0.3037
MEAN(G′ @1R/S)	−0.2673
MEAN(G′ @0.1R/S)	−0.2220
MEAN(G″ @100R/S)	0.1868
MEAN(G″ @10R/S)	−0.1627
MEAN(G″ @1R/S)	−0.3140
MEAN (G″ @0.1R/S)	−0.2698
MEAN(TANδ@100R/S	0.4429
MEAN(TANδ@10R/S)	0.3487
MEAN(TANδ@1R/S)	0.2098
MEAN(TANδ@0.1R/S)	0.2893
MEAN(SSV @0.01S-1)	−0.1720
MEAN(SSV @0.1S-1)	−0.2650
MEAN(SSV @1S-1)	−0.4138
MEAN(SSV @10S-1)	−0.3841
MEAN(SSV @100S-1)	0.0782
MEAN(SSV @1000S-1)	0.2841
MEAN(SSV SLOPE)	0.3798

TABLE 10—Pairwise Correlations between Personal Preference and Paint Applied Properties

VARIABLE	BY VARIABLE	CORRELATION	COUNT	LOWER 95%	UPPER 95%	SIGNIF PROB
KU	MEAN(PERSONALPREFERENCE)	−0.2453	16	−0.6607	0.2850	0.3597
ICI	MEAN(PERSONALPREFERENCE)	0.4733	16	−0.0292	0.7849	0.0640
BRKFLD	MEAN(PERSONALPREFERENCE)	−0.4386	15	−0.7764	0.0950	0.1020
LEVELING VALUE	MEAN(PERSONALPREFERENCE)	0.3341	16	−0.1937	0.7119	0.2060
ANTI-SAG LEX	MEAN(PERSONALPREFERENCE)	−0.3586	16	−0.7254	0.1667	0.1725
GLOSS 20 DEG	MEAN(PERSONALPREFERENCE)	−0.0121	16	−0.5048	0.4865	0.9646
GLOSS 60 DEG	MEAN(PERSONALPREFERENCE)	0.0533	16	−0.4544	0.5349	0.8445
GLOSS 85 DEG	MEAN(PERSONALPREFERENCE)	−0.1901	16	−0.6267	0.3374	0.4808
OPEN TIME	MEAN(PERSONALPREFERENCE)	0.6429	16	0.2160	0.8634	0.0072

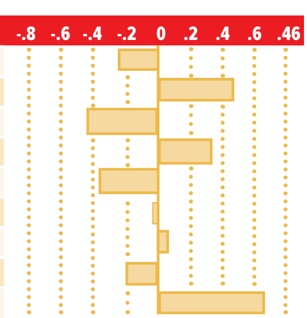

TABLE 12—Pairwise Correlations between Personal Preference and ART Data

VARIABLE	BY VARIABLE	CORRELATION	COUNT	LOWER 95%	UPPER 95%	SIGNIF PROB
MEAN(TOTAL LENGTH)	MEAN(PERSONALPREFERENCE)	−0.8010	16	−0.9282	−0.5063	0.0002
MEAN(STROKES)	MEAN(PERSONALPREFERENCE)	−0.7558	16	−0.9104	−0.4159	0.0007
MEAN (t_PAINTING)	MEAN(PERSONALPREFERENCE)	−0.7374	16	−.9030	−0.3808	0.0011
MEAN(EFFORT)	MEAN(PERSONALPREFERENCE)	−0.6607	16	−0.8711	−0.2454	0.0053
MEAN(<V>)	MEAN(PERSONALPREFERENCE)	−0.5241	16	−0.8095	−0.0384	0.0372
MEAN(EFFORT/t)	MEAN(PERSONALPREFERENCE)	0.3294	16	−0.1987	0.7093	0.2128
MEAN(EFFORT/L)	MEAN(PERSONALPREFERENCE)	0.2992	16	−0.2307	0.6922	0.2603
MEAN(PAINTAPPLIED)	MEAN(PERSONALPREFERENCE)	0.2186	16	−0.3108	0.6445	0.4161
MEAN(MEDIAN Fz)	MEAN(PERSONALPREFERENCE)	0.1969	16	−0.3311	0.6310	0.4648
MEAN(<Fz>)	MEAN(PERSONALPREFERENCE)	0.1630	16	−0.3619	0.6095	0.5464

The number of strokes, painting time, effort, and average velocity all show significant negative correlations with personal preference. The correlation indicates consumers like fewer strokes, shorter painting time, and less effort. Velocity also yields negative significant correlation, suggesting that when a consumer likes a paint, he or she may paint slower.

SUMMARY AND CONCLUSION

This article summarizes a large body of data based on 16 commercial paint formulations. It encompasses data on consumer preference, ART device parameters, rheology, and applied paint characteristics.

Consumer preference studies are expensive, time-consuming, and ultimately produce results with large variability. The purpose of this study was to establish how personal preferences can be predicted with a degree of certainty without a full consumer panel study. It also sought to identify paint characteristics formulators can embrace to produce paints that are likely to strongly appeal to consumer preferences.

The findings show that both rheology and applied paint characteristics produce only weak correlations with personal preference, and, therefore, cannot be used as independent indicators of consumer preference. The few weak correlations observed were the negative correlations with Brookfield viscosity and steady shear viscosity at 1 s^{-1}. Positive weak correlations were observed with ICI viscosity and tanδ at 100 rad/s. These correlations are not intuitive, and their significance is not explored further.

The Application Reader Technology device, on the other hand, unequivocally demonstrated its value by generating parameters that yielded strong or significant correlations with personal preference. ART data output can be used to predict paints likely to be preferred by consumers. As demonstrated, the paints that take the least number of dips per given substrate size, that require the least distance to roll, the fewest strokes, the shortest time to paint with the slowest velocity, and the least effort are expected to be preferred by a consumer panel. ❊

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