Shazam
The Blind Spots of Algorithmic Music Recognition and Recommendation

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App: Shazam
Developer: Shazam Entertainment Ltd.[1]
Release date: 2002
Category: Music
Price: Free
Platform: iOS, Android, Blackberry OS, Windows Mobile, Windows, MacOS, watchOS
Tags: music discovery, serendipity, surveillance
Tagline: "Discover music, artists, videos & lyrics."
Related Apps: SoundHound, Musixmatch

Name That Tune

You're in a coffee shop or a pub, or next to your radio, and love the music coming through loudspeakers, but you can't recognize the track. You could ask a person at the bar or wait for the DJ to announce the song. These were some of the ways—along with cool friends, independent record stores, dingy concert venues, and (in the nineties) xeroxed fanzines and obscure email lists—a music junkie would discover new bands and records. Then came Shazam.

Shazam was the original music recognition app. When the software was first released in 2002, smartphones did not exist. Users dialed the number 2580, brought their cell phones as close as possible to the loudspeaker, then waited for a text message with the song title and artist to arrive. The iPhone version came out with Apple's App Store launch in 2008, to rave reviews. In late 2017 Shazam passed one billion downloads to iPhones, iPads, and Androids, and it has been incorporated into the software for Siri, the Apple iOS personal assistant (Thompson 2014). Shazam's nearest competitor, SoundHound, was nowhere near as popular nor as well-integrated into mobile systems.

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Shazam worked, its name suggested, like magic. Listeners delighted in the way the app brought human and algorithmic ways of listening together. "I remember 10 years ago," user Mary H. noted in 2015, "holding my phone up in a loud restaurant and impressing my friends with the way Shazam could identify a song" (2015). As an app that aligns with what Jeremy Wade Morris and Evan Elkins call "mundane software," Shazam ventured "beyond the computer and into a vast range of everyday routines and activity" (2014). More specifically, the app shared new agency with the user. Music fans stumbled over new sounds in their daily lives. They chose the songs they liked. The app let users identify songs without risking derision from a know-it-all friend or snobby record store clerk. It enhanced the serendipity of a musical encounter.

Since 2002 Shazam's algorithm, database, and interface have all evolved. Shazam updates the Apple version of its app monthly—about average for an iOS top-seller (Kumura 2014). Shazam's song library grows daily, aiming to catch up with emergent music scenes. The company makes deals with other music services, its employees seek out new songs, and independent musicians submit their own (Thompson 2014). The app's software now includes music recommendations and tie-ins with consumer brands as well as push notifications that congratulate users on their last "shazam" ("Nice find!"). Label executives use Shazam's data to make production and marketing decisions. While these features make Shazam more commercial and profitable, they also constrain user agency and work against the accidental aspects of music discovery that users like Mary H. found so compelling.

Shazam's chronology echoes a key dilemma in music history: new styles that emerge informally in local music scenes often end up co-opted by the commercial pop mainstream (Straw 2004). This also plays out the ethical divide in the software industry between corporations that use proprietary algorithms and those open source developers who freely distribute their code (Kelty 2008), particularly as the recognition algorithm has transitioned from a relatively open music identification hack to a proprietary user surveillance infrastructure. Over the course of its history, Shazam's database gradually excised any reference to music outside corporate cloud services. The app's interface, which once delegated agency to listeners, now almost completely curates user experience. The Shazam experience that has evolved is designed less for listeners to discover new songs and more for music producers and brands to discover new markets.

The Algorithm

Shazam was a breakthrough algorithm for its time. When the app launched in 2002, the ability to identify music via audio listening was still mostly theoretical. The most widely used "music recognition" solutions analyzed and tagged audio files on personal computers as metadata or imported CDs into iTunes (Vara 2005). Conversely, Shazam recorded ambient noise on cell phones designed to filter out everything but the loudest vocal frequencies. When the founders tried to listen to these audio recordings, they could not recognize even their favorite songs (Wang 2006).

To overcome this limitation, software engineer and Shazam's cofounder Avery Wang created an algorithm that extracted just a few highest and lowest points from a given recording to create and store a "fingerprint" for every track. Every time any user tried to "tag" a song, the Shazam server received a fifteen-second recording, extracted its fingerprint, and matched it to a relevant record in the database (Wang 2003). Wang's algorithm accounted for the noise, the low recording quality, and the ever growing database. Contrary to the "black box" practice for commercial algorithms (Gillespie 2013), Wang detailed how Shazam's music recognition worked in a 2003 conference proceedings article.

Shazam's popularity spurred algorithmic creativity. In the six months after the iOS store launch in 2008, the app's reach extended from 20 million users to 35 million in sixty countries (Shazam 2009). Several software engineers drew on Wang's article to post online do-it-yourself manuals on music recognition (laplacian 2009; Jacobs 2010; Surdu 2011). Developers ported the algorithm to other programming languages and operating systems. Dan Ellis, professor of electrical engineering at Columbia University, collaborated with the Echo Nest, the creators of an open source music recommendation algorithm, and MusicBrainz, a community-maintained music metadata database, to launch Echoprint, an open alternative to Shazam, in 2011 (Ellis et al. 2011; Echo Nest 2011).

Open source programmers aimed to give musicians and fans control over the range of music available for recognition. "The catalog of current commercial music resolvers is unnecessarily limited," Echoprint's creators pointed out. "You cannot submit your band's music to Shazam." An open algorithm would free developers to create apps that allow users to "'convert' a local catalog of music into any streaming or music service" (Echo Nest 2011). Independent musicians worldwide would submit their tracks to a public "fingerprint" re-

pository, linked to a database that crowdsourced song metadata. New apps would use the algorithm to link fans to a vaster and more diverse sonic universe.

Almost immediately, these DIY projects came under fire from patent owners. By 2009, Shazam's founders, Wang included, left the company, to be directed by investors who sold away the app's core patents. Dutch programmer Roy van Rijn, creator of an open Java version of Shazam, was the first to receive cease-and-desist patent infringement letters. Protests erupted on Reddit, Slashdot, and other hacker sites (van Rijn 2010). "Music fingerprinting," Echoprint cocreator Brian Whitman expressed from the protesters' point of view, "should be a service that every developer can rely on" (Andrews 2011). But in 2014 Spotify purchased Echo Nest and took Echoprint's database offline, making its algorithm unusable. Aggressive patent enforcement halted work on open alternatives to Shazam.

Instead, Shazam's proprietary algorithm evolved to give record companies and commercial brands new ways to probe users. Within months of the iOS store launch, Shazam delivered its first weekly popularity charts based on user data to record labels (Manjoo 2009). Today Shazam's dynamic "heat maps" trace the popularity of a new single over time, which producers use to detect emerging hits and sign artists (Thompson 2014). The app also ventured beyond music. At the time Echoprint went public, Shazam piloted tie-ins with TV commercials: a recognized tune would pop up on phones with a link to a vendor website (Arthur 2015). Now users can identify images with their phone camera wherever they see a Shazam icon and QR code and get augmented reality effects and special offers in return.

This feature creep transformed Shazam into an effective surveillance and marketing engine. For business executives, this is progress, but from the perspective of the open source community, it represents a loss. An open algorithm became proprietary. Users and musicians have little control over the diversity of sounds available for recognition, and the app's "bloatware" foists content and products on users. "Serendipity" is no longer Shazam's most appropriate keyword.

The Database

Shazam required a music fingerprint library when large-scale digital music collections did not yet exist. The four founders first tested the app with their

favorite songs (Wang 2006). Then they scaled up with a barter deal. Ex-CEO Andrew Fisher described how Shazam employees, day and night, digitized vinyl records from a major music retailer, Entertainment UK (EUK). In return, Wang got to experiment with 1.6 million fingerprints (Albanesius 2012). Together with small music assets Shazam had acquired, the database had 1.8 million songs in 2003 (Wang 2003; 2006). But ripping vinyl and CDs even for personal use became legal in Britain only three years later (BBC 2006). When Shazam workers copied the entire EUK distribution catalog of records issued by major and indie labels, they may well have been breaking the law.

Shazam's initial database thus occupied the borderlands between the legal and illegal music spheres. In the first decade of the twenty-first century, many digital recordings circulated via alternative infrastructures: MP3 blogs of digitized antique vinyl records, online avant-garde audio archives like Ubu-Web, and other venues outside of official distribution channels. We might call these recordings "gray music"—analogous to the "gray literature" of technical manuals or white papers, for example—produced and circulated outside official publishing channels (Gitelman 2014, 115–16). Informally distributed gray music, like Shazam's digitized vinyl, moved in and out of the "pirate" status, depending on the vagaries of perpetually revised intellectual property law.

Shazam still works to encompass some marginal music scenes. Its algorithm has improved in recognizing electronic and South Asian music. In 2013 it purchased Beatport's catalog of underground club music, to tag "dubstep, tech house, trance, and other specialist subgenres" (Fischer 2012; Sherburne 2013). The same year, the company partnered with Indian streaming service Saavn to identify "genres like Bhangra, Devotional, Ghazals, Carnatic and Indipop" (SN 2013). Self-producing musicians can now submit their own tracks through digital distribution companies, including CD Baby, DistroKid, and TuneCore.

At a closer look, however, Shazam seeks out not music cultures but paying customers. While a wealthy global diaspora may have led Shazam to incorporate South Asian music genres, most African music scenes remain outside of its purview. In 2014 smartphones took up only 18 percent of the African cellular market overall (Raile 2014), but 40 percent of the South African market (Macauley 2015). Mindful of this digital divide, Shazam partnered with the South African advertising company AdVine but not with streaming services in other African countries, such as Kenyan Mdundo, Nigerian iRocking, or Senegalese MusikiBi (Shazam 2016).

Shazam shuns uncommodifiable scenes, because it has become a key play-

er in the corporate music sphere. It has partnered with major online stores and streaming services—iTunes, Google Play, Spotify, Deezer, and others—that operate according to strict licensing restrictions. These transnational cloud-based services supplant the gray music infrastructure, decimated by takedown software such as Google's Content ID or by FBI raids like the shutdown of Megaupload's cloud service that stored MP3 bloggers' libraries (Bennett 2012). Now Shazam identifies only licensed content. Eighty percent of its income comes from a cut from songs sold and streamed after they have been tagged in the app (Thompson 2014).

Shazam's willful blindness becomes especially misleading when record labels rely on the app to track emerging hits. As Lisa Gitelman points out about digital collections, "the most pervasive" omission is "the elimination of clues that point toward missing material" (2010, 32). With almost the entire African continent left out, Shazam's so-called world popularity charts are global in name only. Even in North America a significant share of independent musicians post tracks on SoundCloud or UbuWeb without signing up with digital distributors—that music does not make its way to Shazam.

The app's selective library, combined with user data, redraws the visible music landscape. Derek Thompson coined this process the "Shazam effect" in an influential 2014 *Atlantic* article: song-tagging data shows mass preference for a few top artists. Label executives welcome a view that shows only the songs they can turn into profit. Musicians, however, believe that reliance on data will make pop music more homogeneous. "If there is the opportunity to throw out the grey with the black, this is often done," sound artist Vicki Bennett argues, "narrowing down results to only mainstream or sponsored content" (2012). Instead of discovering gray music, Shazam makes it disappear.

The Interface

Shazam's interface grew simpler as mobile hardware improved. Its initial dial-up and text-message mode gave way to a Java applet in 2004. Users pressed dial keys on their cell phones to navigate a small screen (Wang 2006). An iconic blue pulsating "Listening" button arrived with the touch screen in the 2008 iPhone app. It gave users the pleasure of identifying a song with a single gesture. As the licensed music sphere expanded, Shazam's interface grew more complex. More buttons cropped up offering ways to stream or buy the iden-

tified tune. The Java app offered ringtones, while the first iPhone app offered iTunes downloads and YouTube videos. Now Shazam links to streaming services and displays music recommendations based on tagged songs. These links let fans explore music further but only in a commercial online environment.

The latest interface options push the commercial environment on music fans. Users can long-press the "Shazam" button to turn on automatic recognition of all songs in the vicinity. Push notifications announce new album releases based on user history. These options take away accidental discovery. TV advertising tie-ins, image recognition, and augmented reality effects seek to structure users' physical environment, expecting them to follow instructions on a billboard or in a TV announcement. The new and improved Shazam provides "richer, deeper brand experiences" (Macauley 2015), at least to its business and corporate partners.

But lay reviewers of the app see this transformation in another light. Of all comments currently available in the app store, none praise the app for its marketing features. One music fan used Siri as an interface to recognize songs without opening Shazam and its recommendations. "I don't see the point," he wrote in a typical comment (@disqus_I9SPCKW3oJ 2016). For another user, the feature-laden app was too slow: by the time it opened, any song he tried to tag was already over (blunden 2016). In 2016 Shazam released a Lite version of the app. Designed for areas with spotty internet access, it does nothing but identify songs and save tunes for later recognition. Within four days of release, a hacker bypassed the region limit of the Lite app and got thanks from music fans who downloaded his version (blunden 2016). These active users preferred the original pleasure of identifying ambient music with just one touch or, with Siri, one phrase.

Avant-garde musicians and their hard-core fans have measured Shazam against informal interfaces for discovering sounds in everyday life. Vicki Bennett remembers the clunky but seductive routes to gray music's "gift economy" before the commercial services arrived:

> A web search for an obscure artist heard on the radio will take you to a blog telling you about them, sharing out-of-print material, with tags linking to related areas. An adjacent column will have links to 25 other websites and radio stations with similar interests. There then follows a wonderful odyssey into hidden and often forgotten sonic worlds. (2012)

Many of these online music scenes have disappeared as college radio stations closed and MP3 blogs went offline, together with "blog rolls" of recommended links.

But other alternative sonic worlds and interfaces have become prominent. Urban Dictionary listed the term "unshazamable" (spelling varies) as early as 2009. It connoted rare and coveted material, as in "Wow! That song is unshazamable . . . can I copy that cd?" (B lav 2009) With only one "Shazammable show" on its grid, cult freeform station WFMU airs music ranging from early twentieth-century phonograph cylinders to local demo tapes (Greg from Bloomfield 2014). "Un-Shazam-able" DJ Jonathan Toubin draws thousands to his club dance parties, where he spins forgotten 45s from the 1950s and 1960s (Fischer 2012). Entire genres and styles of music can be unshazamable, as user @Wyntonav mocks on Twitter: "When you Shazam African music you get 'we didn't catch that'" (2016). In this light, historical, grassroots, live, and non-Western gray music genres gain in cultural value, because Shazam fails to recognize and data-mine them, but they also become harder to discover and diffuse to new listeners as a result of their exclusion from the database.

Conclusion

By corporate standards, Shazam has become an app juggernaut. It has over a billion downloads, it has a number of partnerships with major online services, and it integrates with mobile operating systems. Its user data plays a key role in music production decisions. Yet several important groups have interpreted the app's story as decline: open source software developers; avant-garde musicians and DJs; active app users; as well as hardcore fans of experimental, out-of-print, and non-Western music. They discern a decay of the app's original purpose: loss of serendipity, user agency, and experimentation. For these observers, Shazam's chronology represents the ways corporate digital economies have encroached upon the spheres where open source software and gray music circulate.

Taken together, these appraisals suggest new directions for critical histories of "mundane software." They zero in on the exploratory stages of app development. Shazam may have been typical in requiring some version of music "piracy" at an early stage: Spotify incorporated MP3 files from the Pirate Bay website to grow its initial database and test its recommendation algorithms

(Andy 2017). Open music fingerprint experiments represent political ideas that are still resonant today (Kelty 2008) arguments for making all cultural works available for discovery. An algorithm, or an app, can have different political and aesthetic valences depending on people and institutions taking it up.

In calling for a vaster sonic universe, Shazam's critics shift the focus from individual sonic works to the diverse spheres and scenes where they circulate (Gaonkar and Povinelli 2003). Scholars have analyzed digital music as a "fluid" and "conflicted" commodity whose status, value, and meaning change with formats, circulation, and use (Morris 2015; Sterne 2012). From the perspective of "unshazamable" scenes, "discoverability" means more today than a work's commodity status or digital format (McKelvey 2016). A rare 45 spun at a club has more in common with an MP3 posted for free on a blog than with a vinyl record that is also available on iTunes. The MP3 on that blog also has more in common with an MP3 traded for cash over Bluetooth in Mali (Shimkovitz 2012) than with a track streamed for free on Spotify.

Even though for some independent and avant-garde musicians the cultural cache of "unshazamable" sounds echoes punk and indie rock's disdain for selling out and may also recall the still-fresh memories of early file-sharing networks and other gift economies, Shazam continues to hone its app to take advantage of marketing partnerships and user data. We could conclude, since independent and nontraditional artists are de-prioritized in Shazam's catalog and thus less discoverable, the future of music apps looks pretty grim from the point of view of the corporate cloud, with its visions of a "deeper brand experience" (Macauley 2015).

But scholars of mundane software need not follow the corporate gaze. Several appified services bring independent music closer to a sustainable digital economy. "Unshazamable" WFMU and UbuWeb offer an app. Bandcamp, a pay-what-you-can music store with its own app, lowers the barrier to entry into the commercial music sphere for self-published artists. On Bandcamp, MP3 blog *Awesome Tapes from Africa* releases music from the region, paying 50 percent of profits to African artists. "The circle of influence and inspiration has been critical to music's evolution since humans began singing songs," blog creator Brian Shimkovitz explains. "Musicians growing up in Africa are aware of what is happening and deserve to be a part of it" (2012). These "appified" scenes and services offer a sense of history and a sense of place that few best-selling tracks can provide. And while all songs (best-selling or not) offer a sense

of place and history, it is services like Shazam that circulate those sounds in ways that either foster those connections for listeners or just play them out in the hope of gathering clicks and data.

Note

1. Apple bought Shazam in December 2017. As of March 2018, as *Appified* went to print, the app still worked as described in this article. The European Commission was reviewing the deal for possible ways the sale could "adversely affect competitive practices" (Gibbs 2018).

iMaschine 2
Music-Making Apps and Interface Aesthetics
VICTORIA SIMON

App: iMaschine 2
Developer: Native Instruments
Release Date: November 2015 (Current Version: 2.2.0)
Category: Music
Price: $9.99
Platform: iOS
Tags: productivity, update culture, music-making, work flow
Tagline: "Make Music Anywhere"
Related Apps: Traktor DJ, Figure

"Did you press a button and something awesome happen? That was a productive minute."
　　—Andrew Higgins, former head of Native Instruments Mobile
　　　App Division

iMaschine 2 is a composition app developed by the Berlin-based music-technology company Native Instruments that enables users to quickly sketch out musical ideas or create full-length tracks. On iMaschine 2's website, po-