



BigQuery for Experiment Analysis

Everything you need to know to get started

A Practical Guide to
Reliable A/B Test Analysis
with BigQuery



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Executive Summary

Running trustworthy A/B tests means having data you can trust. But many teams still rely on GA4 reports to decide which variation wins – and that can be risky.

GA4 sometimes produces misleading results due to data sampling, aggregation, or a technique called **HyperLogLog++**.



In some cases, this can make a test result look more confident than it really is.

This whitepaper, based on the webinar by Bas Linders (Happy Horizon) and Steffen Schulz (Verify), explains how BigQuery helps reduce that risk. You'll learn what makes BQ different from GA4, how to avoid common data pitfalls, and **how to get started**.

With simple **SQL templates, real-life testing examples, and hands-on tips**, you can begin using BigQuery right away – even without a full data team.

This is not just about tools. It's about creating a more reliable foundation for decision-making.

Introduction

Many teams use GA4 to run experiments. It's fast to set up, works with Looker Studio, and feels like a good default.

But tools like GA4 weren't designed for detailed test evaluation. They focus on speed and usability – not necessarily accuracy.

These visualizations are often based on modeled or sampled data. While this helps load dashboards faster, it can make the real effects of a test harder to judge.

In the webinar, we explained how this can lead to misleading conclusions. When the underlying data is pre-processed and simplified, **important details might be lost**. This makes it harder to understand what really happened during an experiment.

BigQuery, by contrast, provides raw event-level data. It allows you to explore the data without filters, modeling, or aggregation. You can group it how you want, compare what matters, and see the actual differences.

If you're running experiments, the way you access and analyze data matters. GA4 and similar tools may be great for reporting – but not for deep statistical analysis.

That's why many teams shift their analysis layer to BigQuery. It's not about replacing GA4. It's about **taking ownership** of the interpretation layer – and making sure it reflects what truly happened.

GA4 vs. BigQuery – Key Differences Explained

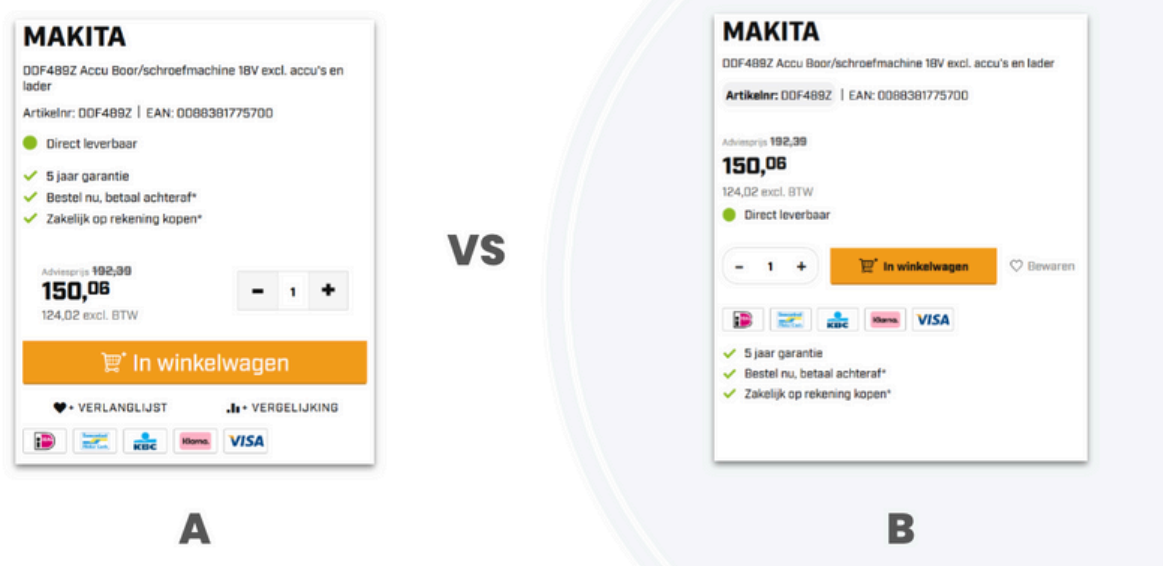
GA4 and BigQuery may use the same underlying data, but the way they present and access that data is fundamentally different.

Google Analytics 4 uses probabilistic methods (HLL++) to estimate unique users, especially when your experiment has a large number of visitors (over 12,000)¹. As a result, metrics like users and conversions may be reported higher than they actually are. This is important to keep in mind when evaluating the results of high-traffic experiments.

Even small percentage shifts (**like +2% users, +3% conversions**) caused by modeling can create the illusion of a clear winner. But when the same data is analyzed in BigQuery, using raw numbers, the uplift may turn out smaller and statistical certainty lower. To demonstrate this Bas brought an A/B test with him, showcasing exactly this.

The A/B Test

A/B test: Buybox redesign



¹Source: <https://blog.analytics-toolkit.com/>

GA4 vs. BigQuery – Key Differences Explained

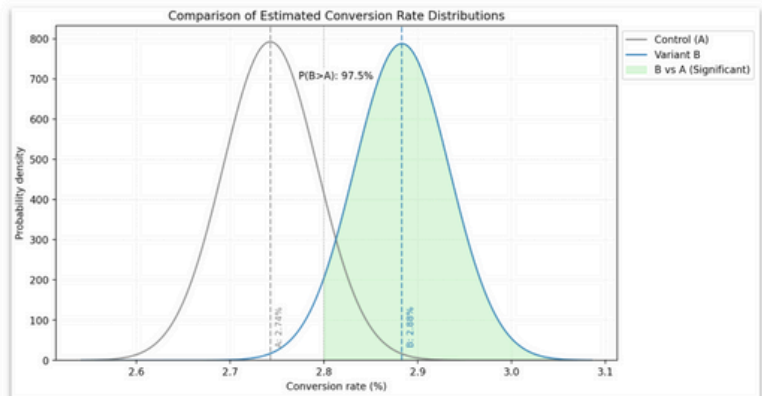
Results with GA4 Reporting

Experience variant	Users	Transactions
A	107742	2955
B	106554	3072

Test results for B vs A

- Statistically significant result for B with p-value: 0.0247!
- Observed power: 62.56%
- Conversion rate change for B: 5.12%

Variant B is a winner, congratulations!



Chance to win: 97,5%

happy horizon

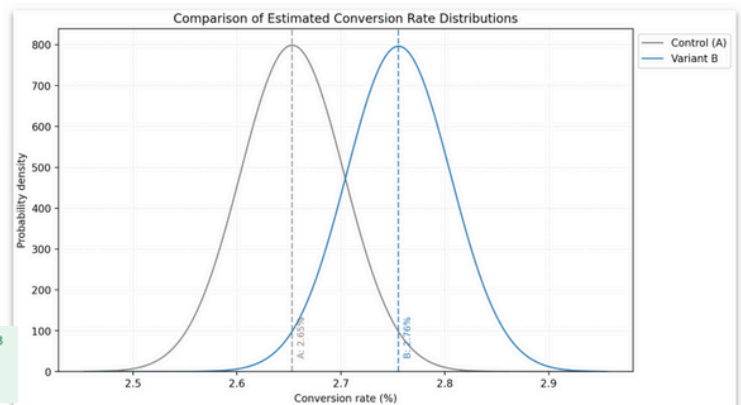
Results with BQ Reporting

Experience variant	Users	Transactions
A	105495	2799
B	104809	2888

Test results for B vs A

- Confidence interval for difference in conversion rates: (-0.0004, 0.0024)
- Observed power: 42.11%
- p-value: 0.0741
- Conversion rate change for B: 3.86%
- P-value (non-inferiority test): 0.0000

Although the Z-test is not statistically significant ($p = 0.0741$), the non-inferiority test suggests that B is not significantly worse than A within the predefined margin. This suggests that the variant may perform similarly to the control.



Chance to win: 92,49%

happy horizon

GA4 vs. BigQuery – Key Differences Explained

That doesn't mean GA4 is not-good. It's excellent for **reporting trends, funnel visualizations, or campaign monitoring**. But if you need precise answers for experiment evaluation, BigQuery is a safer bet. To summarize and properly showcase the differences, please refer to the attached comparison:

BigQuery

vs.

Google Analytics 4

 Stores **raw event-level data**

 Data is always **unsampled**

 Data is organized in **daily tables**, with an event-based schema


 Requires writing **SQL** to access and analyze data

 Data is typically exported the **following day** (but can take up to 72 hours to finalize)


 It's **free** (up to the predefined limits)

 Presents **processed** and aggregated data

 **Can apply sampling** in reports

 Data is presented through **predefined reports** and customizable explorations

 Uses a **graphical user interface**

 Data can take **up to 48 hours** to fully process

 It's **free** (with GA4 360 as an upgrade)

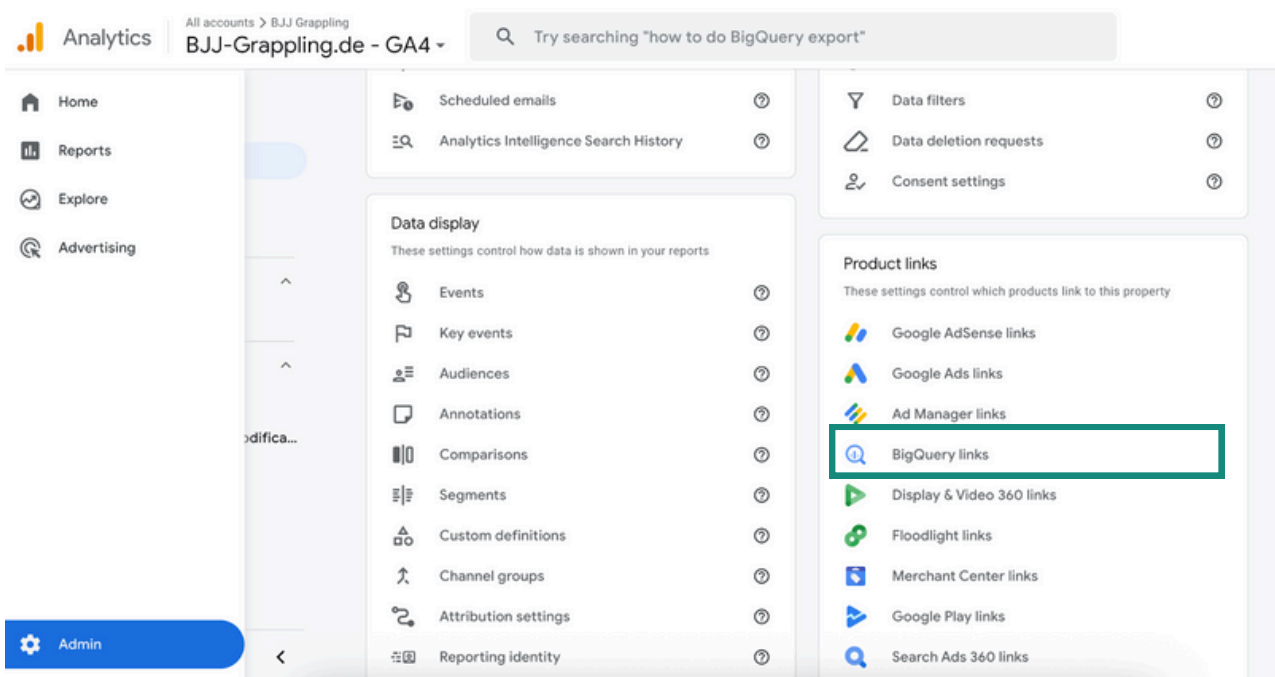
Importantly, this isn't just about GA4. Many A/B testing tools also model and smooth their data. That's why the principle applies more broadly: **trust the raw data** – and question the polished interfaces.

The first steps in BigQuery

Connecting GA4 to BigQuery

Connecting GA4 to BigQuery is easier than you might think – and it doesn't require a data engineering team. GA4 already collects event data in a structured and reliable way. The challenge starts when that data is processed for dashboards or reporting. That's where BigQuery comes in.

To connect your existing GA4 to BigQuery you want to simply turn it on. To do so you will have to find the "BigQuery links" section in your settings:



The first steps in BigQuery

Connecting GA4 to BigQuery

After clicking on “Link” at the top right corner you have to connect the corresponding data source of your previously created BigQuery project, (if not automatically set up by Varify.io) and adjust the settings the following:

The screenshot displays the BigQuery configuration interface, divided into two main sections: "Event data" and "User data".

Event data section:

- Data streams and events:** A section with a menu icon and a title. Below the title is a description: "Configure which data streams and events to export. All event volumes are estimated. Daily limit enforcement will be based on actual export. [Learn more](#)".
- TOTAL ESTIMATED DAILY EVENT VOLUME TO BE EXPORTED:** A box containing "0 / 1 million daily limit ⓘ", "1 of 1 stream selected", and "No events excluded". Below this box is a link: "Configure data streams and events".
- Include advertising identifiers for mobile app streams:** A checkbox that is currently unchecked.
- Export type:** A section with a menu icon and a title. Below the title is a note: "Streaming only available for Cloud Projects with Billing enabled.".
- Export type options:** Two options are listed: "Daily" (checked with a blue square) and "Streaming (best-effort)" (unchecked). The "Daily" option is highlighted with a green rectangular box. Below "Daily" is the description: "A full export of data that takes place once a day". Below "Streaming (best-effort)" is the description: "Continuous export, within seconds of event arrival. Data will be exported on a best-effort basis without a completeness guarantee. [Learn more](#)".

User data section:

- Export type:** A section with a menu icon and a title. Below the title is a description: "All users with activity for the current day, based on a change in one of the user's [attributes](#), will be exported. User data export will be paused if the event data export exceeds the limit. [Learn more about BigQuery user data export](#)".
- Export type options:** Two options are listed: "Daily" (checked with a blue square) and "Streaming (best-effort)" (unchecked). The "Daily" option is highlighted with a green rectangular box. Below "Daily" is the description: "A full export of data that takes place once a day".

These settings are recommended by us to ensure a robust data export.

The first steps in BigQuery

Ready-made SQL Queries to start with

After successfully connecting GA4 to BigQuery you can start testing it out via the Job explorer and your queries. To make this even easier, we shared two practical SQL templates during the webinar:

Transactional test evaluation – comparing the number of purchases between two variations



[LINK](#)



Revenue-based test evaluation – comparing average order value or total revenue uplift

[LINK](#)

After inserting the queries into the Job explorer, you should see something like this:

The screenshot shows the Google Cloud BigQuery Jobs explorer interface. The left sidebar contains navigation links for Administration, Monitoring, Jobs explorer (selected), Capacity management, BI Engine, Disaster recovery, Recommendations, Migration, Assessment, Interactive translation, Batch translation, Partner Center, Settings, and Release Notes. The main panel displays the 'Jobs explorer' view for the 'EU (multiple regions in ...)' location. It shows a summary of jobs: Total 6, Completed 6, Errored 0, Active 0, and Queued 0. Below this, a table lists job details for a specific job (Job ID: scrip..., Timestamp: 5/13/25 3:23 PM, Owner: varify..., Project ID: big-quer...). The 'Query results' section is expanded, showing a table with columns: Row, experience_variant_label, with_transaction, visitors_a, visitors_b, mobile_user_count, mobile_buyers, desktop_user_count, and desktop_buyers. The table contains three rows of data.

Row	experience_variant_label	with_transaction	visitors_a	visitors_b	mobile_user_count	mobile_buyers	desktop_user_count	desktop_buyers
1	A	26	337	0	256	16	78	11
2	B	22	0	298	231	11	67	11
3	Other	51	0	0	497	28	149	24

Practical Tips for Successfully Using BigQuery

Once your data is in BigQuery, the next challenge is working with it efficiently. During the webinar, we shared a few techniques that help you write better queries and avoid unnecessary costs.

Here's what we recommend:

- Use **_TABLE_SUFFIX** to filter by date. This lets you limit the amount of data scanned and keeps queries fast and cheap.
- Select only the fields you need. Avoid **SELECT *** – it's tempting, but it loads too much data and slows things down.
- Filter early. Apply conditions like **event_name = 'purchase'** or experiment-specific filters at the start of your queries.
- Use **SAFE_DIVIDE** when calculating rates. It protects you from division-by-zero errors.
- Start with a LIMIT. When testing your query, use **LIMIT 1000** to preview results without scanning your full dataset.

These tips make it easier to get started – especially if you're new to SQL. And if you're unsure how to build a query from scratch, the templates shared earlier are a great starting point.

Recommendations & Next Steps

Here's what we recommend if you want to use BigQuery to improve how you analyze experiments:

- **Compare your data sources.** Before making any decisions, take a step back and compare the results from different analytics platforms – not just GA4 and BigQuery, but also your A/B testing tools. Do the conversion numbers match? Are user counts consistent? If not, understand why. Each tool processes data differently, and these differences can shape your interpretation. Establishing clarity about what you treat as your 'source of truth' is the foundation for reliable analysis.
- **Work with SQL templates.** Use tested queries from the webinar or your team as a starting point. They help you avoid mistakes and make results easier to share.
- **Understand your GA4 schema.** If you're analyzing GA4 data in BigQuery, know your structure: `event_name`, `event_params`, `user_pseudo_id`, and so on. That's the backbone of any query.
- **Optimize before scaling.** Don't just run queries – improve them. Filter by date, avoid joins where possible, and document what each step is doing.

Recommendations & Next Steps

- **Use “safe spaces”** If you're using Varify, you already have one. Our visual analysis board lets you safely explore your BigQuery data without writing a single line of SQL. It's a guided interface built on top of your own experiment data – including variation exposure, conversions, and custom metrics. That means you can start analyzing confidently before ever opening the query editor.
- For teams writing their own queries, we recommend building **reusable base templates**. These help reduce errors and save time – especially when you're working with complex experiment setups.
- **Ask for help early**. If something feels off, ask your data analyst or reach out to someone with SQL experience, like Bas. It's better to be slow and correct than fast and wrong.


BigQuery gives us a powerful way to **own** our experiment data – but only if we use it well. The earlier we build clean habits and simple workflows, the more confident we can be in every result we share.

Test BigQuery through Varify.io

Free and with no SQL

If you're using Varify, you don't need to work with SQL yourself. After connecting Varify with BigQuery via our auto setup or by selecting the right data source, the experiment data is synced automatically – including exposure events, conversions, and variation assignments.

Advanced Data Source Settings

 Use BigQuery Data On ☒

Project:

Status: ● found dataset

Exclude Empty Purchase Events
On ☒

Exclude Multi-Variation Users
On ☒

Update

Curious to try it out? Join Varify's BQ-community, link on the last slide!

Test BigQuery through Varify.io

Free and with no SQL

After successfully connecting BigQuery in Varify.io you will start seeing your GA4 events as you are used to – but this time without them being extrapolated or you needing to create SQL queries.

The screenshot displays the Varify.io interface for experiment analysis. At the top, there's a date range selector (30/05/2025 - 10/06/202) and an 'Update Results' button. Below this are filters for Device (All), Segment (All Visitors), and Baseline (Original). There are also toggle switches for 'Outlier Smoothing' and 'Exclude Duplicate User Events'. The interface shows three goals:

- Goal 1: view_item (GA4)**: A table comparing 'Original' and 'Variation 1' across metrics: Visitors, Event Count, Conversion Rate, Improvement, Confidence, and Significant. The 'Significant' column shows 'No' for both.
- Goal 2: view_item (Count) (BigQuery)**: A similar table comparing 'Original' and 'Variation 1'. The 'Significant' column shows 'No' for both.
- Goal 3: purchase (Revenue) (BigQuery)**: A table comparing 'Original' and 'Variation 1' across metrics: Visitors, Revenue, Revenue / Visitors, Improvement, Confidence, and Significant. The 'Significant' column shows 'Yes' for 'Variation 1'.

Each goal section includes a message: "No statistically significant differences were found. Please continue testing to ensure a sufficient sample size." (Note: This message appears for the first two goals, but the third goal shows a 'Yes' in the 'Significant' column).

Goal	Visitors	Event Count	Conversion Rate	Improvement	Confidence	Significant
Goal 1: view_item (GA4)						
Original	14,049	2,259	16.08%	-	-	-
Variation 1	14,020	2,320	16.55%	2.91%	85.6%	No
Goal 2: view_item (Count) (BigQuery)						
Original	13,959	2,261	16.20%	-	-	-
Variation 1	13,797	2,309	16.74%	3.32%	88.7%	No
Goal 3: purchase (Revenue) (BigQuery)						
Original	13,959	785.05	0.06	-	-	-
Variation 1	13,797	479.90	0.03	-38.15%	96.0%	Yes

Curious to try it out? Join Varify's BQ-community, link on the last slide!

Additionally you are now able to directly compare your GA4 and BQ data – **Are you surprised?**

References

- Based on the webinar of Bas Linders & Steffen Schulz: BigQuery for Experiment Analysis
- View the full recording of the webinar [here](#)



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Reach out on LinkedIn

Join our educational BigQuery-Community!

Whether you have open questions or simply want to try BigQuery for free through our platform - join our [Slack Community](#) full of beginners and experts!

