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Using SAS® Customer Intelligence 360 Multivariate Testing to Determine Incremental Campaign Revenue

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ABSTRACT

Do you want to determine which campaign would be the most financially successful at increasing revenue for each customer segment? Probably your business has different customer segments, but you want to determine which single campaign will be the most relevant at driving the most business value. Most companies want to identify their most impactful campaigns. Accenture found that “91% of consumers are more likely to shop brands who provide relevant offers and recommendations,” but concluding which campaign resonates the most with your visitors can be overwhelming and time-consuming. In this paper, we discuss SAS® 360 Discover, SAS® 360 Engage Digital, and SAS® Studio solutions can be leveraged for an e-commerce business to determine which campaign and functional effort was the best at delivering incremental revenue and conversion per customer segment. We deployed A/B and multivariate tests using SAS 360 Engage and captured the data that delivered targeted personalized campaigns, and then we analyzed each marketing campaign to adjudicate the most prosperous based on conversation rate, average order value, revenue per session, and conversation rate lift. Finally, we calculated the statistical significance of each metric.

INTRODUCTION

Today’s online shoppers are savvy and have high expectations. They have little patience with content that does not engage them. Retailers are challenged to maximize their campaign budget while increasing their marketing channel reach and providing relevant and engaging campaigns that work for each segment. There are infinite potential opportunities to convey the same message. What are the risks that businesses face when they do not meet visitors’ expectations? “One in three consumers (32%) say they will walk away from a brand they love after just one bad experience” (PwC). So how can we determine what content is going to resonate with the customer experience or drive incremental value?

The challenge for marketers is trying to predict campaigns or creative outcomes that entice customers to convert via a purchase or even just a click. How can we determine what campaigns are going to be the most engaging? “Consumers have become so accustomed to businesses only shooting relevant messages their way, that 71% of them feel frustrated when their retail experience feels impersonal” (Business 2 Community). Testing for e-commerce business is an essential part of understanding a user’s behavior, and A/B or Multivariate (MVT) testing gives marketers the ability to identify what campaign will work best. However, there are challenges with testing. How quickly can testing be implemented? What is the difference between clicks and purchase conversation? How can you determine a clear winner? What is the financial impact of each creative campaign?

Digital campaign testing can be quick to deploy and easy to build. In SAS 360 Engage Digital, you can test a hypothesis while randomizing testing visitors and examine engagement to analyze whether there is a statistical difference between the creative versions and conclude which of the variants drive the most conversions. But why stop at the

basics? E-commerce business can cross-layer the testing results with website performance and financial data to assess the impact of a creative or promotional decision.

In the following use case, we share how SAS 360 Discover, SAS 360 Engage Digital, and SAS Studio were used for an e-commerce retailer to determine campaign successes. They leveraged users' behavioral data to identify which campaign was driving incremental revenue and conversion. SAS 360 Discover collects customer-level data to identify, track, and define all customer segments and interactions across digital channels. SAS 360 Engage Digital enables marketers to dynamically create, test, manage, and place digital content in real time. Downloaded visitor engagement data from Data Hub is analyzed with SAS Studio to create a granular picture of the customer's A/B and MVT campaign behavior and journey for a financial realization of the campaign. The analysis led e-commerce business owners to determine the successful multivariate test. Deploying that approach would drive incremental campaign revenue in the following ways:

- increase conversion click behavior by having more visitors engage with the creative campaign
- increase revenue by leveraging creative campaign offers
- increase number of items purchased by added incremental pieces to their shopping cart

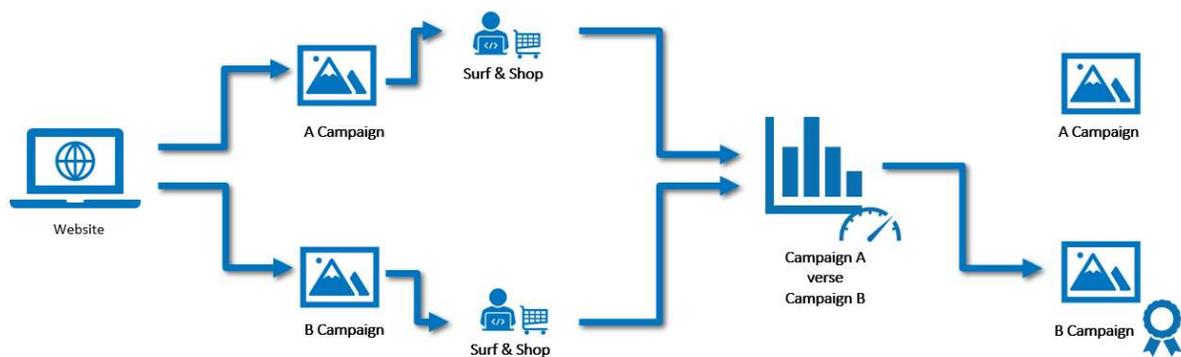


Figure 1: A/B or MVT Campaign Testing Use Case

Business objectives prompted which critical data points were needed to analyze the financial impact of the campaigns. These data points included Average Revenue Per Session, Average Order Value, Order Count, Total Order Value, Total Session, and Conversion Rate Lift, including calculating the statistical significance between variations for several of the metrics.

Domain 1 Results										
Creative Name	Total Sessions	Total Order Value	Order Count	Conversion Rate	New Visitor Conversion Rate	Average Order Value	Average Time on Site	Bounce Rate		
Creative A	270,053	\$1.611MM	11,100	4.123	3.155	\$ 140.28	995.63	27.949		
Baseline	268,000	\$1.612MM	11,000	4.112	3.134	\$ 145.92	1008.62	27.231		

Domain 1 Conversion Lift Significance Level				
Creative Name	Comparison	Variable	Adjp	Sig_Level
Creative A	Baseline	CR Lift	0.8374	0.163

Domain 1 Significance Level Average Order Value				
Creative Name	Comparison	Variable	Adjp	Sig_Level
Creative A	Baseline	AOV	0.4389	0.5611

Domain 1 Significance Level Revenue Per Session				
Creative Name	Comparison	Variable	Adjp	Sig_Level
Creative A	Baseline	RPS	0.7694	0.231

Figure 2: Sample A/B Report with Statistical Significance

PLANNING AND DEPLOYING THE TESTING PROCESSES

Understanding business-critical metrics like conversion rate, lift, baskets, abandoned, baskets, completed, new visitor conversion, and e-commerce conversion was critical to determining which test variant generated incremental revenue. The test was designed and deployed using SAS 360 Engage Digital. However, the primary e-commerce metrics for calculation were collected with SAS 360 Discover. Data from both SAS 360 Engage Digital and SAS 360 Discover was exported from the Data Hub for analysis in SAS Studio.

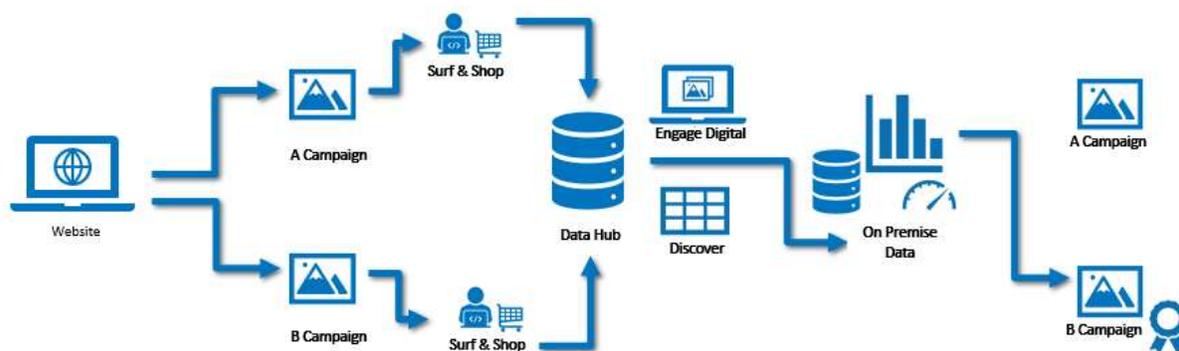


Figure 3: SAS 360 Multivariate Testing Use Case Data Flow

COLLECTING WEBSITE DATA WITH SAS 360 DISCOVER

The first step was to start collecting general website and e-commerce data using SAS 360 Discover. SAS 360 Discover automatically starts collecting basic website behavior when the site is tagged (for example, time on site, views, bounce, return or new visitor, date/time, pages, and session). To collect custom or website-specific information, you need to use configurations or the JavaScript Event API. To build configurations rules, there are several options to identify the data that needs to be collected, which include selecting, coding in the 360 user interface (UI), or pulling the data using JavaScript. Events are a specific configuration used for populating three e-commerce Discover tables with data such as Add to Cart, Cart View, Product Categories, Cart Quantity, Basket Adds, Basket Revenue Added, and others.

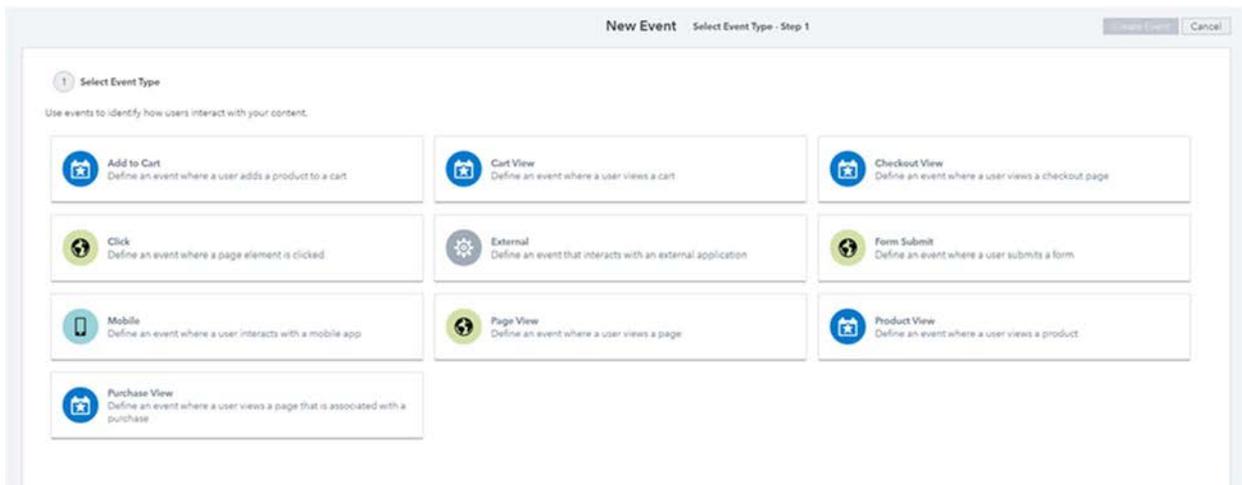


Figure 4: SAS 360 Engage Digital Event Screen

Technical website limitations specific to this domain required building Total Revenue as a Custom Attribute Configuration using an existing JavaScript variable located in the data layer. Custom Attributes are needed for collecting information that does not easily fit in a typical collection rule. Custom Attribute information populates the Custom Attribute Table.

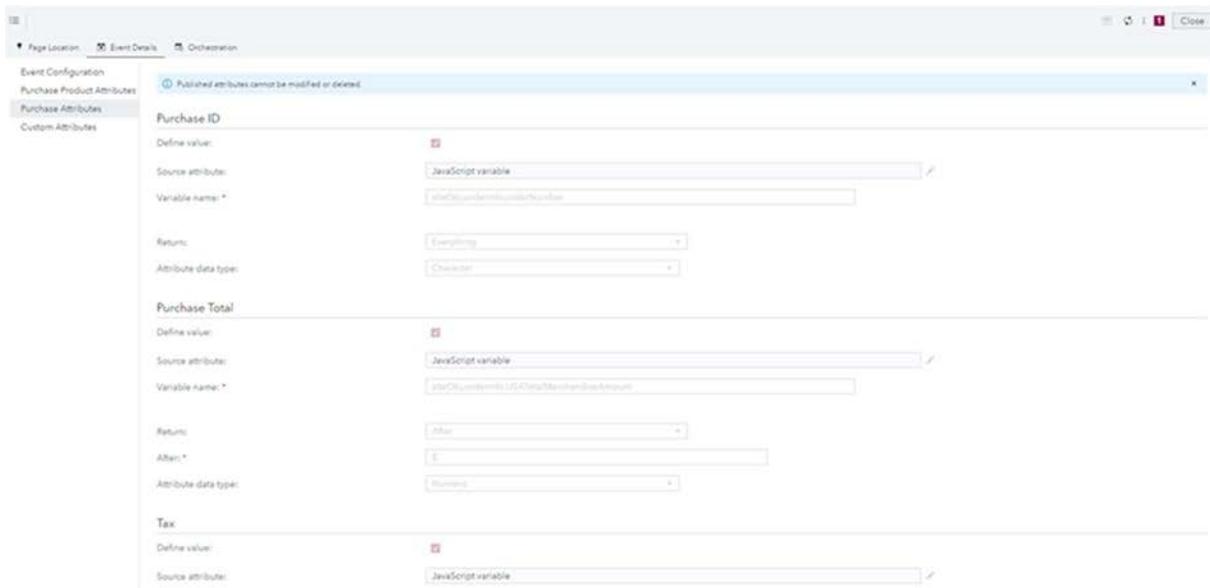


Figure 5: Event Collection Rule for Capturing JavaScript Variables

BUILDING AN A/B OR MVT TEST WITH SAS 360 ENGAGE DIGITAL

After the data collection was validated, the next step was to build the testing experience in SAS Engage Digital. SAS 360 Engage Digital distributed the randomized A/B Test, known as an A/B Task. The campaign or creative content is displayed and tracked. Reporting metrics on the users' behavior are collected to populate the Engage Digital tables inside of the Data Hub. If desired, return site visitors can have creative or campaign continuity during the time of the testing. Typically, the creative variations are designed inside the UI, but content already exists on the website.

The Spot, or location, where the Creative content was going to be delivered was in a hidden location on the page, which needs to be visible only when the designated test recipient was on that page. Developers embedded an HTML identity modal on the websites and SAS 360 Engage Digital leveraged the "SAS container" to turn the creative on when deploying the test (as seen in the following HTML code).

```

<!-- SAS Containers -->
<style>
.sas-testing-containers {
  display: none;
}
</style>
<div id="sas-container" class="sas-testing-containers"></div>
<div id="sas-container2" class="sas-testing-containers"></div>
<div id="sas-container3" class="sas-testing-containers"></div>
<div id="sas-container4" class="sas-testing-containers"></div>
<div id="sas-container5" class="sas-testing-containers"></div>

```

Figure 6: Website Creative Container for Deploying Content

The process embeds the HTML identity modal information as a Spot on the SAS 360 UI, and then builds a creative element to trigger the hidden campaign, using HTML code, which is controlled by an A/B Task.



Figure 7: HTML Code Inside of Creative Block

Developing the A/B or MVT Task is the last step in launching a test. The Task defines the Spot, Creative, segment, test time frame, along with some general primary and secondary reporting metrics. Primary metrics that were added included Add to Cart, Checkout, Product View, and Purchase. They were built as SAS 360 Discover e-commerce events configurations. Click-through was a secondary metric.

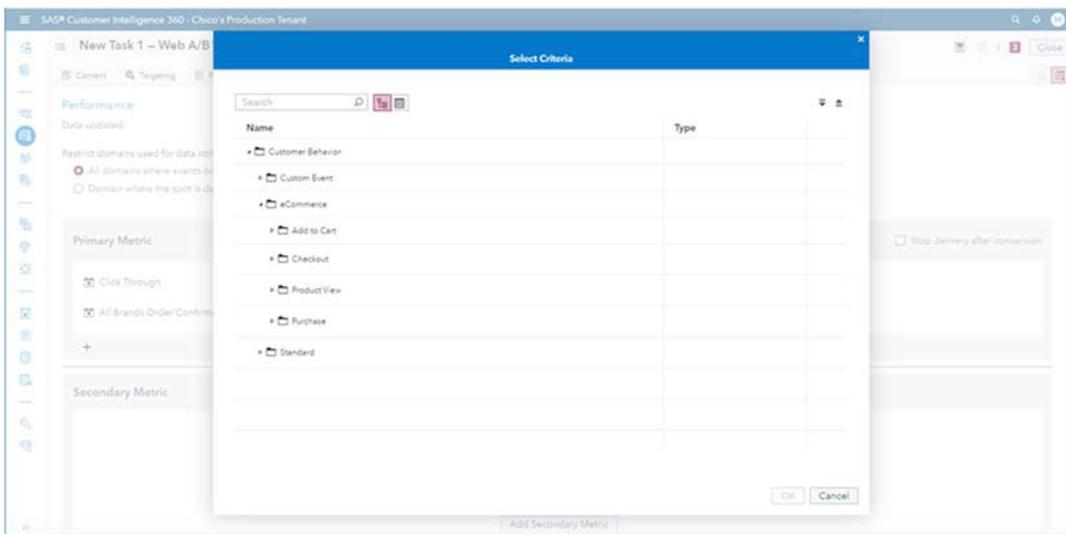


Figure 8: Selecting Custom Reporting Metrics

A/B OR MVT TEST IMPLEMENTATION

After we have added all the elements needed for the build and general reporting metrics, we Publish the Task to start running the test. On the retailer's website, the A/B or MVT Test starts to run seamlessly. As visitors are served up the Test Creative, SAS 360 Insights provides real-time reporting out-of-the box. For this use case, raw session-level data was downloaded into an on-premises reporting environment each morning from the SAS Data Hub.

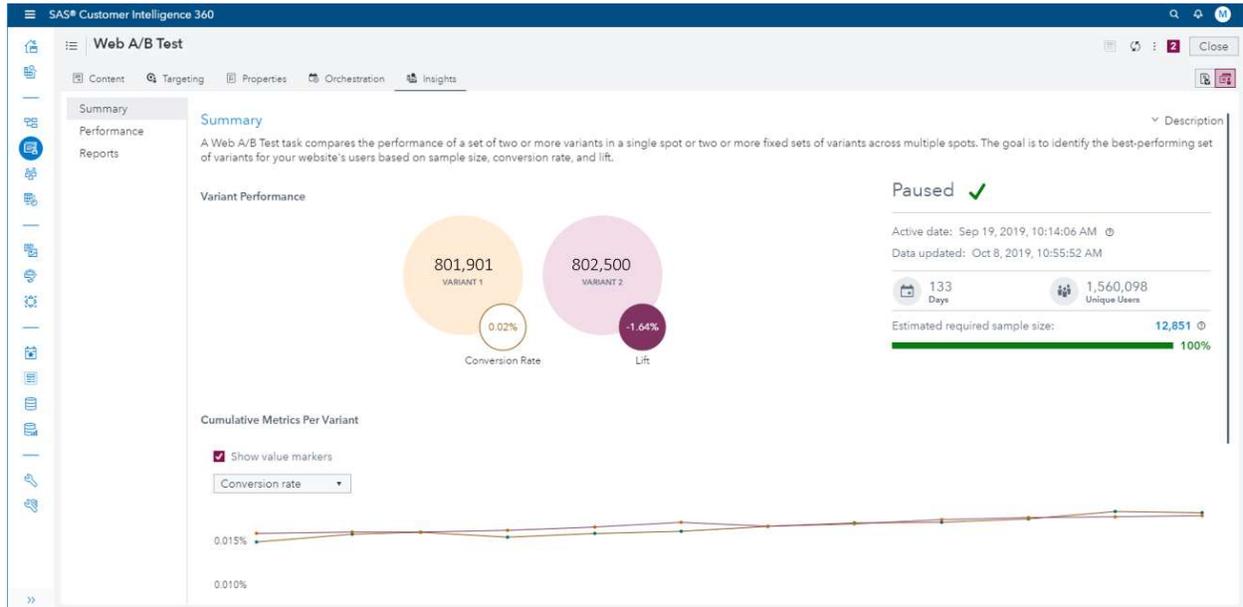


Figure 9: SAS 360 Insights Report

CUSTOM REPORTING METRIC DEFINITIONS

REPORTING METRICS USED TO ASSESS CAMPAIGN SUCCESS

SAS 360 Discover reports on many key metrics are used to ascertain the success of a web A/B test. Note that some metrics are available to be aggregated at the session or user level. These include, but are not limited to, the following:

Average Add to Cart
Average Order Value
Average Page View
Bounce Rate

Conversion Rate
Revenue Per Session
Time on Site

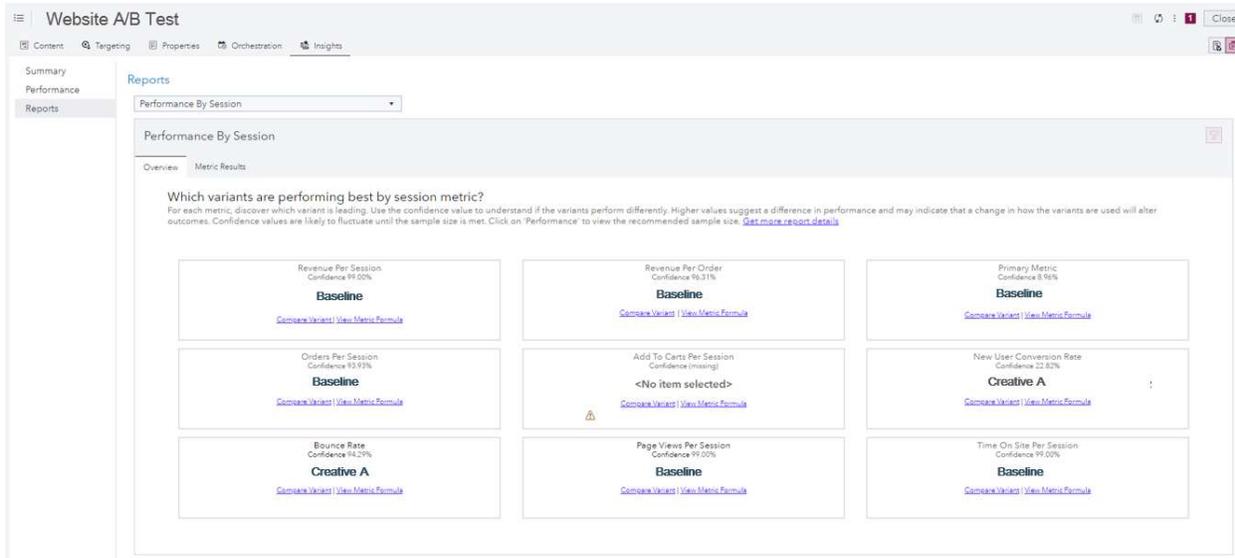


Figure 10: Revenue per Session and Average Order Value

Two of the above metrics, Revenue Per Session and Average Order Value (also referred to as Revenue Per Order), are integral to determining which variant of an A/B test generates more revenue. Other metrics like Bounce Rate, Page Views, and Time on Site are more relevant to assessing a viewer’s level of engagement with a page. You can see the formula used by SAS Customer Intelligence 360 for any of the metrics by clicking **View Metric Formula**.

Here are the definitions and formulas listed for Revenue Per Session and Revenue Per Order from the **View Metric Formula**:

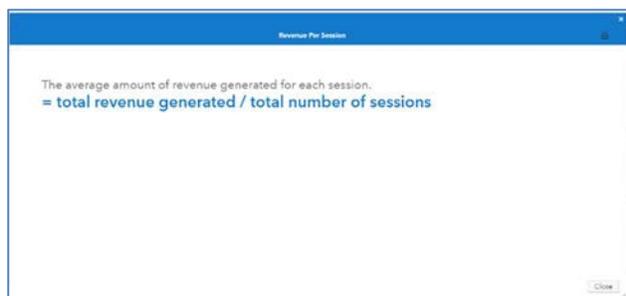


Figure 11: Revenue per Session Formula from View Metric Formula

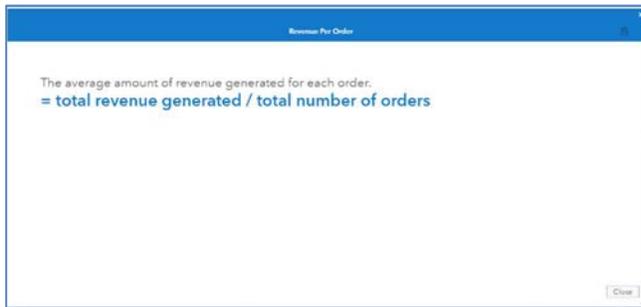


Figure 12: Revenue per Order Formula from View Metric Formula

For most use cases, you can leverage these KPIs from within the SAS Customer Intelligence 360 UI. However, in the case of our retailer, we were not able to use the metrics as defined within the tool. For our use case, some of the metrics were not accurately captured in the tool due to website data collection. The metrics were also calculated using custom attributes. One metric was defined by different business logic and needed to be recalculated using a different formula.

We will elaborate on our reasons for using custom metric calculations and the methods for doing so in later sections.

METRIC ENHANCEMENTS – USING CUSTOM ATTRIBUTES

We also needed to define some of our own e-commerce custom metrics in order to assess which variant was most successful. The customer website was not accurately capturing customer order values as mentioned in the section "Collecting Website Data with SAS." This was due to technical website limitations in the check-out pages. Therefore, we configured a custom attribute called "checkout_custom" to accurately capture each order value.

For more information about configuring custom JavaScript variables, consult the SAS® Customer Intelligence 360 User's Guide.

CUSTOM REPORTING SOLUTION

CREATING THE REPORT DATA SET

The SAS Customer Intelligence 360 data download is possible via the SAS Customer Intelligence 360 Download API, which is detailed in *SAS Customer Intelligence 360: Tutorials and Examples*. This paper does not address the API, but instead covers applications of transforming and analyzing the downloaded data.

Once the data is downloaded, we needed three tables for our use case of recalculating Average Order Value and Revenue Per Session.

The following tables were needed:

- Custom_Attributes –checkout_custom attribute configured as noted above
- Order_Summary
- Engage

Note that these tables were used in a prior release of SAS Customer Intelligence 360. Now that these tables are in a Unified Data Model, they are different. However, the fields should still be the same.

We will not provide the exact code, but we will sketch a general approach on how to transform the data into the format needed for reporting.

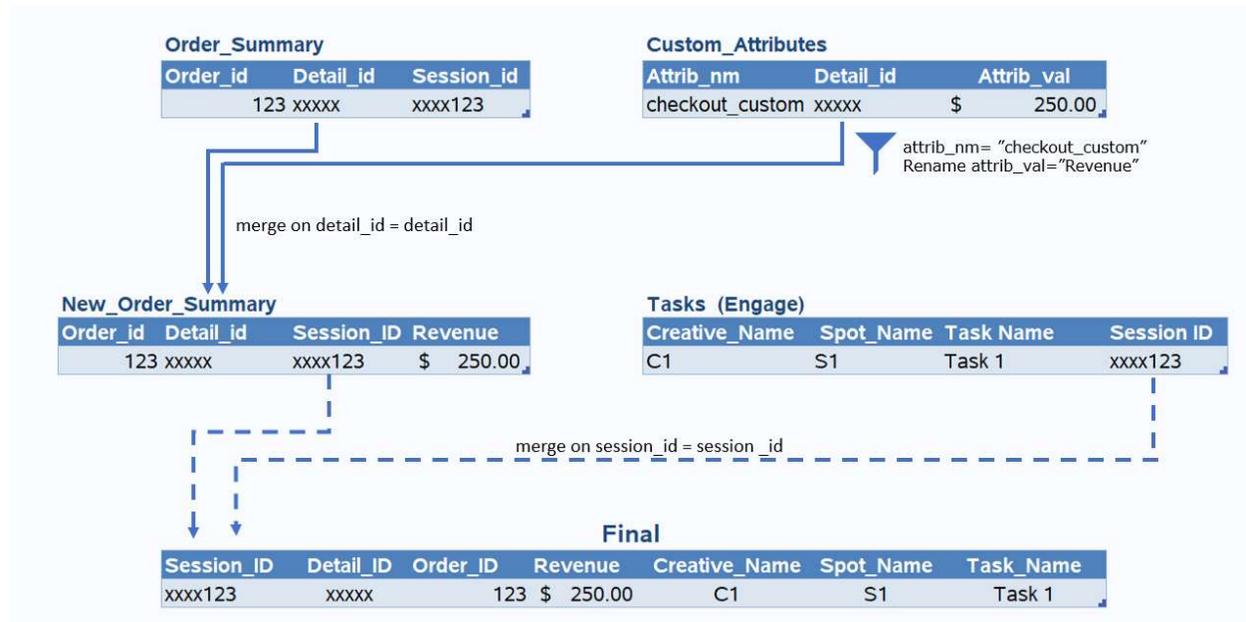


Figure 13: Example of Process of Integrating Data Tables

The following logic was used to merge these tables into the final dataset:

1. Filter the Custom Attribute Table to only the desired custom attribute and assign a logical name to the attribute value (where `attrib_nm="checkout_custom"`, rename `attrib_val="Revenue"`).
2. Merge custom attribute information to the `order_summary` table.
3. Merge the new, combined table to the Task/Engage table.

Final

Session_ID	Detail_ID	Order_ID	Revenue	Creative_Name	Spot_Name	Task_Name
xxxx123	xxxxx	123	\$250.00	C1	S1	Task 1

Figure 14: Example of Final Table

From this table, you can then aggregate the data using the tool of your choosing to create the final report. Aggregation and tabulation follow the same formulas as indicated in the first section, just using what is available in this new table. Any custom metric formulas would be introduced at this point, as discussed in the next section.

CUSTOM METRIC DEFINITION: CONVERSION RATE

Another possibility is that your use case may not fit squarely within the predefined calculations in the tool. For our e-commerce use case, we recalculated Conversion Rate outside of SAS Customer Intelligence 360 based on a different calculation that is available in the tool.

A website conversion occurs when the customer completes the action that is the goal of the test or campaign. For different tests, this could be providing one's email address, viewing a desired page, or completing a form. In the realm of e-commerce, this often is defined as making a purchase.

SAS 360 Engage Direct has several possibilities that can be configured as the primary metric for a conversion (i.e., Page View, Click Through). For an e-commerce site, a conversion is often considered to be a purchase. In implementing the site configuration, there were some hurdles in fully and accurately capturing purchases as a conversion. For example, one could count order confirmation page views. However, one could reload the page or close the page too quickly for the tracking cookie to be loaded.

Instead of trying to define within SAS Customer Intelligence 360, we calculate Conversion Rate and Conversion Rate Lift outside the tool based on the data set in Figure 14. Note this is a calculation on the aggregated conversion rate for the test variant and baseline variant.

$$\text{Conversion Rate} = \text{Total number of orders} / \text{Total number of sessions}$$

Conversion Rate Lift can then be calculated once Conversion Rate has been calculated for the Test and the Baseline:

$$\text{Conversion Rate Lift} = (\text{Conversion Rate Test} - \text{Conversion Rate Baseline}) / (\text{Conversion Rate Baseline})$$

STATISTICAL TESTING

Are the variants really that different?

After calculating your custom metrics, or metrics based off custom attributes, you may find yourself wondering — Are these values different enough between variants to conclude if there is a true "winner"?

For our use case, we ran significance testing and used a 95% confidence level as our barometer for materially different performance.

For our purposes, we used PROC GLM along with some simple data transformations to produce this table for the report.

```
ods output diff=aov;
proc glm data= custom_data(where=(revenue is not missing));
class creative_name;
model revenue=creative_name;
lsmeans creative_name/pdiff=all alpha=0.05 cl;
```

`quit;`

You will then get an output table called WORK.AOV:

Effect	Dependent	RowName	1	2
Creative_Name	Revenue	1	-	0.9205
Creative_Name	Revenue	2	0.9205	-

Here is sample output from PROC GLM, showing $Pr > |t|$ is 0.9205, as it is in the table.

The GLM Procedure
Least Squares Means
Adjustment for Multiple Comparisons: Tukey

Creative_Name	Order_Value LSMEAN	H0:LSMean1=LSMean2	
		Pr > t	
A	372.167939	0.9205	
B	369.419847		

Creative_Name	Order_Value LSMEAN	95% Confidence Limits	
A	372.167939	333.859279	410.476599
B	369.419847	331.111188	407.728507

Least Squares Means for Effect Creative_Name			
i	j	Difference Between Means	Simultaneous 95% Confidence Limits for LSMean(i)-LSMean(j)
1	2	2.748092	-51.428541 56.924724

Figure 15: The GLM Procedure

Confidence equals $1 - p\text{-value} = .0795$. This is less than 95%; therefore, we conclude that the mean order value between Test A and Test B does not have a statistically significant difference.

In order to visualize this in a tabular output, we used PROC TRANSPOSE to create a table, and then simplified and formatted it:

```
proc transpose data=aov out=aov_trans;
  by rowname;
  var _numeric_;
run;
```

RowName	_NAME_	COL1
1	1	.
1	2	0.9205
2	1	0.9205
2	2	.

```
proc sql;
  create table aov_final as
  select case when strip(rowname) = '1' then 'Baseline'
```

```

end as creative_name,
  case when strip(_name_) = '2' then 'Creative_A'
end as creative_name_comparison,
  coll as adjp FORMAT= 6.4,
  1-coll as significance
from aov_trans
  where strip(rowname)='1' and strip(_name_)='2'
;
quit;

```

creative_name	creative_name_comparison	adjp	significance
Test	Baseline	.9205	.0795

You can use a similar testing method to assess the statistical significance of the revenue per session.

Note that when running statistical testing, to choose the proper test, you should consider the attributes of your data and the hypothesis that you are testing. By doing so, you will have confidence that there is a true difference in the performance of the variants, as opposed to differences that are negligible or due to natural variation in the data.

SUMMARY

SAS Customer Intelligence 360 is a powerful tool for marketers that allows for the design, execution, and analysis of e-commerce and m-commerce marketing campaigns. However, it is not an exhaustive testing tool, and can be enhanced in several ways, such as by configuring custom JavaScript variables, calculating custom metric formulas, and running statistical analysis on these new metrics.

M-COMMERCE SEGMENTATION TESTING

Marketing campaigns are a large financial risk for e-commerce and m-commerce (mobile) businesses. Marketers need to analyze not only a single element but a whole campaign or a series of campaigns. The marketers wanted to have a deeper understanding of campaign impact by device type, so using SAS Customer Intelligence 360, they were able to run an MVT campaign to answer campaign influence.

The targeted segment test, e-commerce and m-commerce was randomized by SAS 360 Engage and presented creative alternatives from discounting, which included free shipping. Moreover, the campaigns were delivered mobile-only, using the desktop as a baseline during a two-week period.

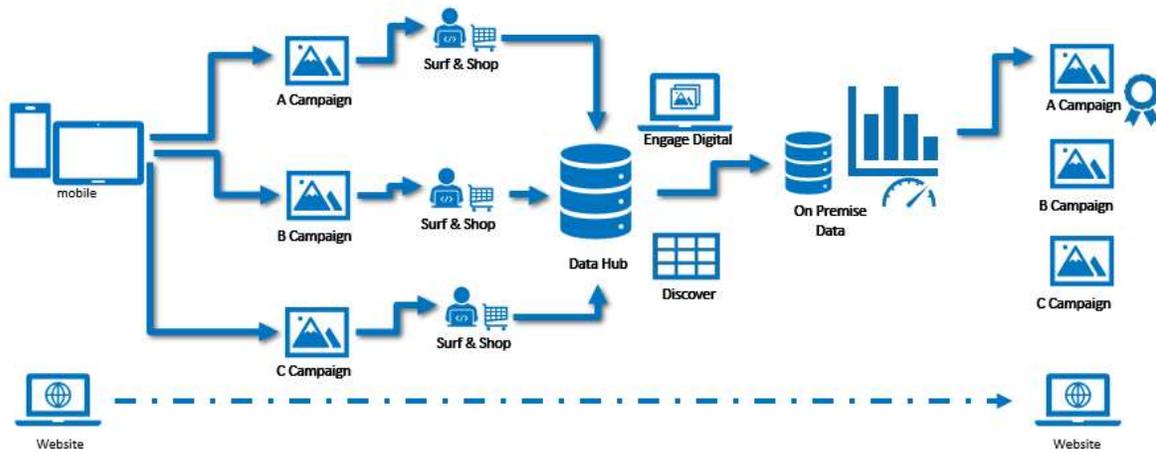


Figure 16: M-Commerce MVT Segment Testing Use Case

Understanding the behaviors of brand enthusiasts can change a business. Leveraging customer loyalty segments for testing is a great way to gain a better understanding of how customers are interacting with the brand. Not only is the MVT segment great for testing messaging impact, but also great for testing ideas and understanding the customer’s expectations. The MVT segment test ran on the website and mobile for over a month to understand what type of discounting is most important: free shipping, discounting at 10 percent with free shipping, or discounting at 20 percent.

Do different segments need different campaigns?

CREATING NEW SEGMENTS WITH TESTING

Testing can lead to new segmentation discoveries and identifying groups and behavior that were otherwise unknown about the customer. Not all segments are based on the dollars spent because not everyone wants a deal. Some people want their style or color. SAS 360 Engage Digital can build customer segmentation and customer journeys from testing results. The retailer started with an unknown visitor that had not purchased during a previous visit, and then maybe they see a campaign and end up purchasing. A second test could be a product recommendation based on previous purchase. If the customer is interested in product upsells, then that might be a new segment based on types of items that are purchased. You try different type of campaigns like free shipping, or product upsell, or discounting. Segmentation is more customized for the individual, so their shopping/brand engagement meets their individual expectations. This approach could create brand enthusiasts or loyalists, because you are providing a better customer experience based on their interactions.

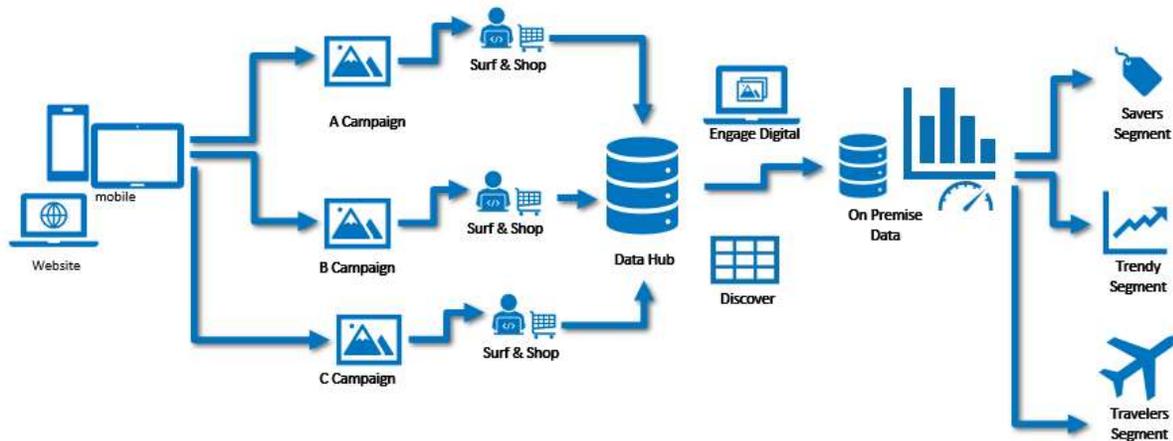


Figure 17: Creating New Segments

Based on the visitor’s interactions, they would continue to be part of specific loyalty groups or be migrated to a newly designed segment or sub-segment.

This new customer segment data was then downloaded for integration with offline data or SAS Marketing Automation (now SAS Direct) to be identities in a new group.

BENEFITS OF CUSTOM REPORTING

Customizing reports leads to many benefits, which give marketers a more holistic and accurate reporting view. It’s then possible to enrich reporting by layering in data from additional sources, such as loyalty information, geography, demographics, or past purchase information.

The reporting interface can also be built out in the interface of your choice. We used output to Microsoft Excel, because our report consumers wanted something that could be easily distributed. Moreover, the report could be built out in existing infrastructure and designed to look cohesive and comply with company standards.

CUSTOM REPORTING – OFFLINE INTEGRATION

The steps and approach outlined here are just a few ways to apply custom reporting to assess A/B Test and MVT Test incremental growth. Other applications could include re-running the report after a period of time. Business owners could look at the updated revenue after adjustments or returns and assess whether the results of the test are still valid. This is especially true in our e-commerce example for the total revenue net after returns.

Reporting could also be enhanced to include customer offline behavior to see whether there is any cross-channel impact. Which online promotions drive customers to the store?

Other ideas would be to look at the projected lifetime value of the customers in each test and see whether one test was more appealing to those high-value customers. Other statistical tests could be considered as well for reporting, such as including confidence

intervals on revenue-based metrics or analyzing whether there are statistical differences in the demography of purchasers versus non-purchasers.

CONCLUSION

Every message counts. Creatives and campaigns that do not engage e-commerce or m-commerce visitors have statistically shown they create brand-agnostic customers. In today's competitive environment, marketers need to ensure they are deploying the right message, on the right device, at the right time, for the right segment, all while staying within budget.

SAS 360 Discover, SAS 360 Engage Digital, and SAS Studio solutions can help businesses determine success for A/B and Multivariate testing. SAS 360 Engage Digital gives marketers the ability to dynamically create, test, and manage digital content in real-time implementation tests, while SAS 360 Discover collects the visitor behavior and revenue. Businesses can then download the visitor testing data to an environment and use SAS Studio. Then SAS Studio will allow analysts to stitch together the Discover behavioral and revenue data with Engage Task tables to build analytical models. The analytical models can reveal buyer behavior that reveal campaign potential, that in turn can increase customer engagement, increase revenue, and purchase of incremental items.

The SAS solutions helped the e-commerce retailer successfully deploy tests, capture the data, and analyze the results to adjudicate the most prosperous campaign based on conversation rate, average order value, revenue per session, and conversation rate lift, along with authenticating significance and confidence intervals. The retailer is continuing to develop new offline and online testing opportunities for greater understanding of their customers' behavior for increased engagement.

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RECOMMENDED READING

- SAS Institute Inc. *SAS® Customer Intelligence 360 Blogs*. Available <https://blogs.sas.com/content/?s=Customer+Intelligence+360>.
- SAS Institute Inc. *SAS® Customer Intelligence 360: Tutorials and Examples*. Available <https://go.documentation.sas.com/?docsetId=cintex&docsetTarget=use-discover-download-api.htm&docsetVersion=19.09&locale=en>.
- SAS Institute Inc. *SAS® Studio Support*. Available <https://support.sas.com/en/software/studio-support.html>.

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