

The Self-Navigating Region

5/23/2018

#ptw17

PTW
2017
COMCAST



CONNECTIONS
2045

GREATER PHILADELPHIA
FUTURES GROUP
ENGAGE. COLLABORATE. ENVISION

DELAWARE VALLEY
dvrpc
REGIONAL
PLANNING COMMISSION

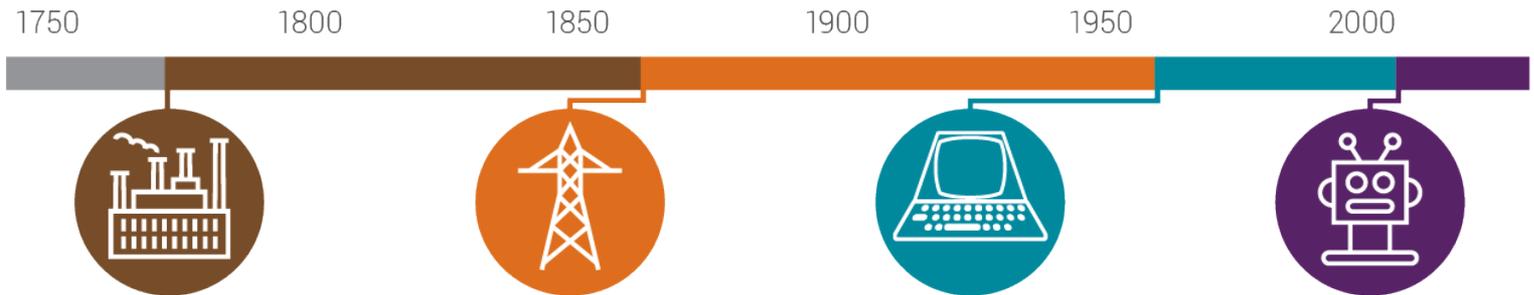
DVRPC



By the Numbers:

- 2 States
- 9 Counties
- 351 municipalities
- 5.7 million people (2015)
- 6.4 million people (2045)
- 3.0 million jobs
- 108 million daily vehicle miles traveled
- 1 million transit trips / day

Four Industrial Revolutions



	FIRST (1770s)	SECOND (1870s)	THIRD (1960s)	FOURTH (2010s)
Technology	Steam Power Mechanical Production	Electricity Mass Production	Electronics & Computers Automated Production	Robotics & AI 3-D Printing ???
Urban Form	Factories	Elevators Suburbanization	Globalization Internet & e-commerce	Internet of Things Networked Space ???
Transportation	Canals Railroads	Subways & Trolleys Cars, Buses, Trucks Airplanes	ITS Real-Time Transport Space Travel	CVs & HAVs UASs (Drones) ???
			The Digital Revolution	

Adapted from World Economic Forum

The Digital Economy



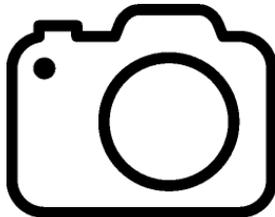
Alibaba, the highest sales retailer, has no inventory.



AirBNB, the largest accommodation provider, owns no real estate.



Facebook, the most popular media provider, creates no content.



Instagram, the most valuable photo company, sells no cameras.



Netflix, the fastest growing television network, lays no cables.



Uber, the world's largest taxi company, owns no fleet.

Source: Tom Goodwin

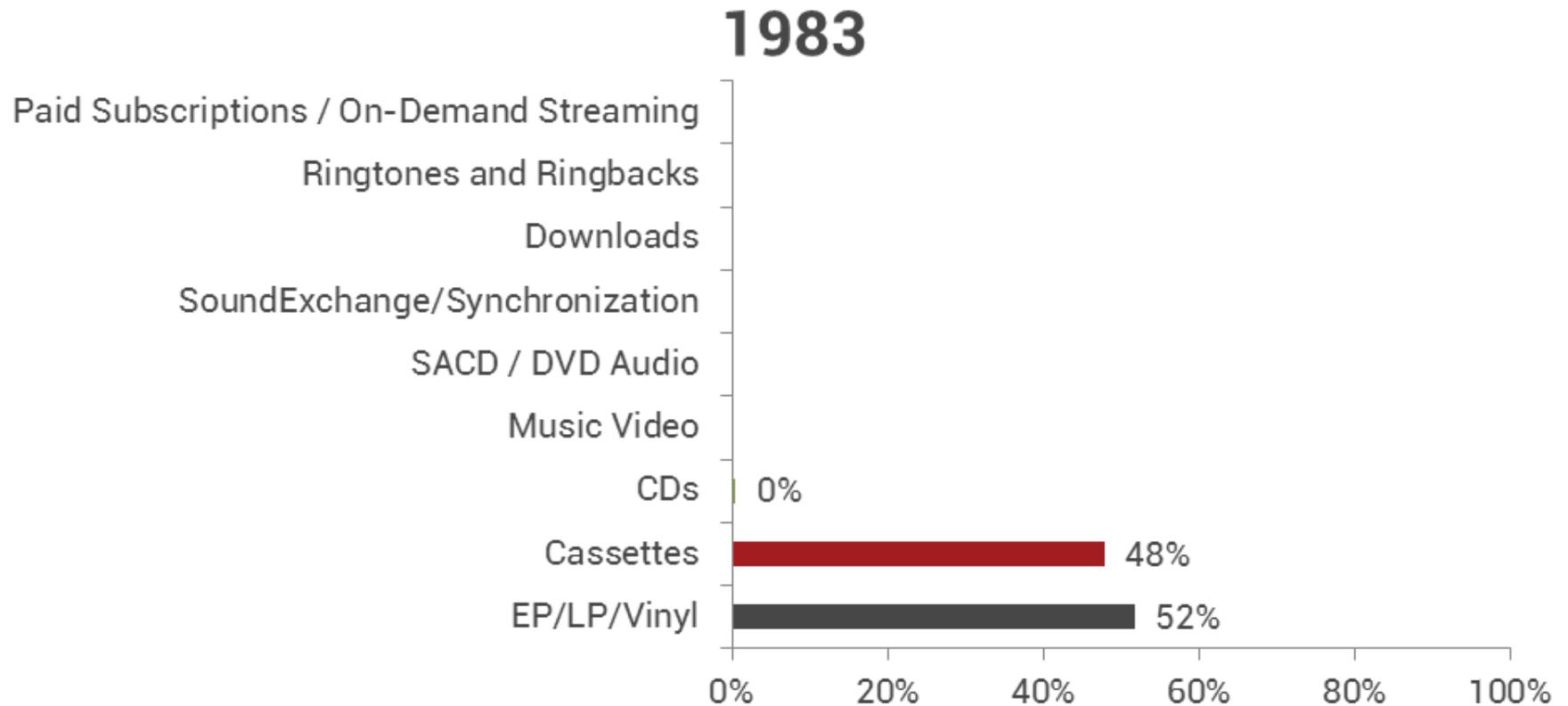
Networks

A **network** is a group of interconnected people and things.

A **network effect** occurs when a good or service becomes exponentially more valuable as more people & things are a part of it.

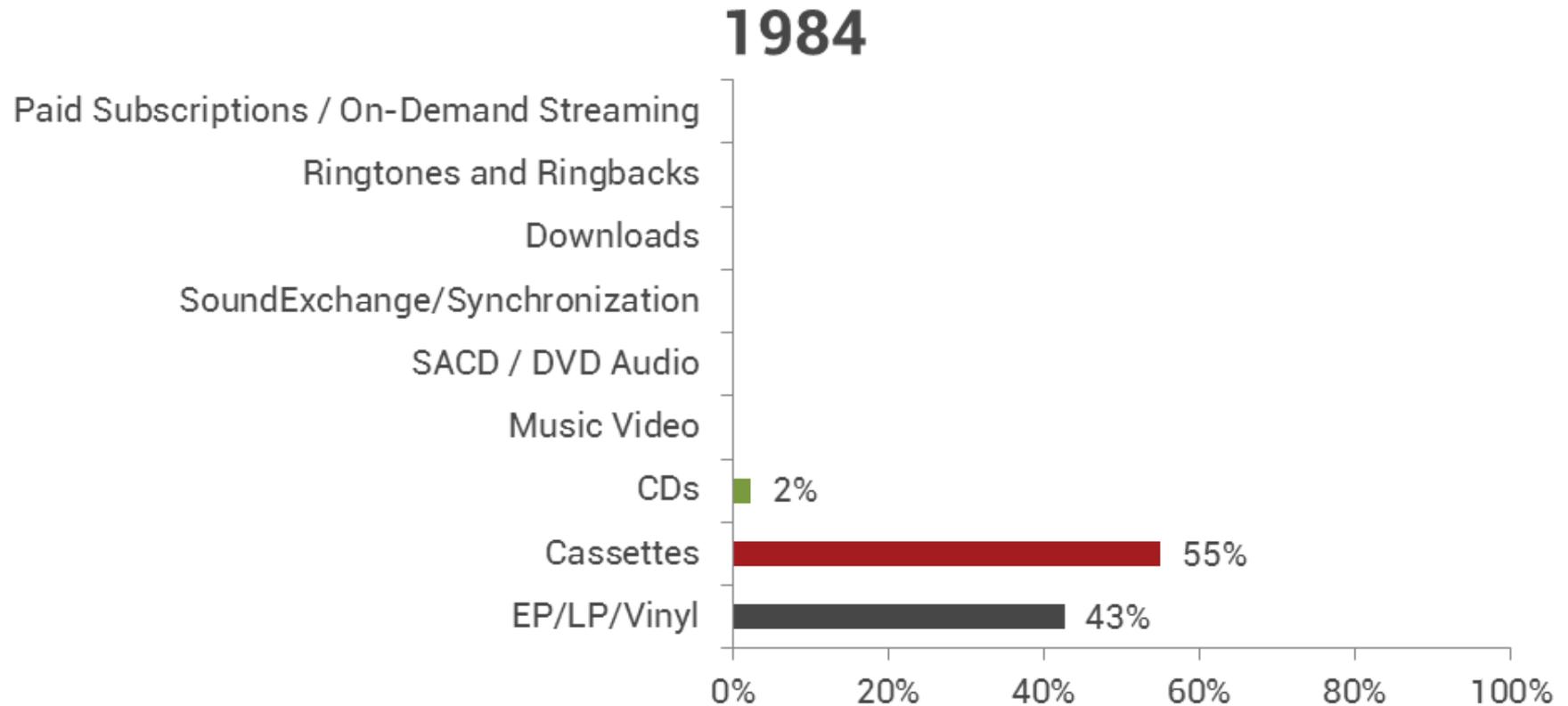


Music Industry Digitization



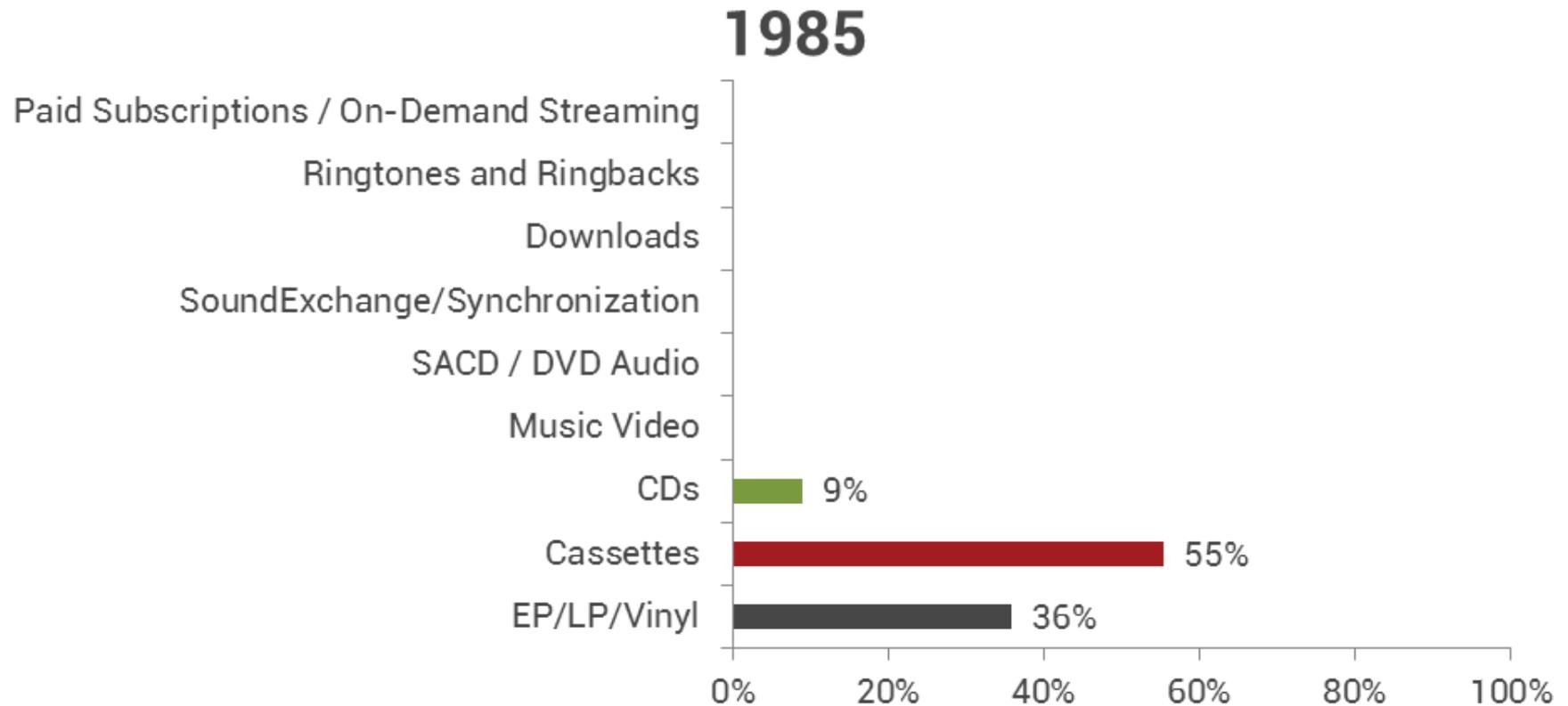
Source: Recording Industry Association of America, 1983 – 2015

Music Industry Digitization



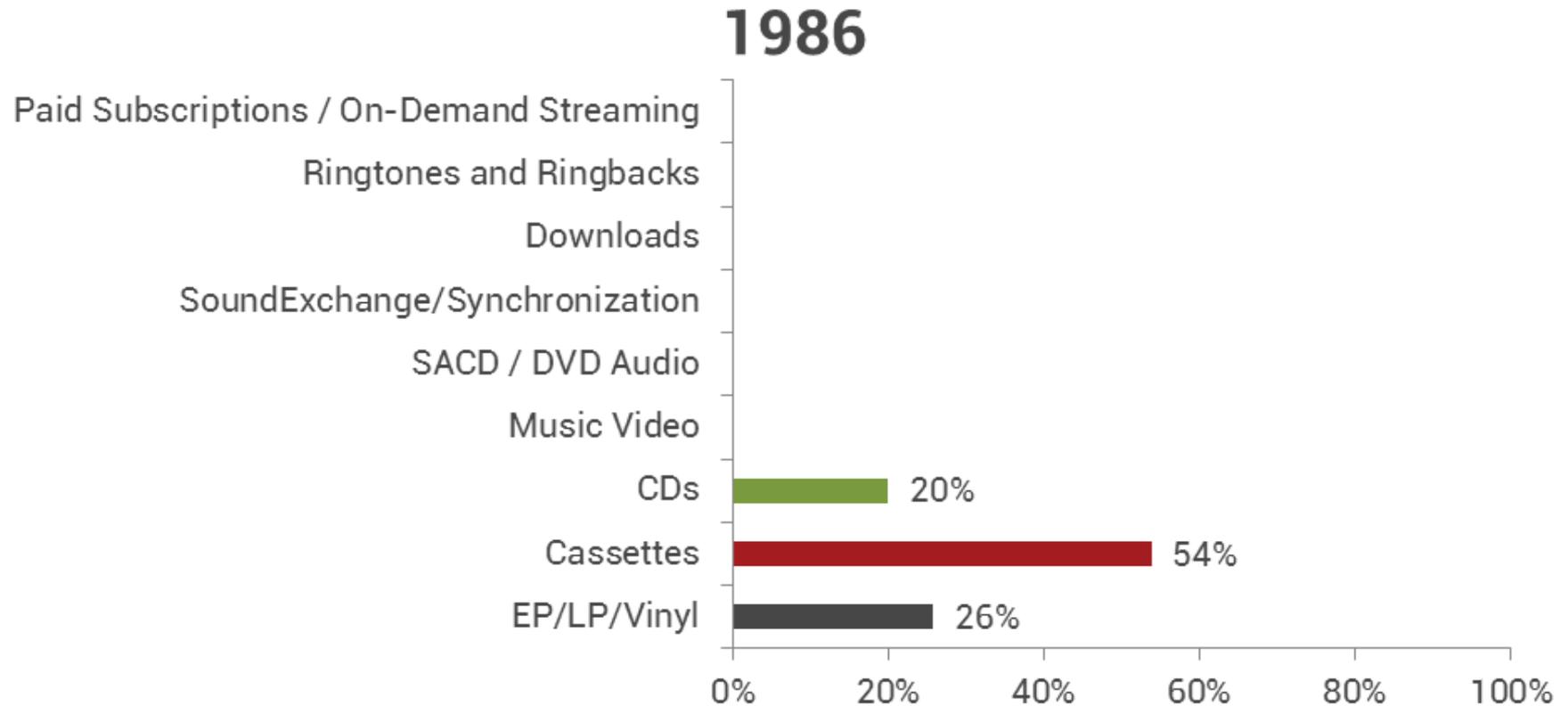
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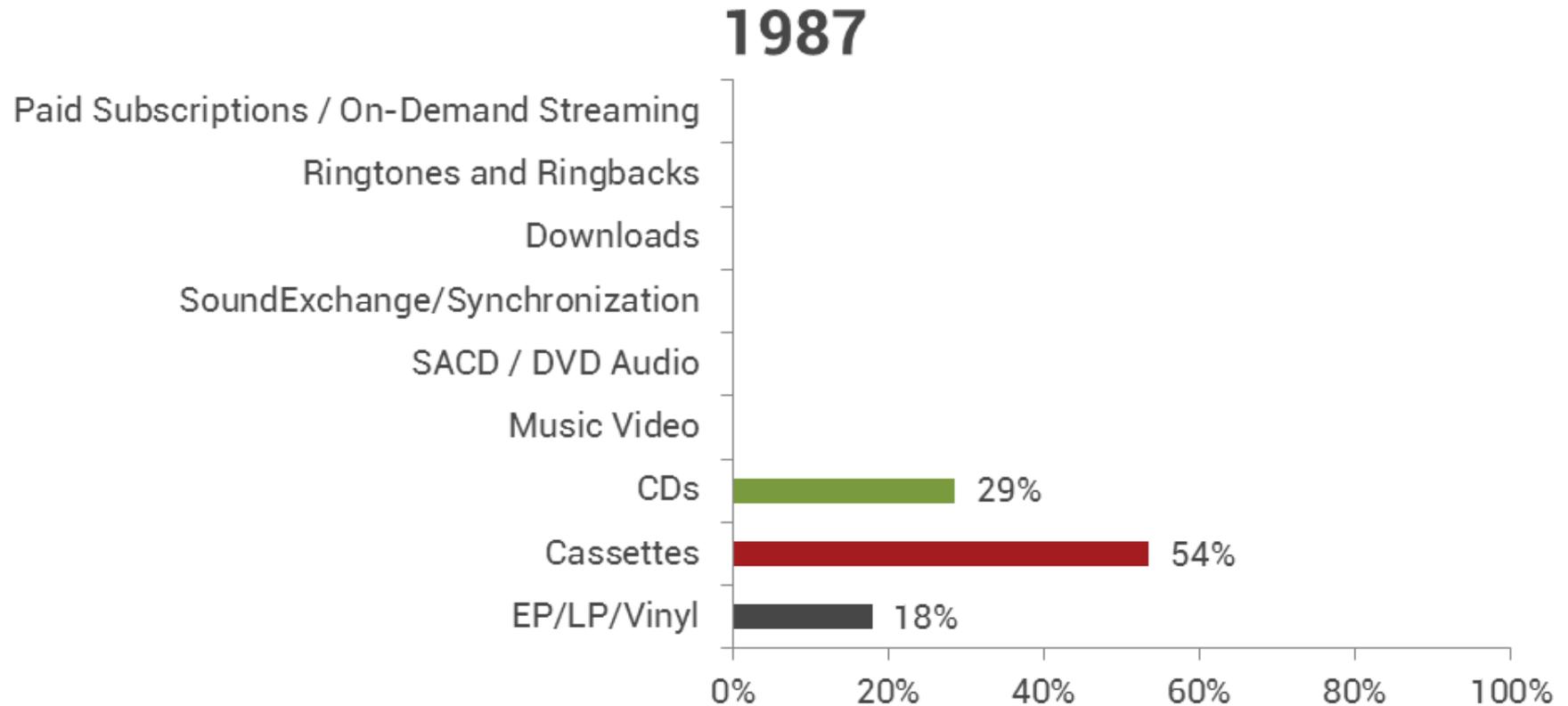
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Music Industry Digitization



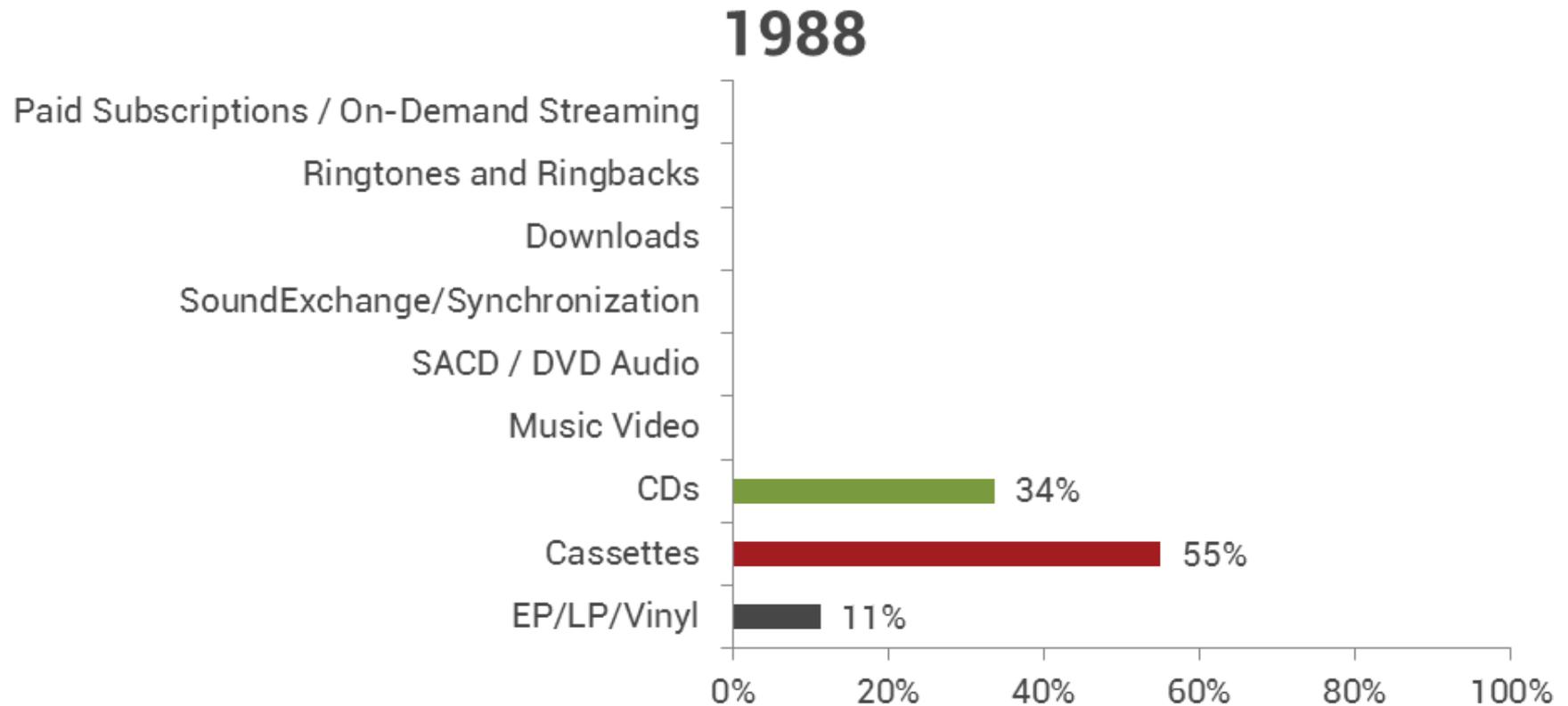
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Music Industry Digitization



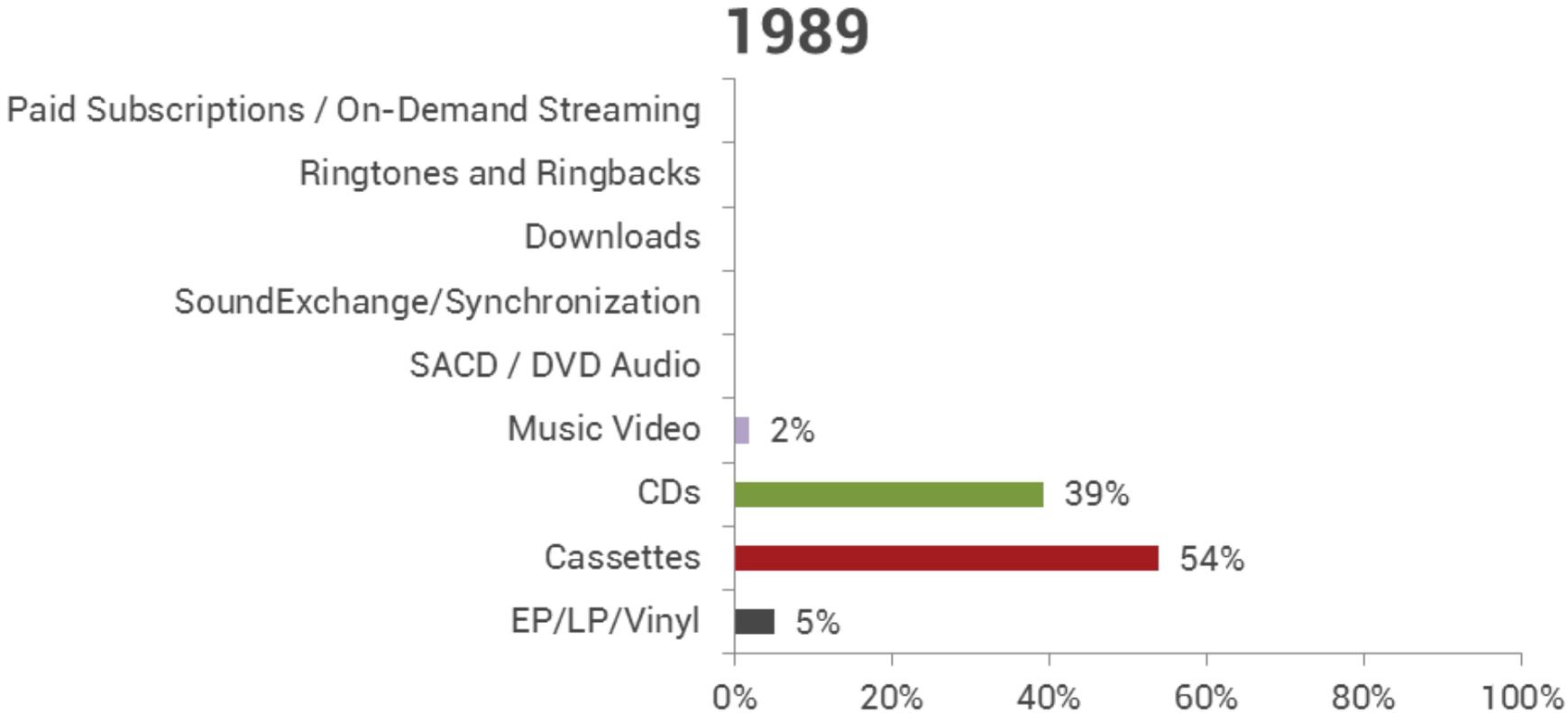
Source: Recording Industry Association of America, 1983 – 2015

Music Industry Digitization



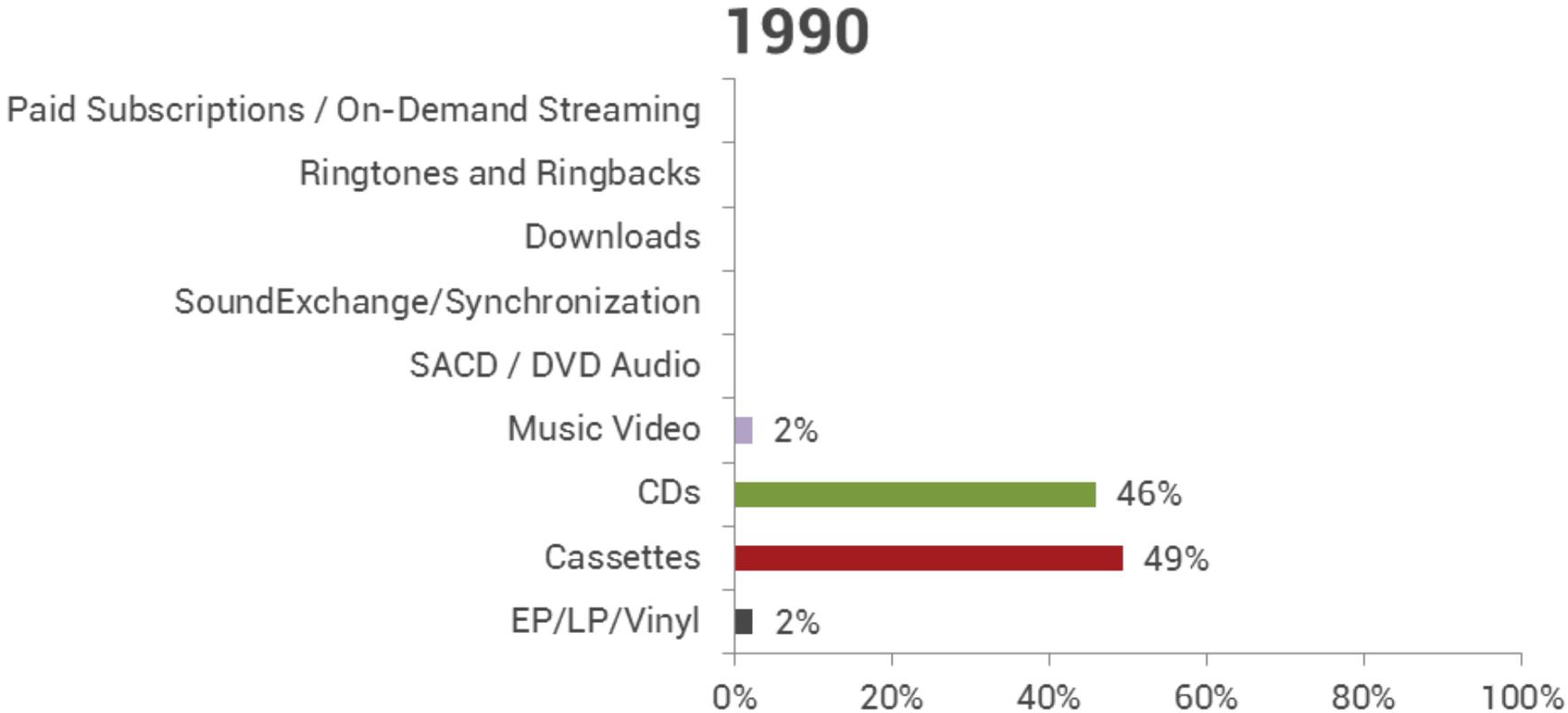
Source: Recording Industry Association of America, 1983 – 2015

Music Industry Digitization



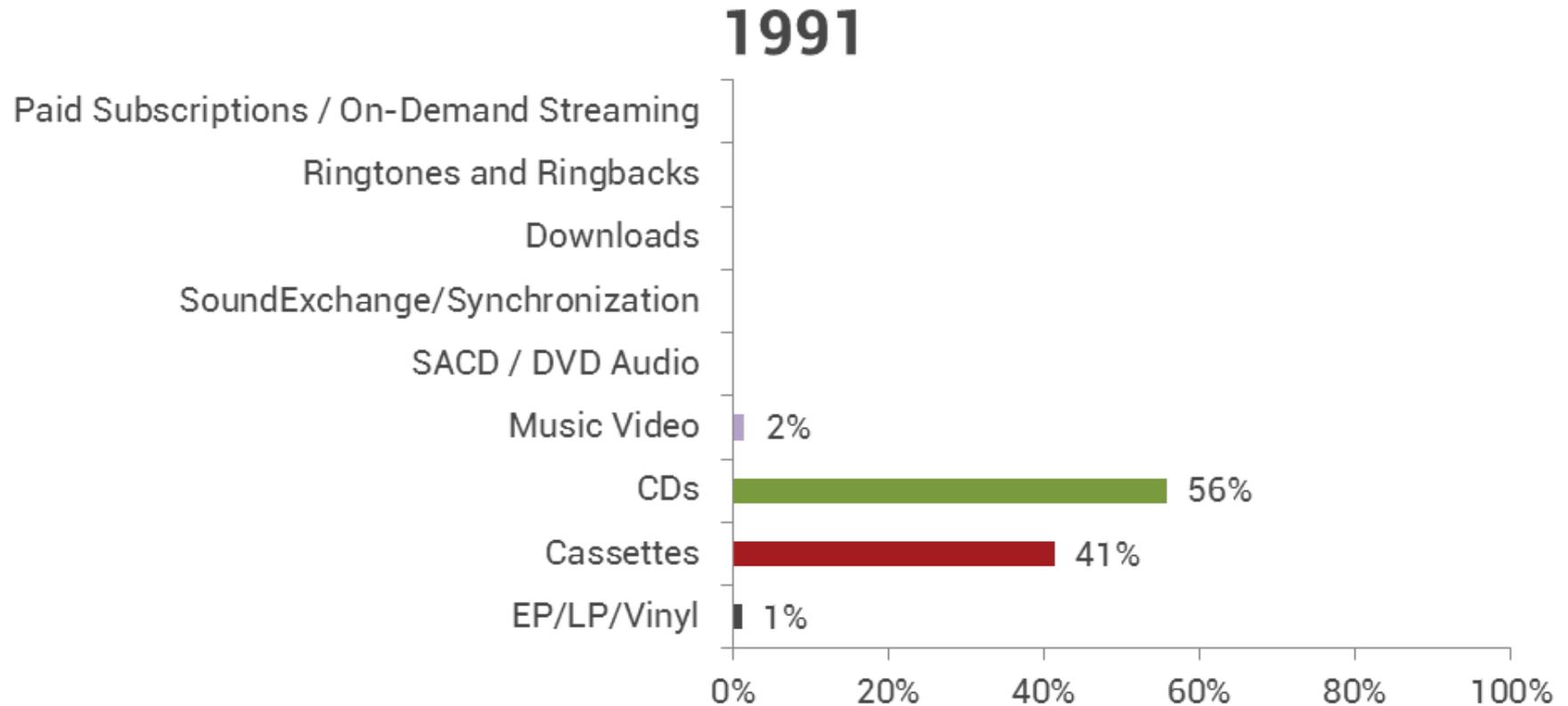
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Music Industry Digitization



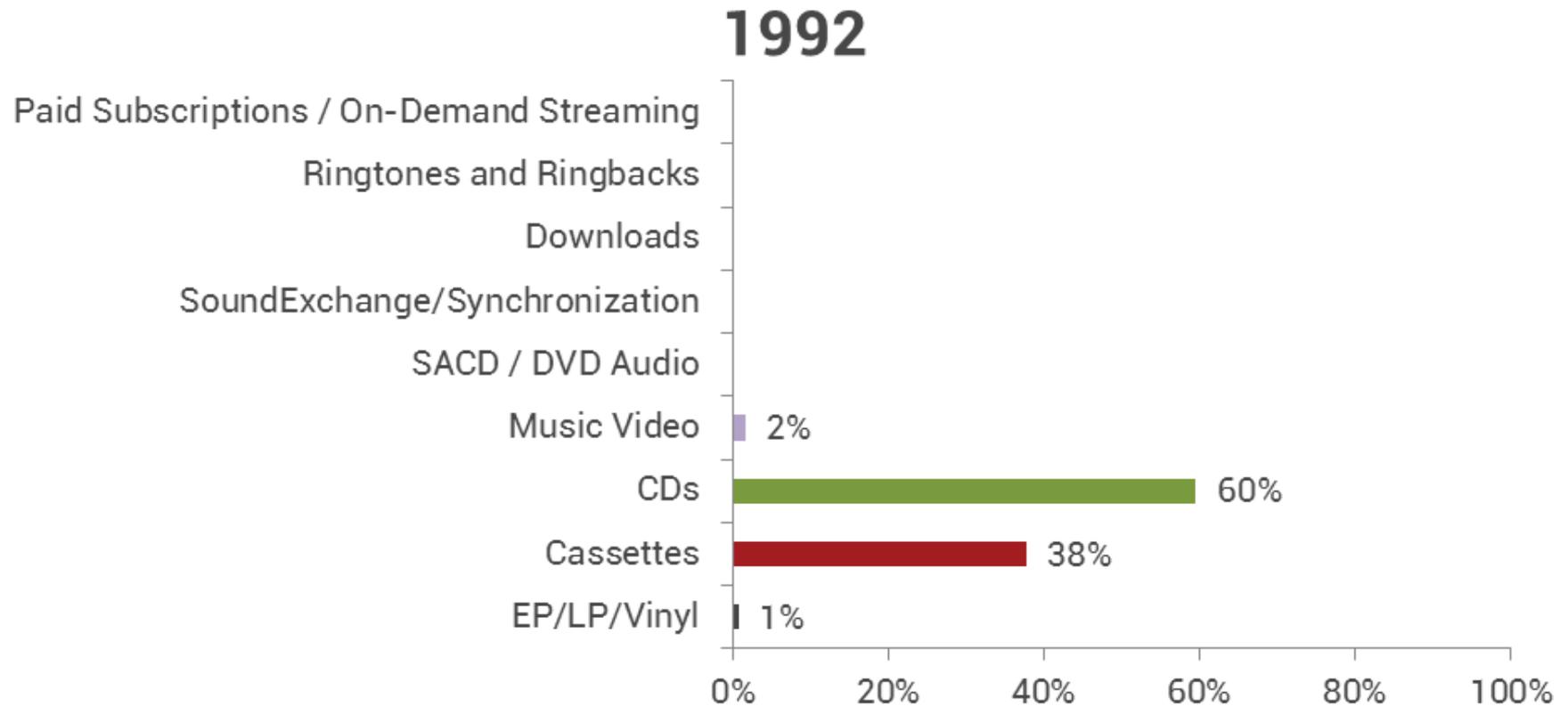
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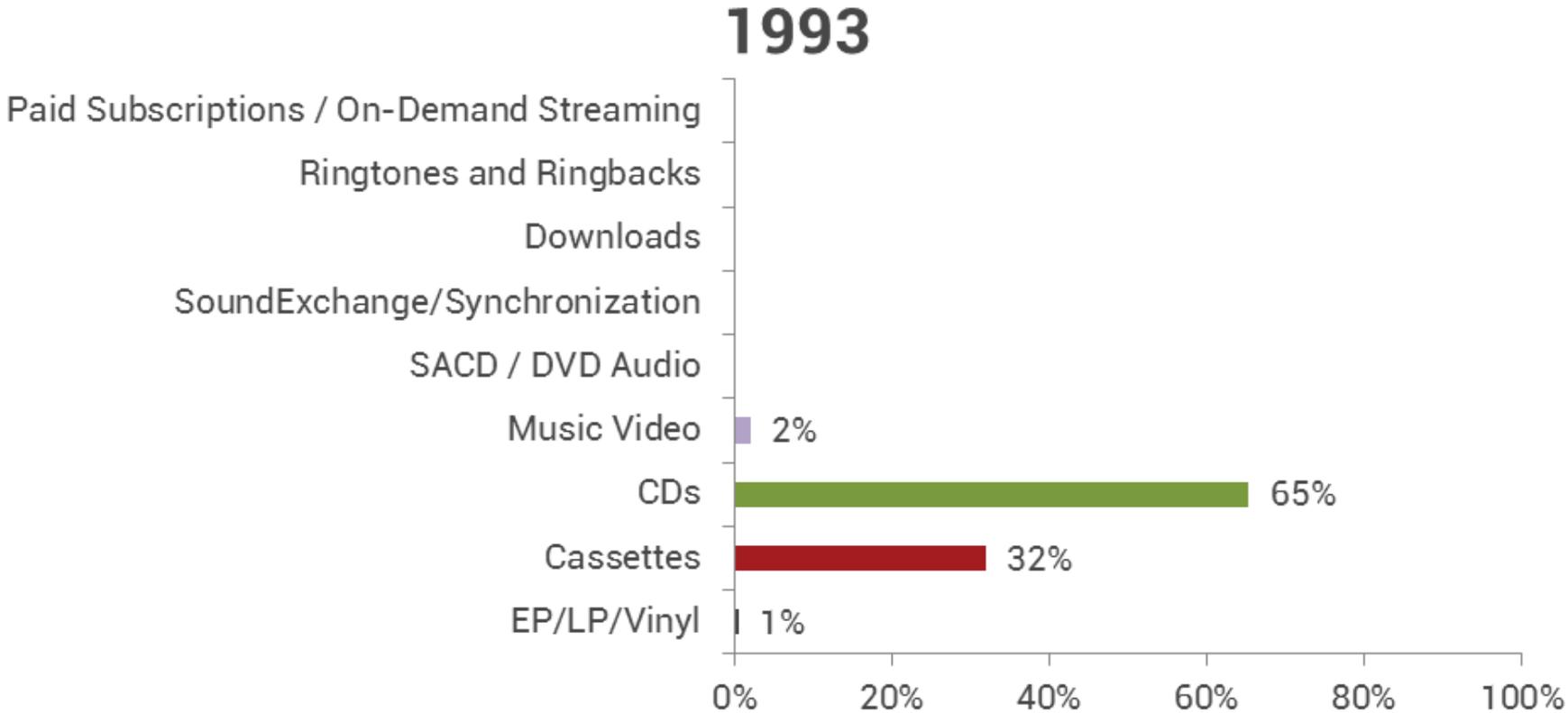
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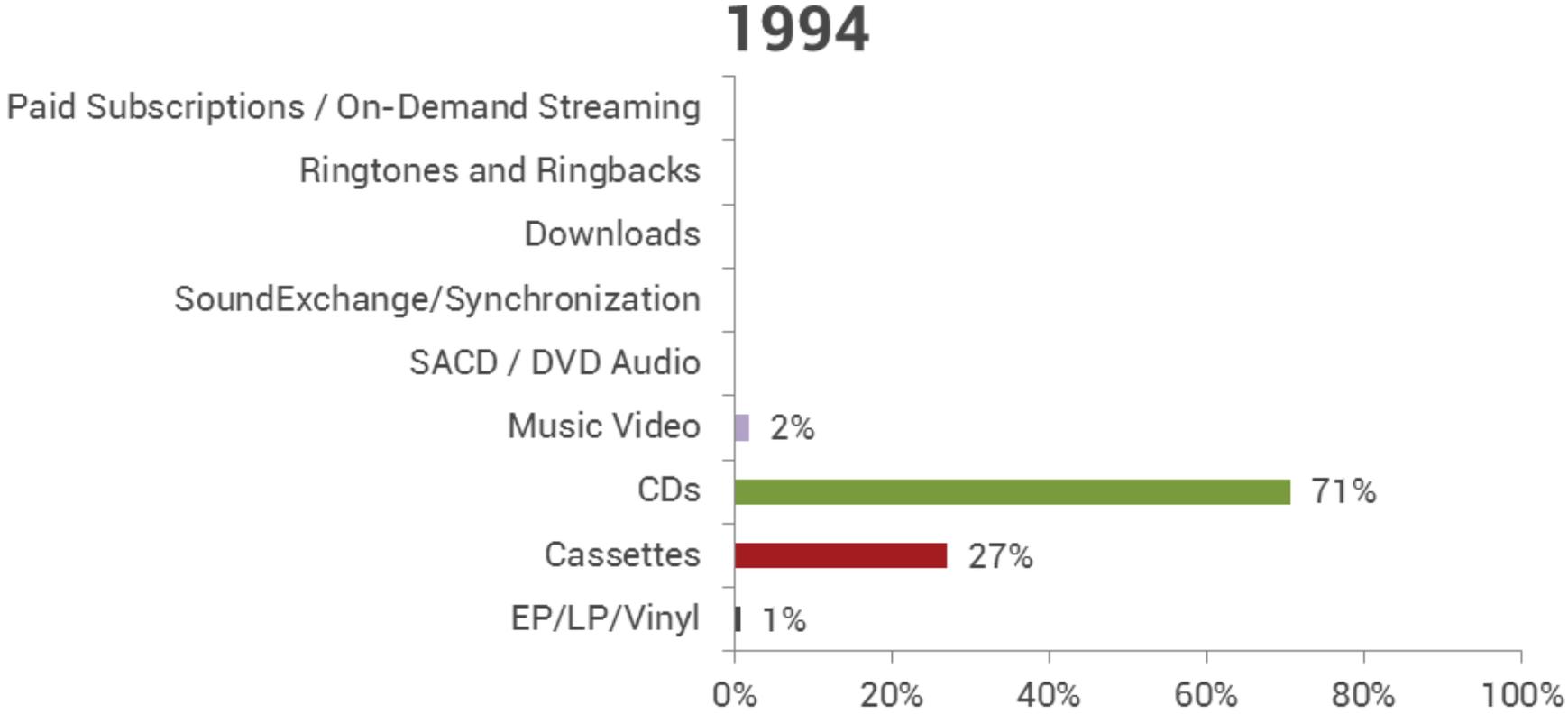
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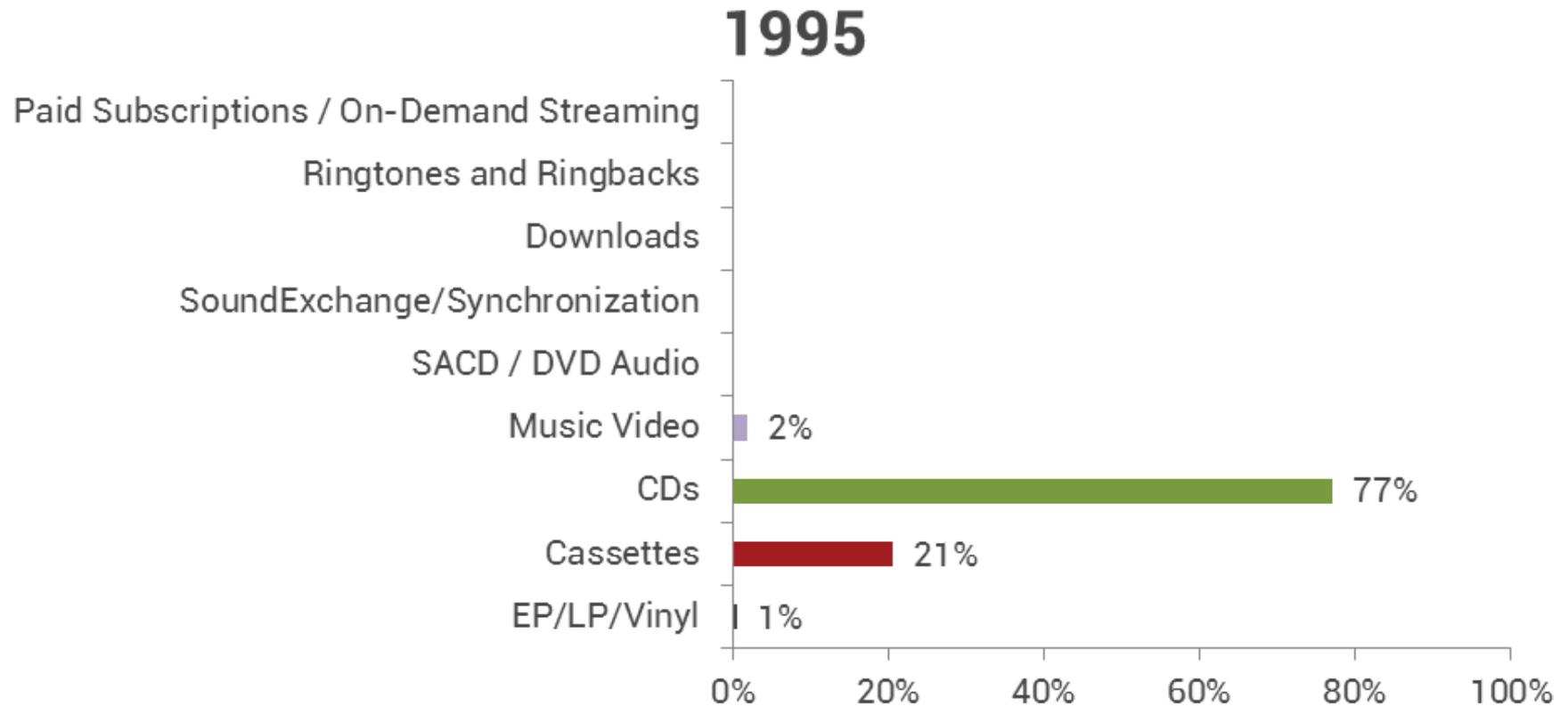
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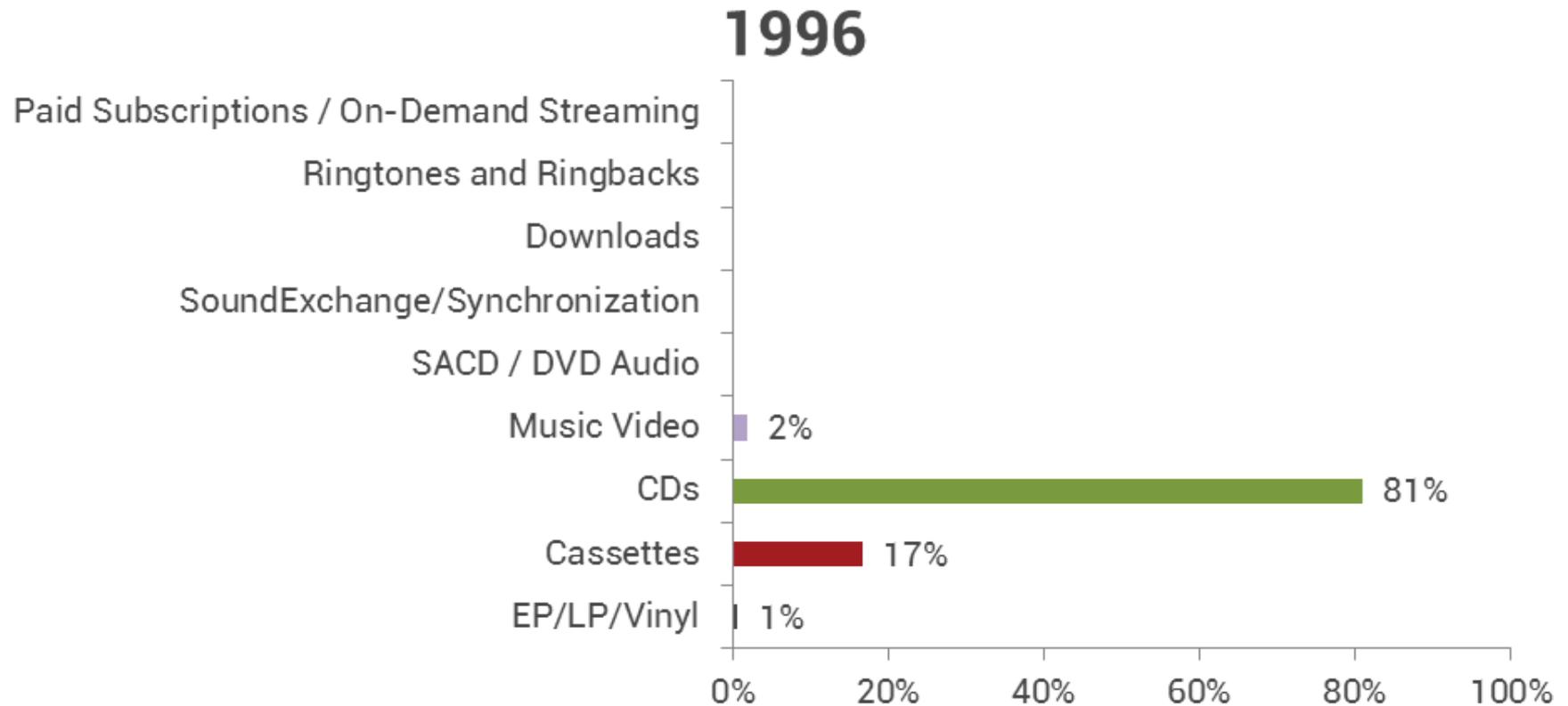
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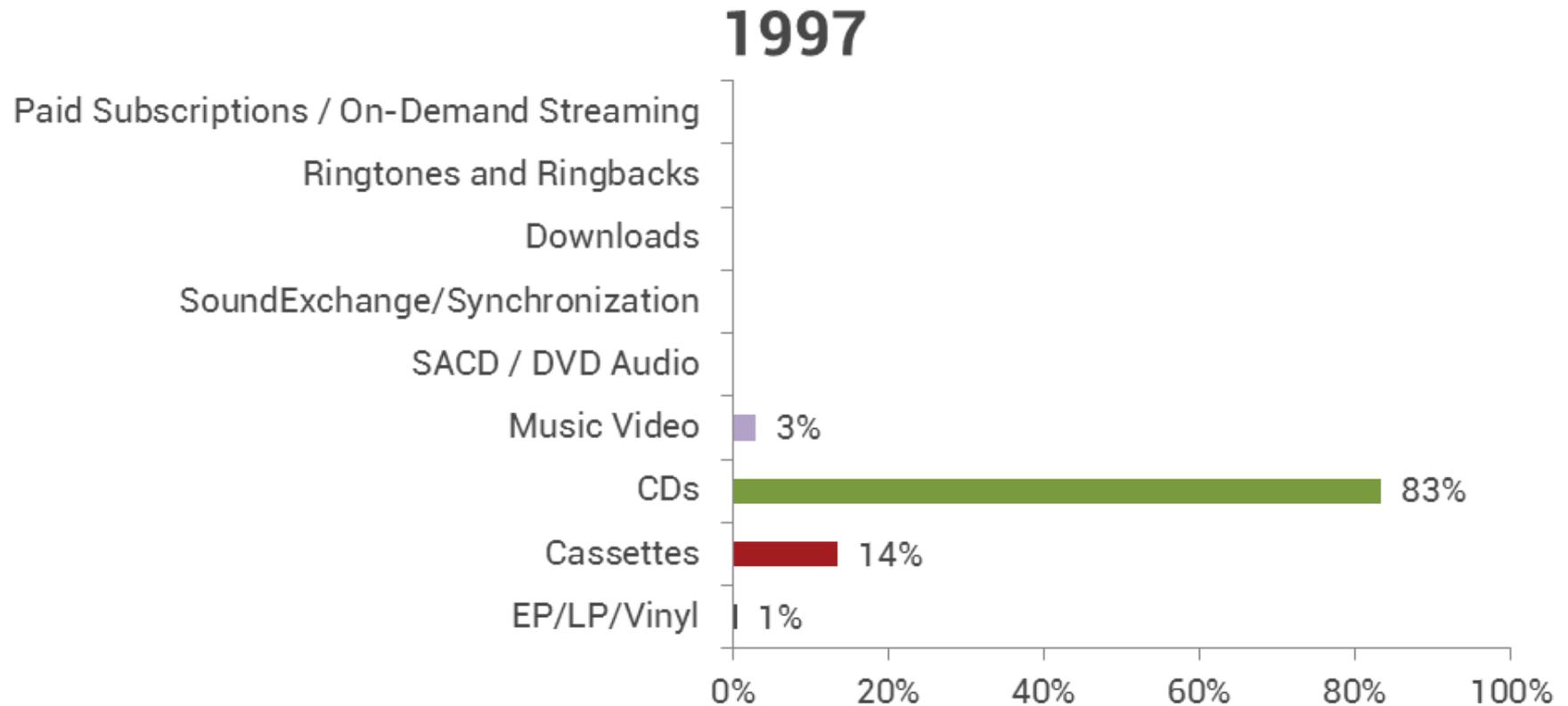
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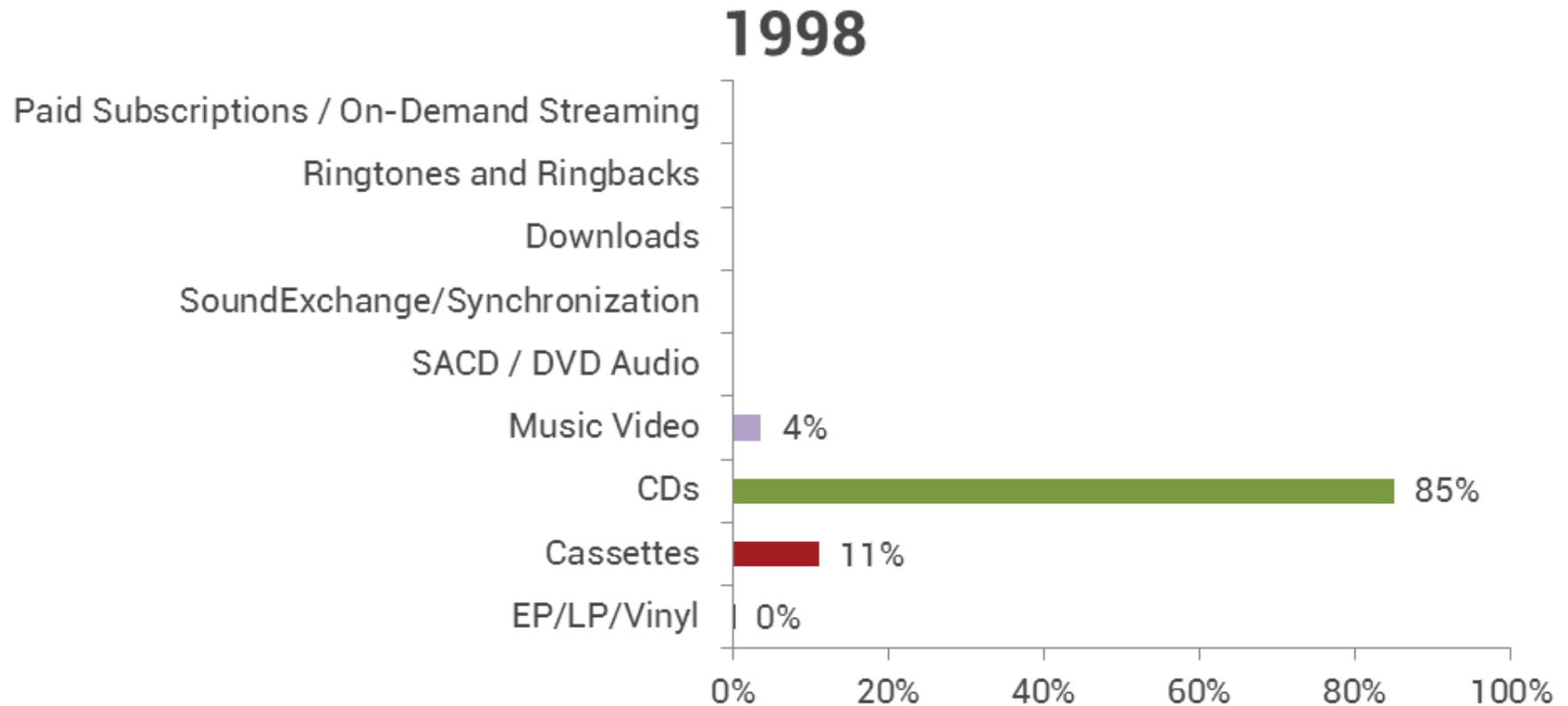
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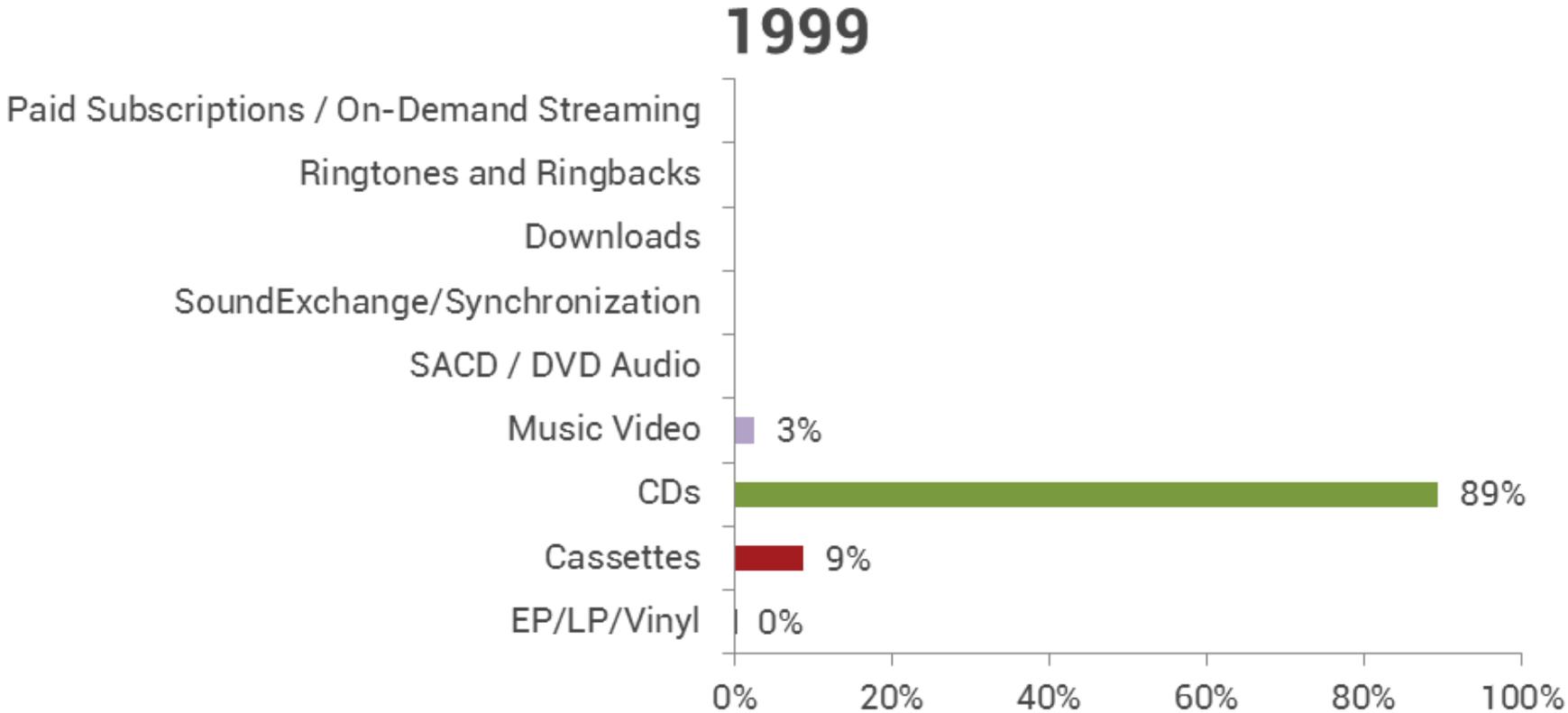
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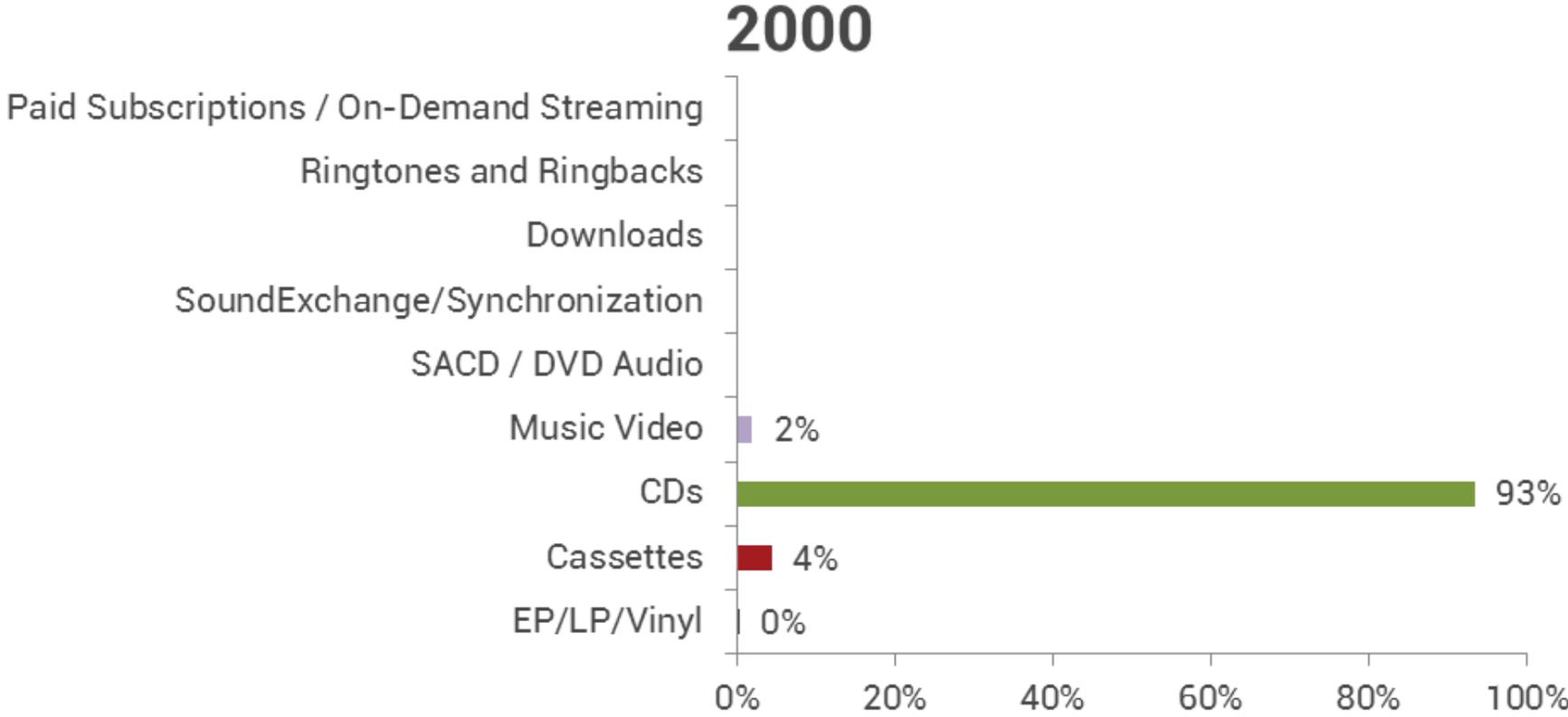
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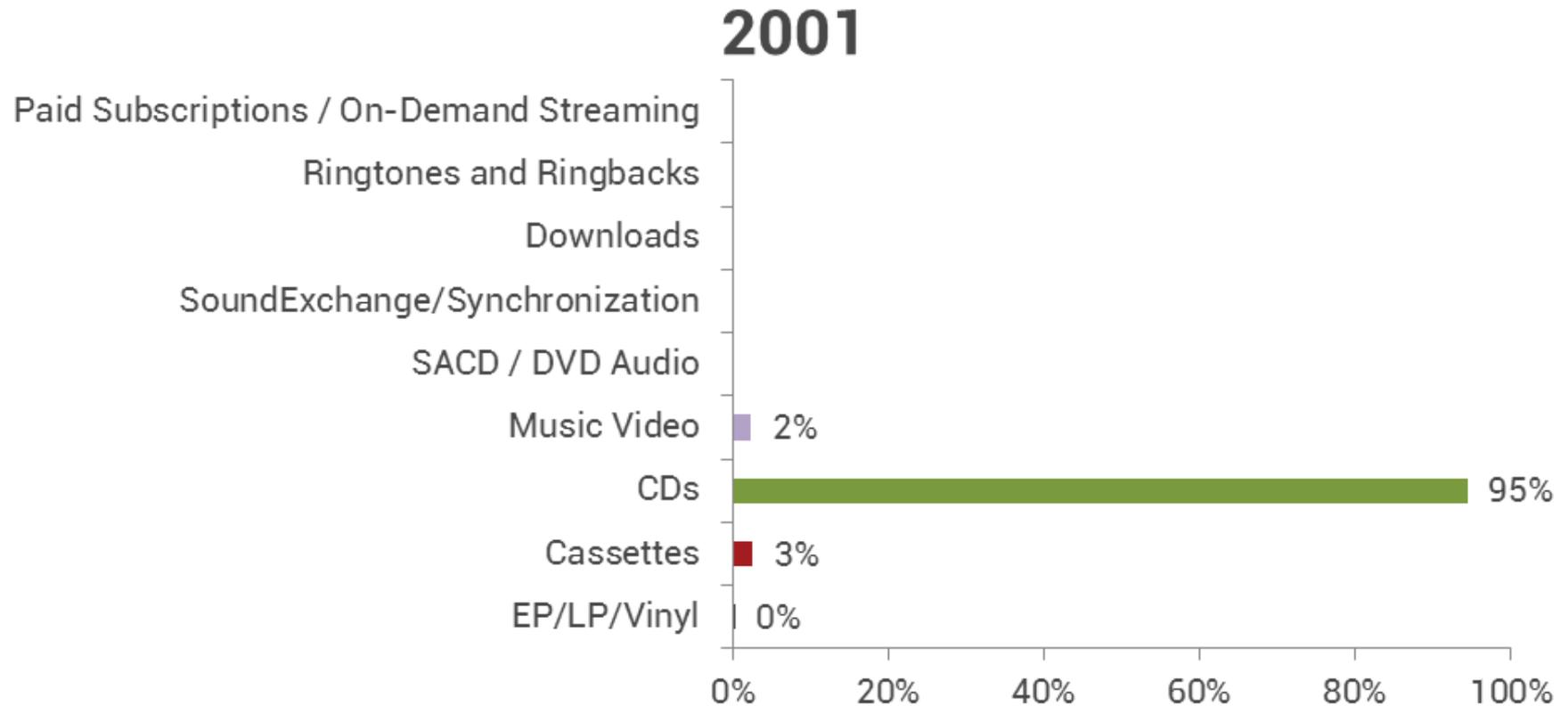
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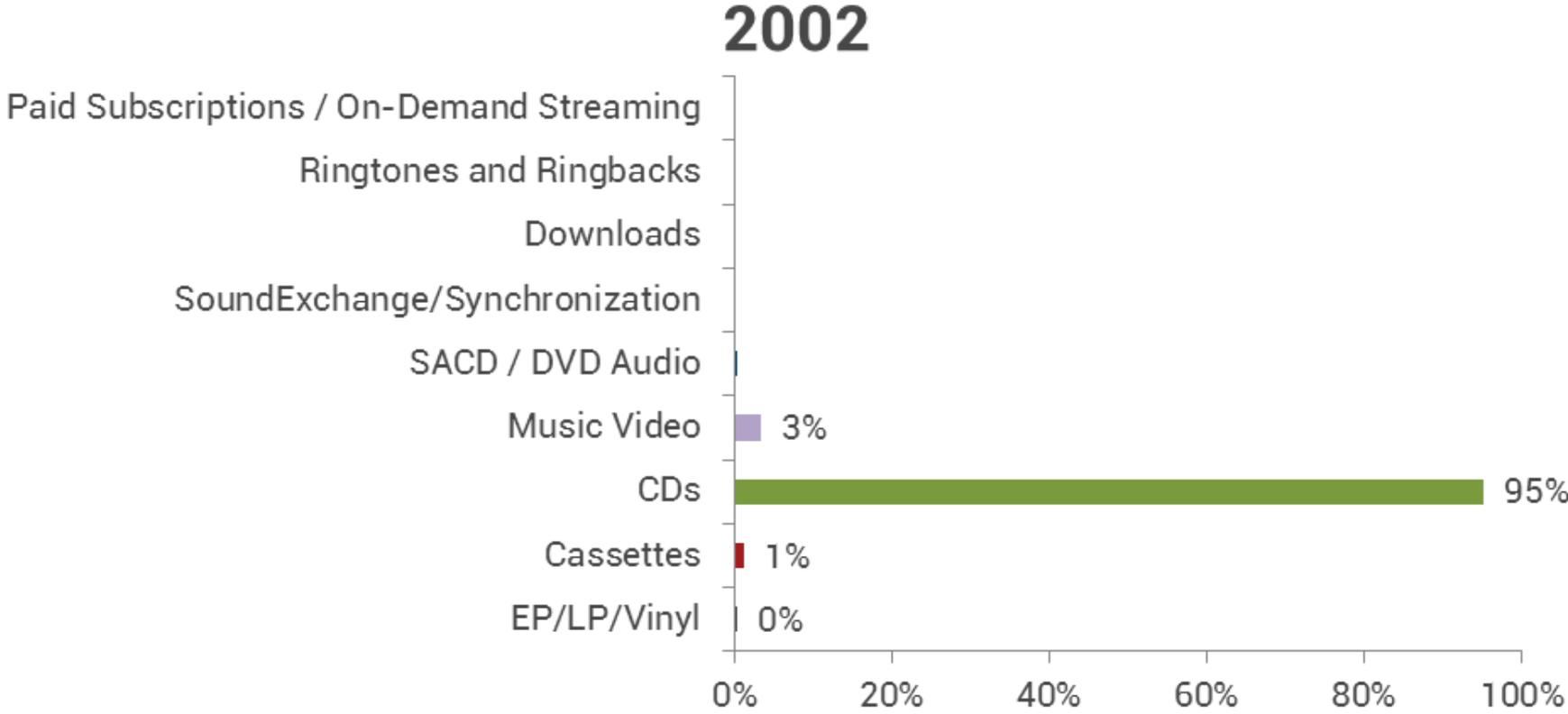
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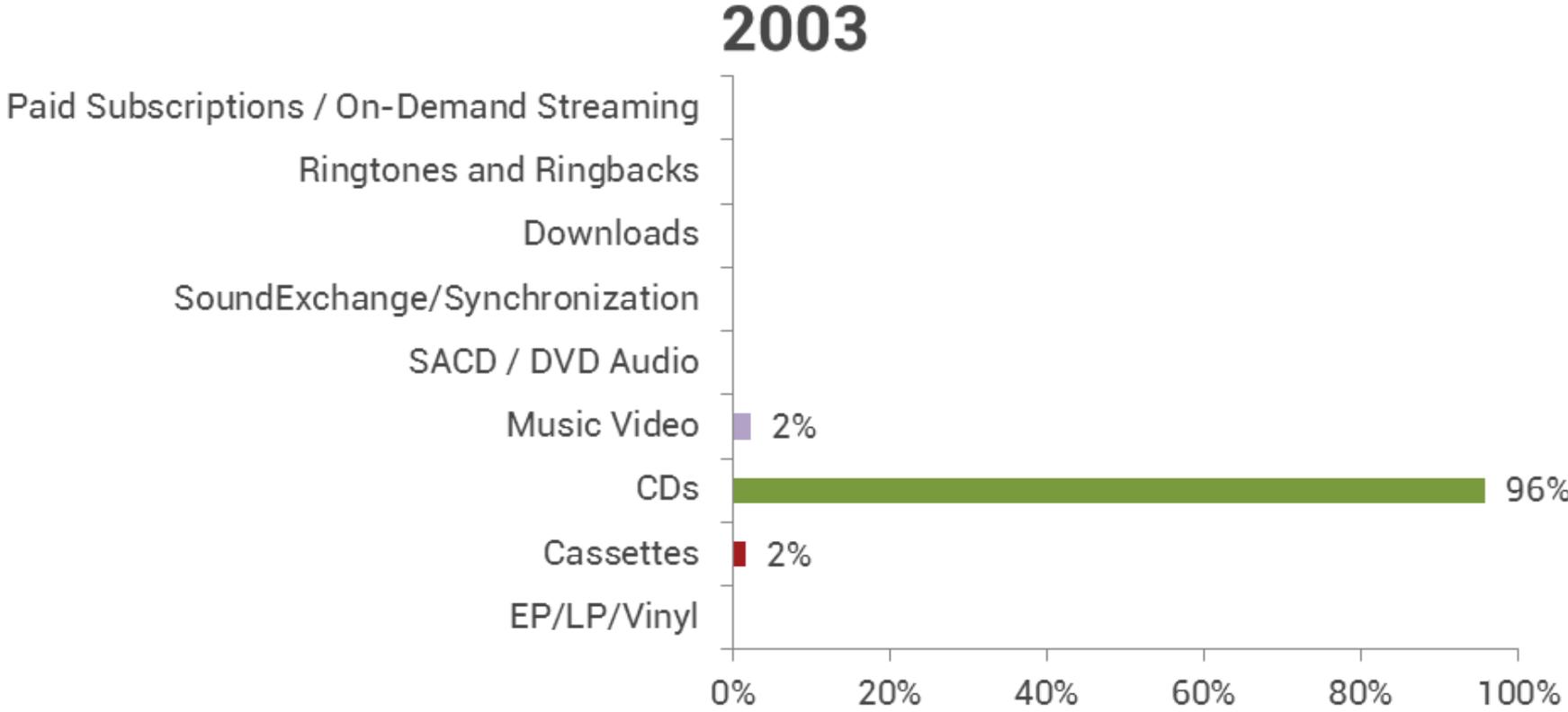
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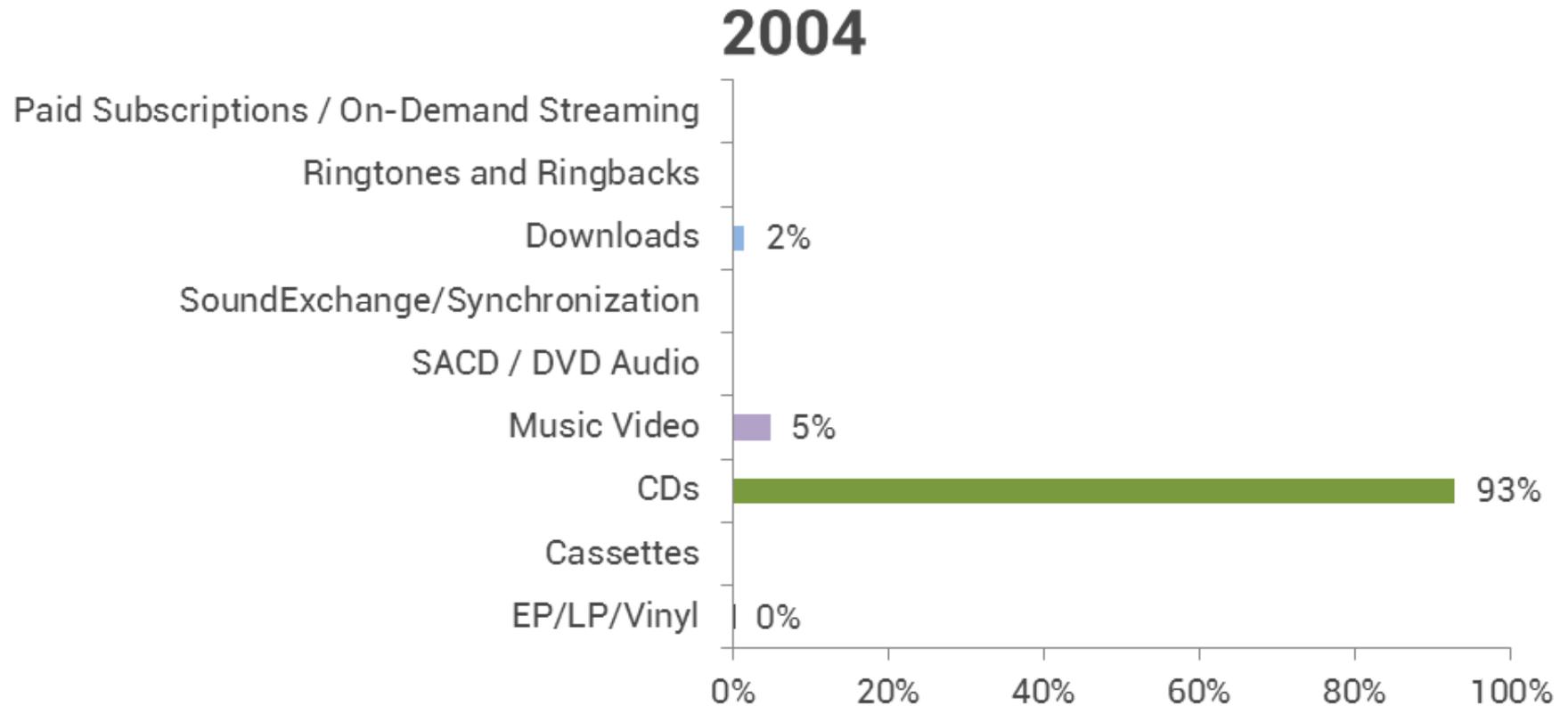
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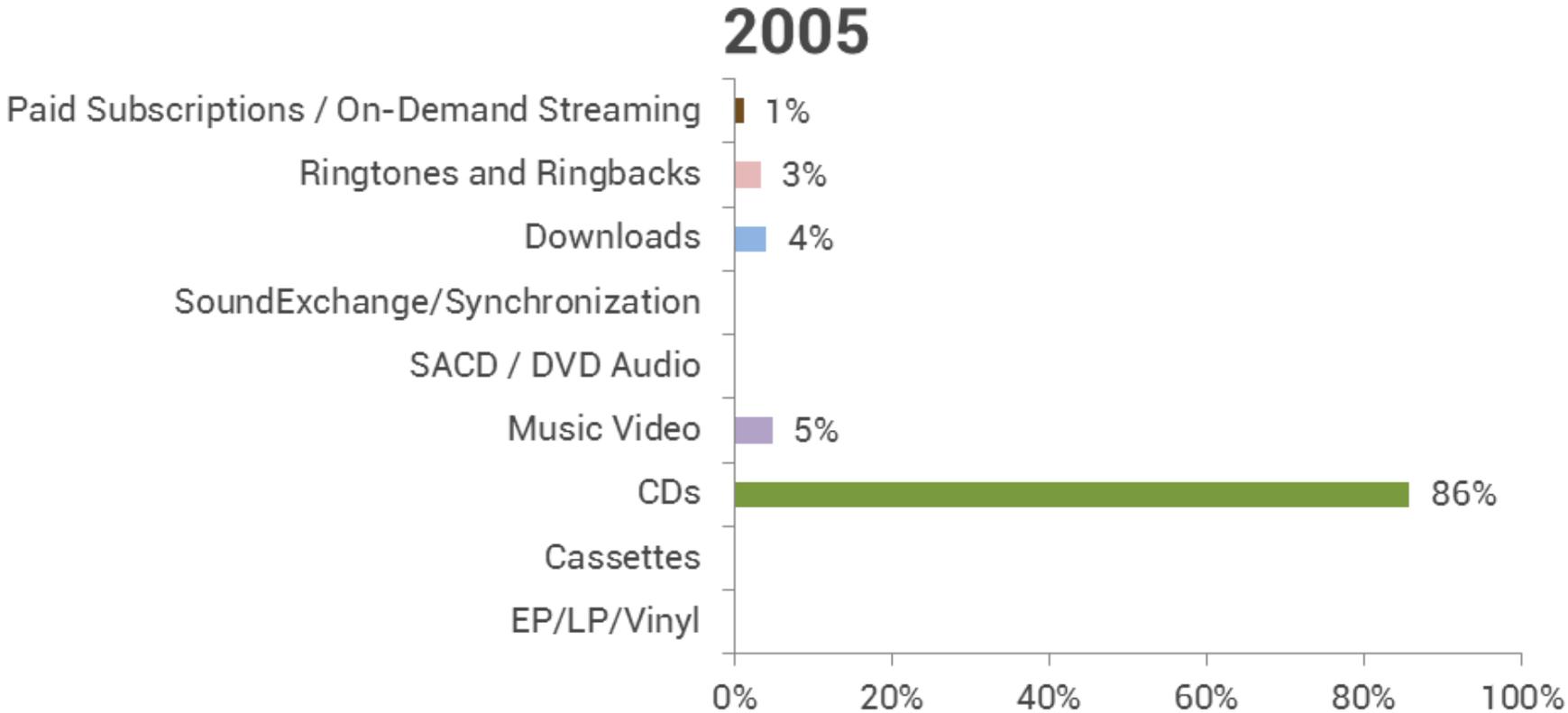
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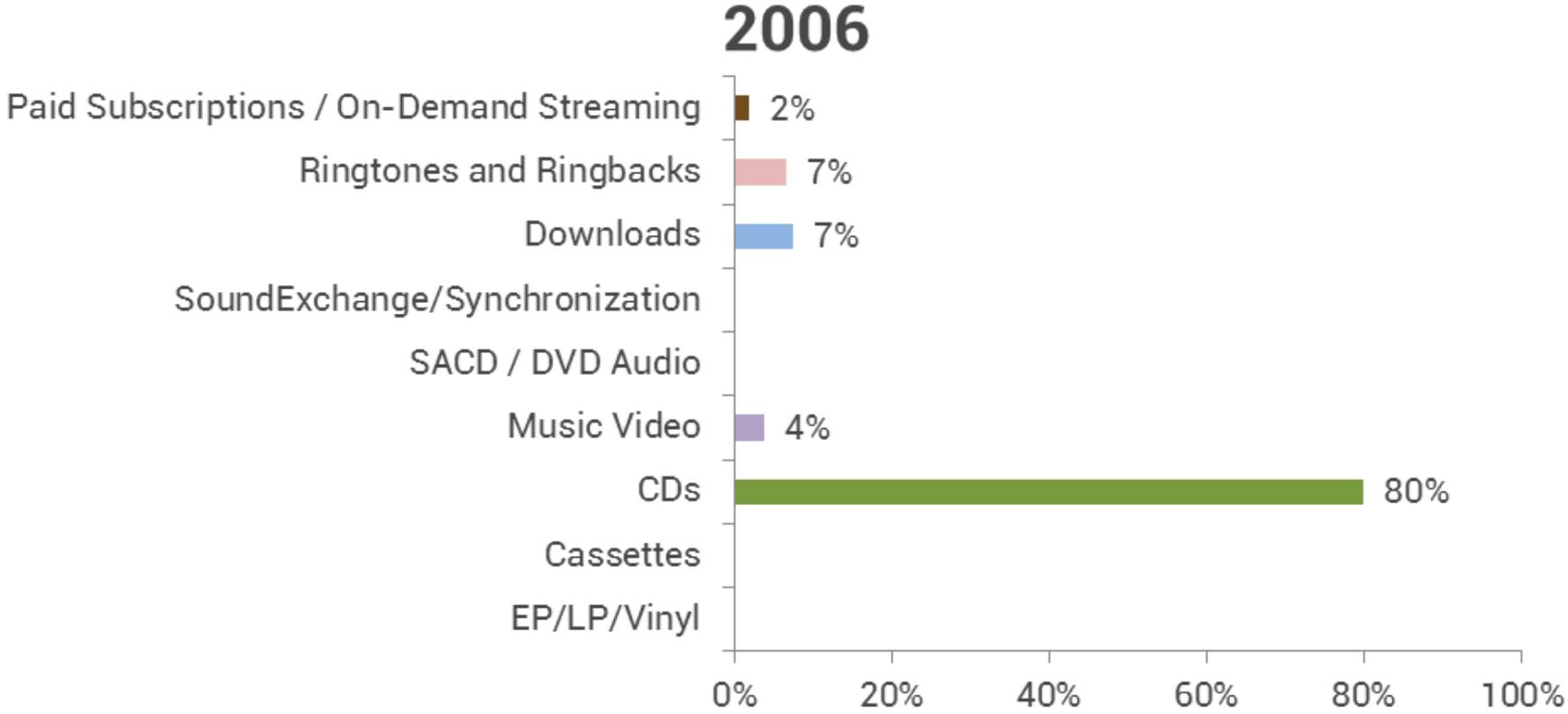
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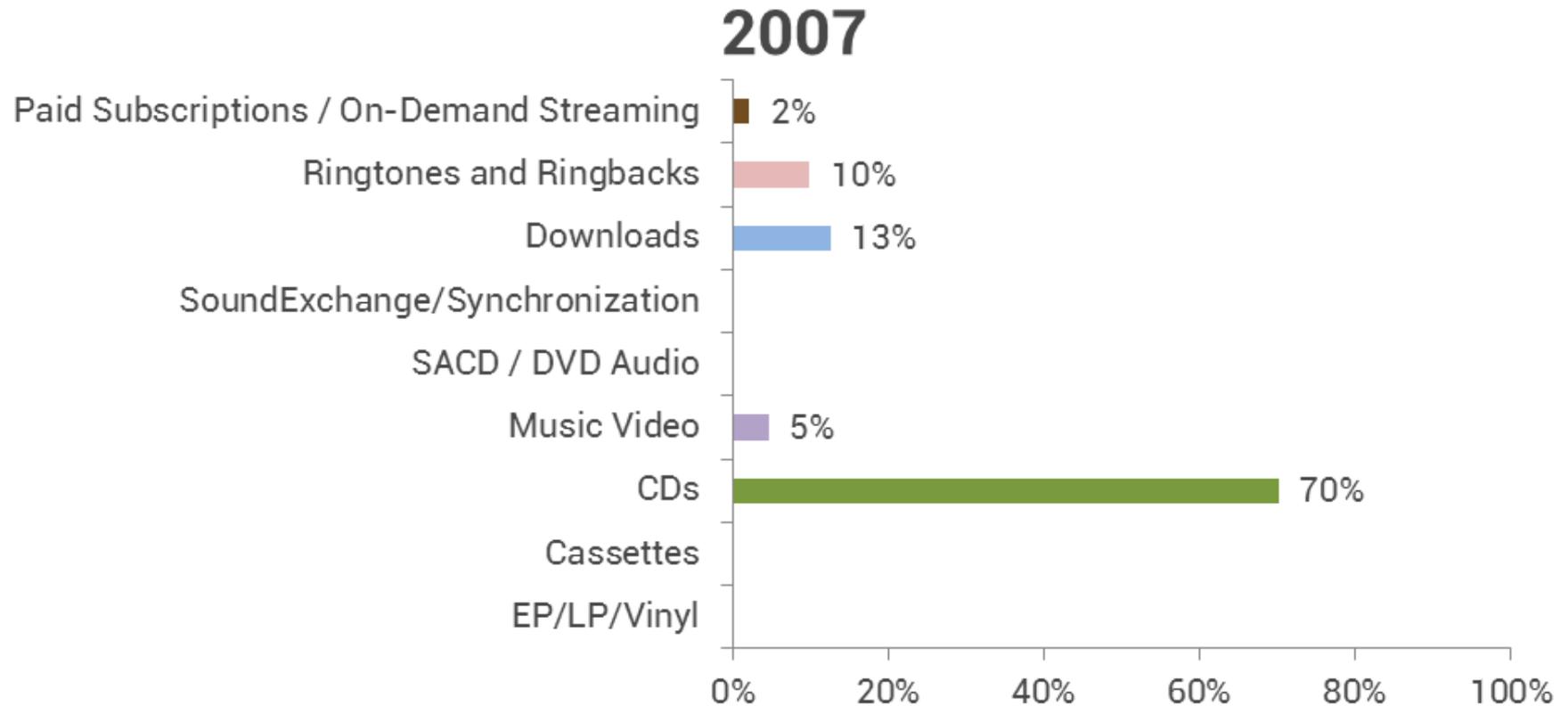
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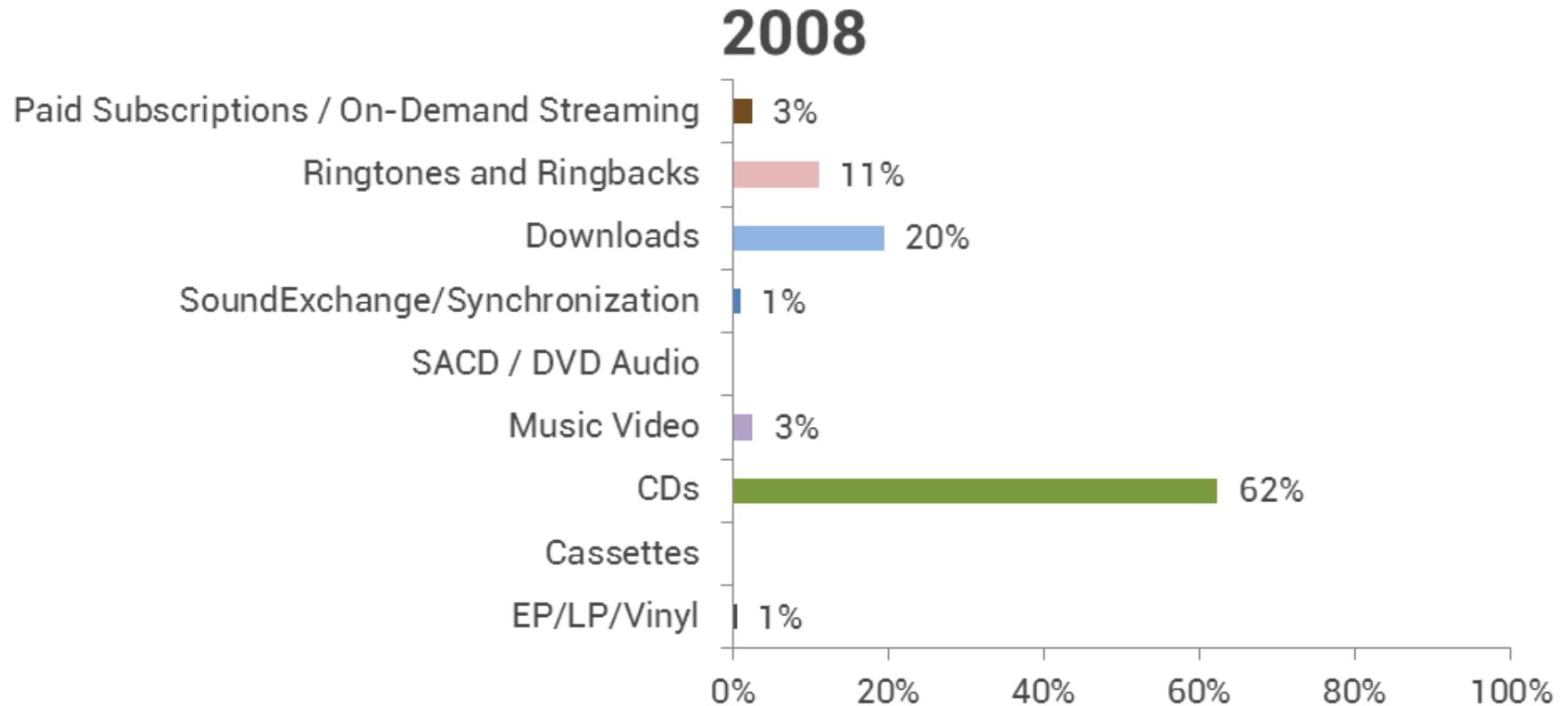
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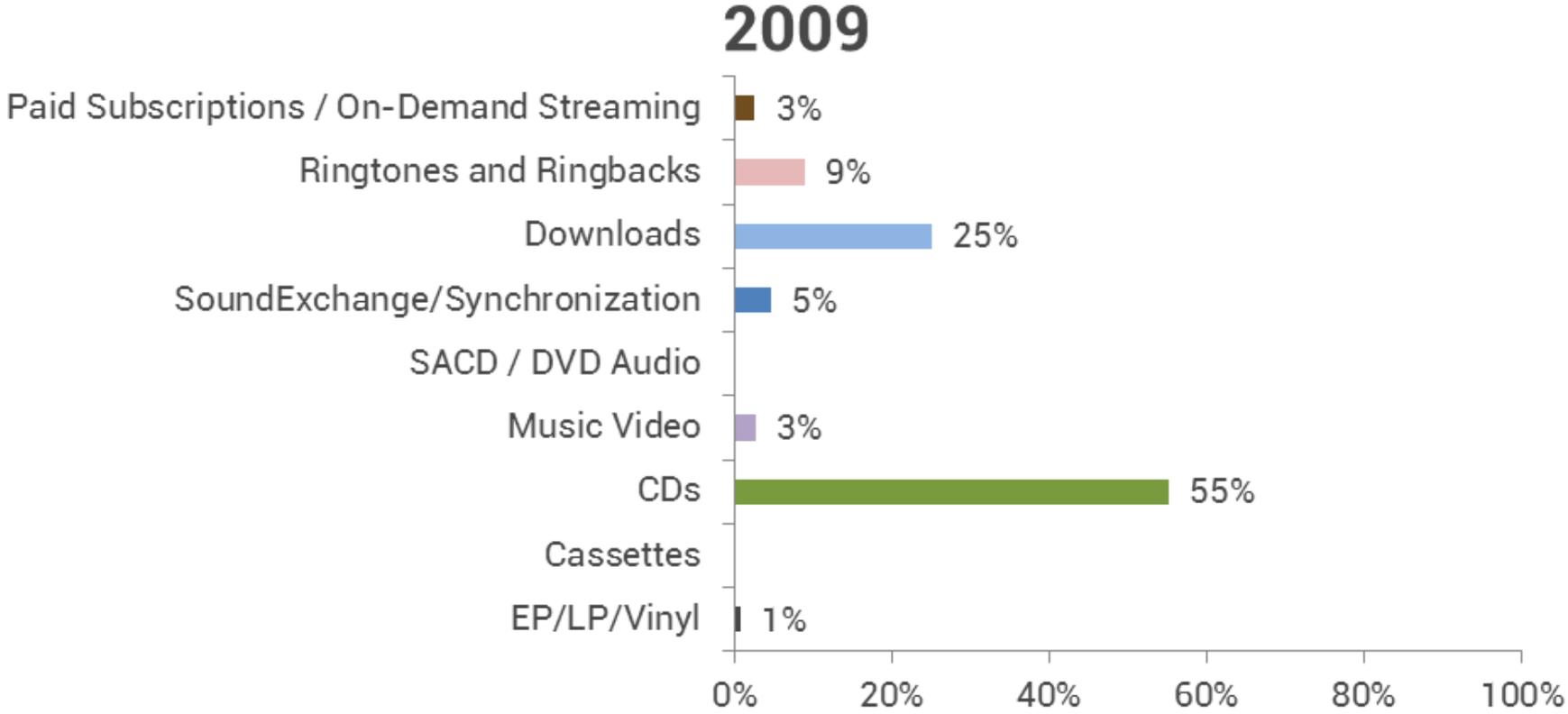
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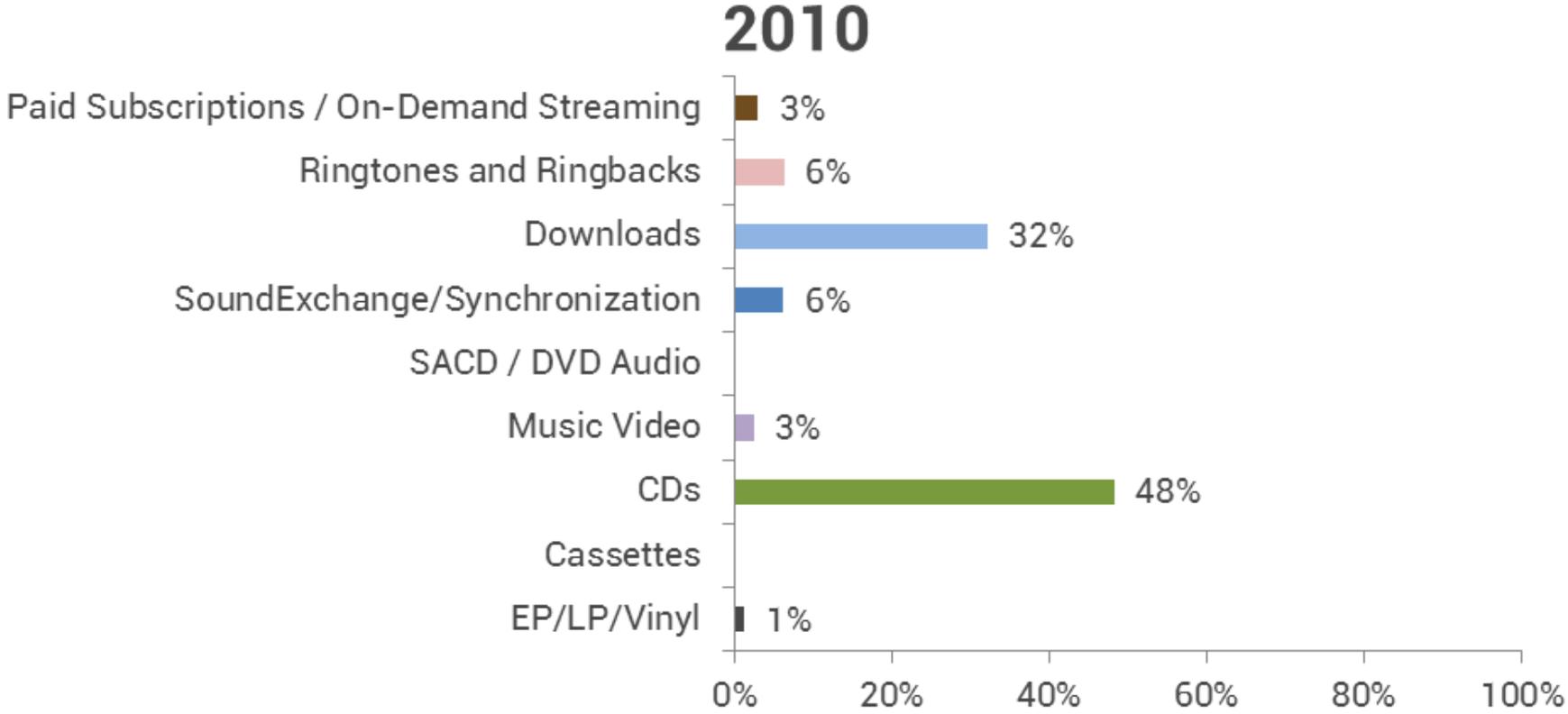
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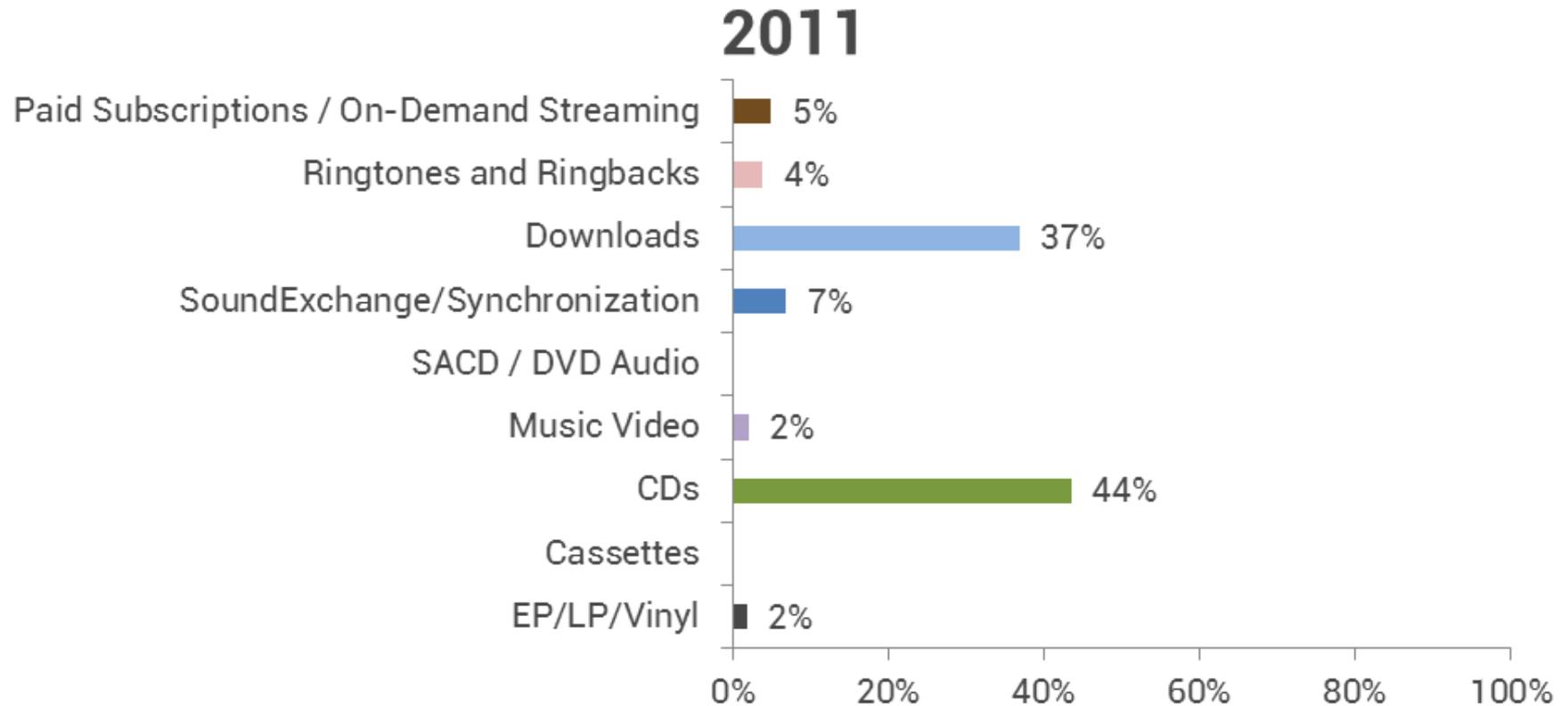
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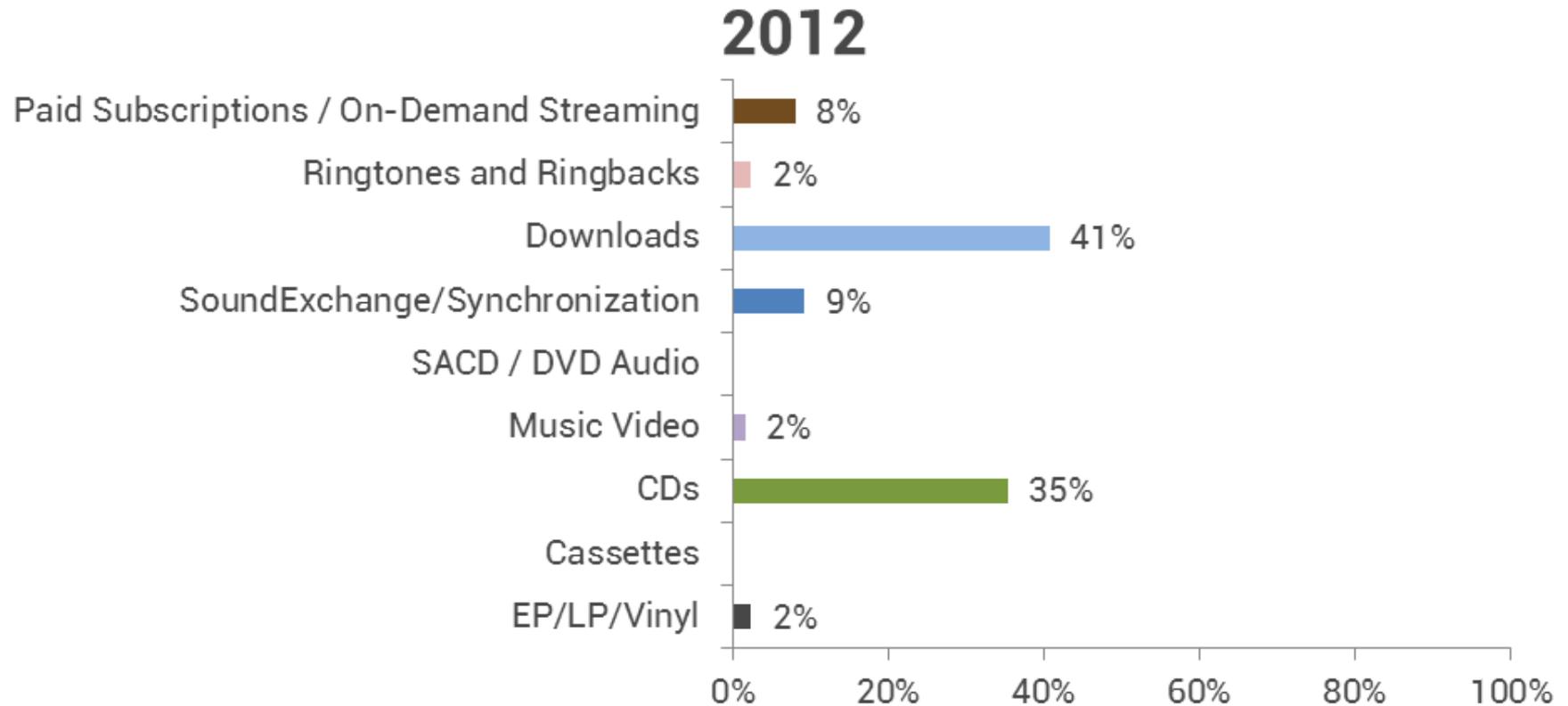
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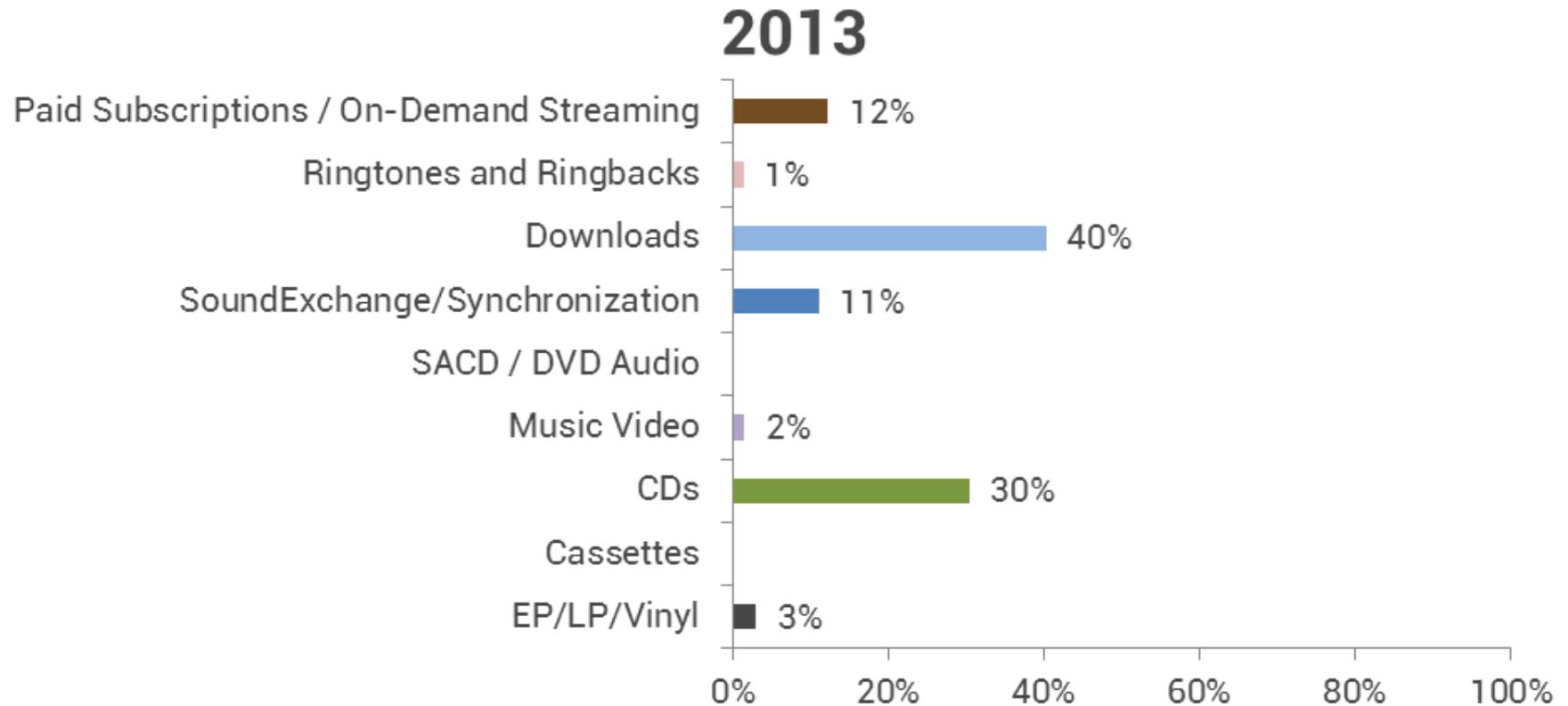
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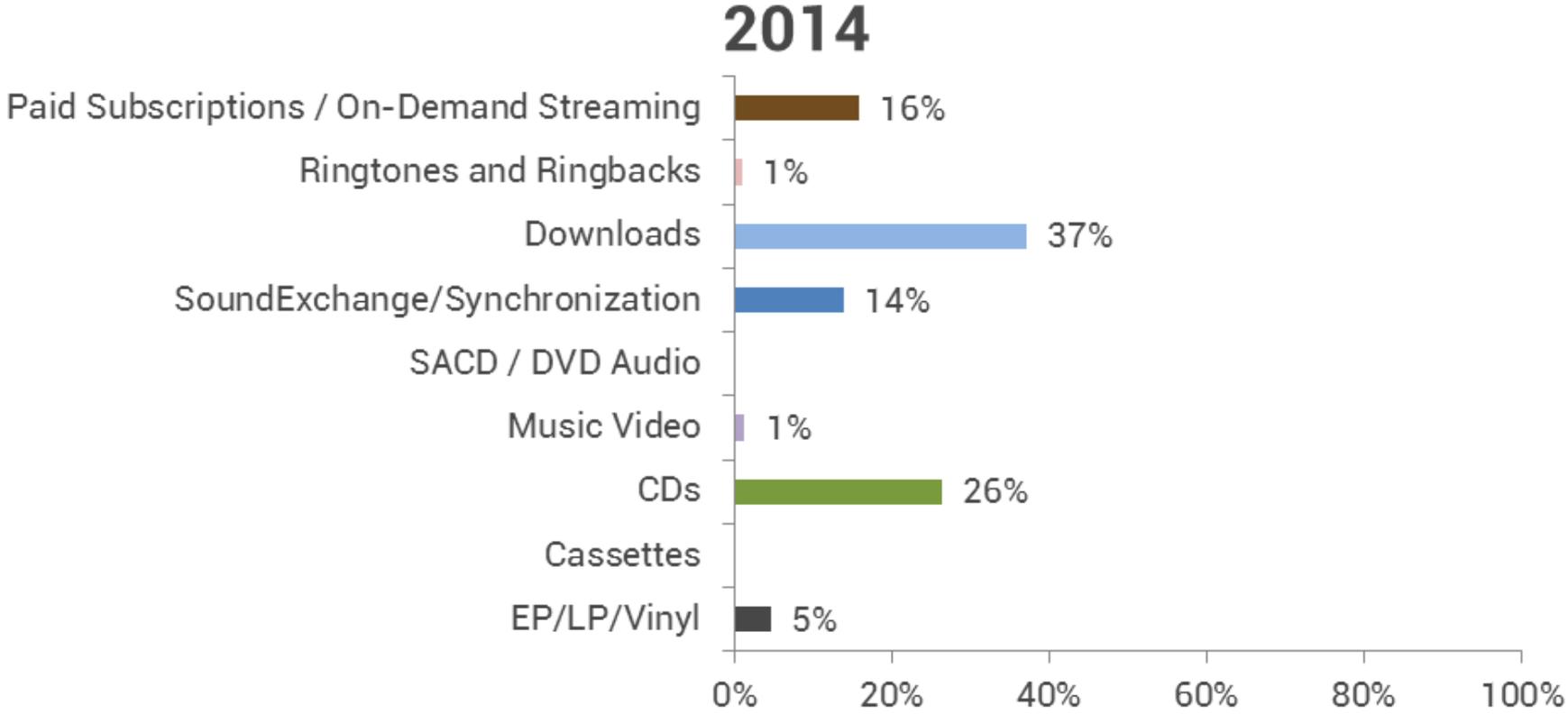
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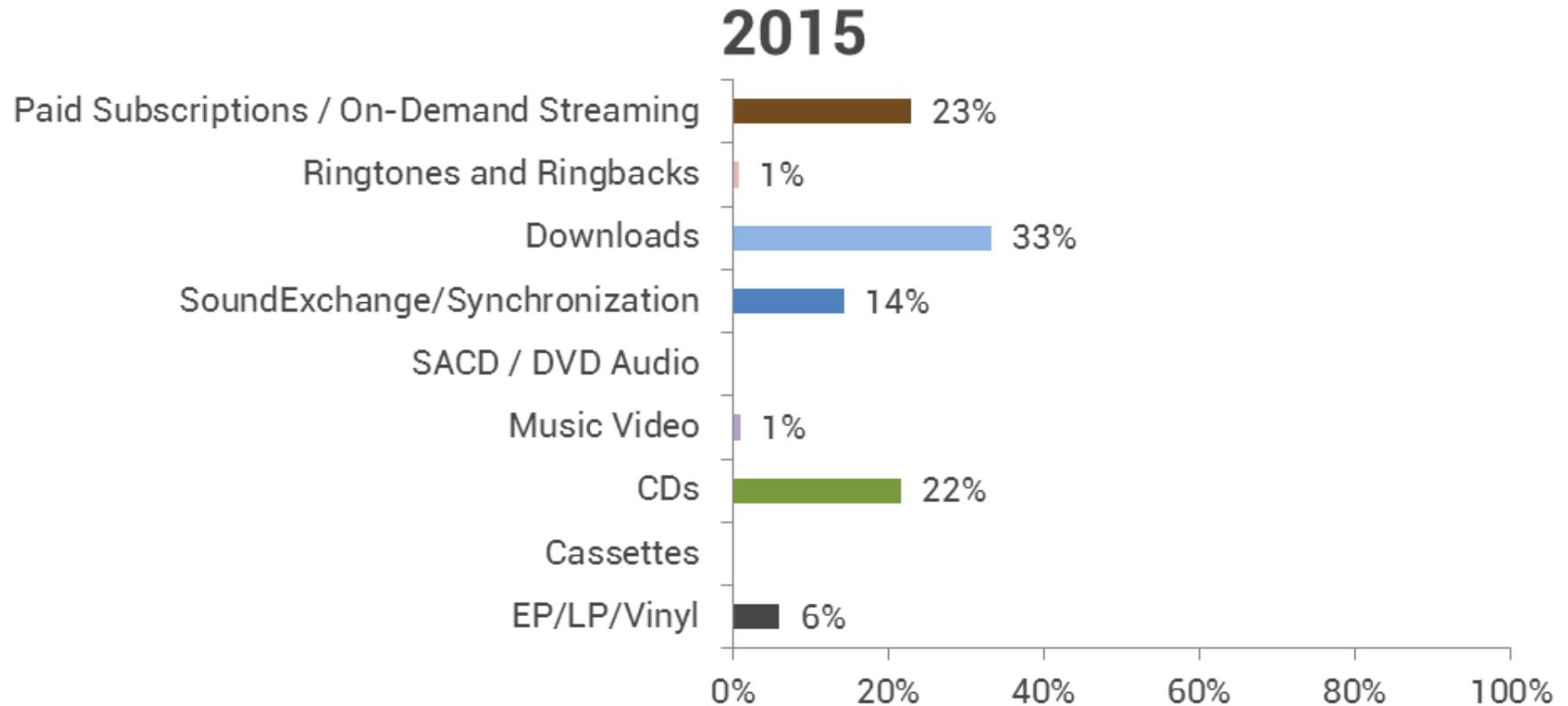
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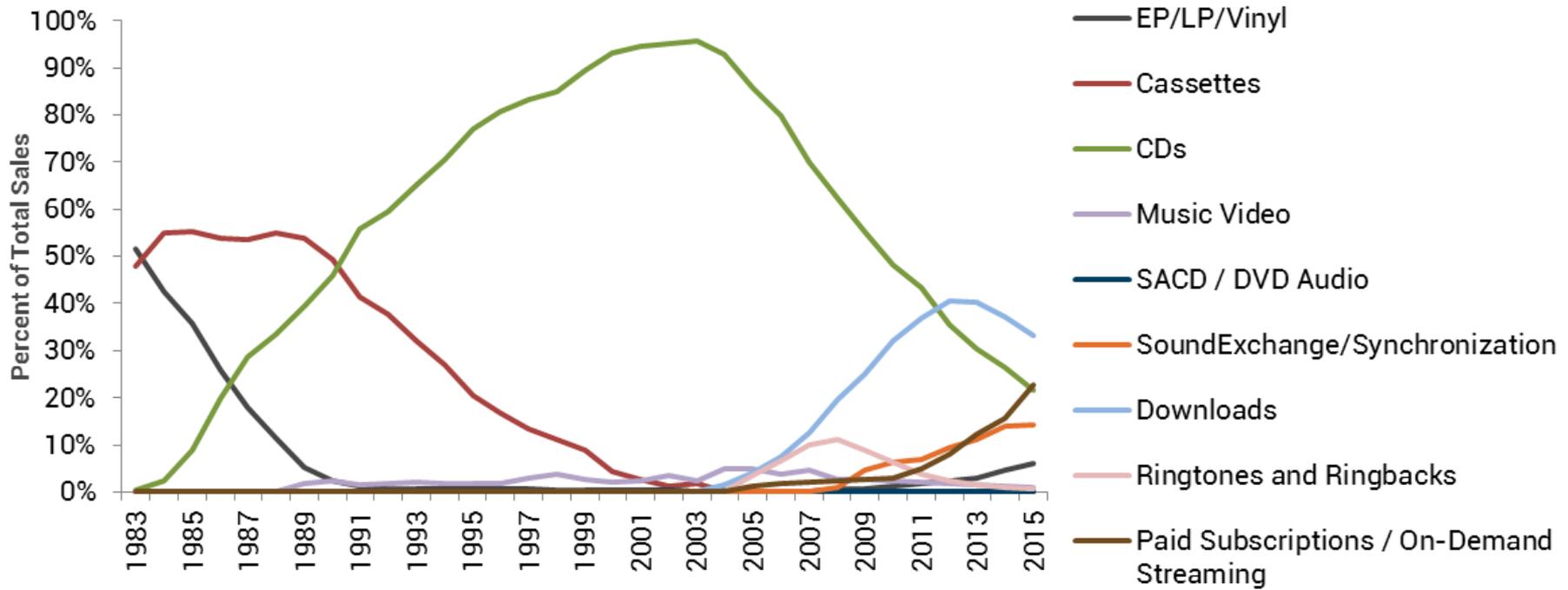
Source: Recording Industry Association of America, 1983 – 2015

Music Industry Digitization



Source: Recording Industry Association of America, 1983 – 2015

Music Industry Digitization



Source: Recording Industry Association of America, 1983 – 2015

to the music industry, what year do you think terms of digitizing transportation?

1980: No digitization

1990: Early
digitization

2000: On the cusp on
transformation

2010: 2nd
transformation

2020: Ahead of the
music industry

Start the presentation to activate live content

If you see this message in presentation mode, install the add-in or get help at PollEv.com/app

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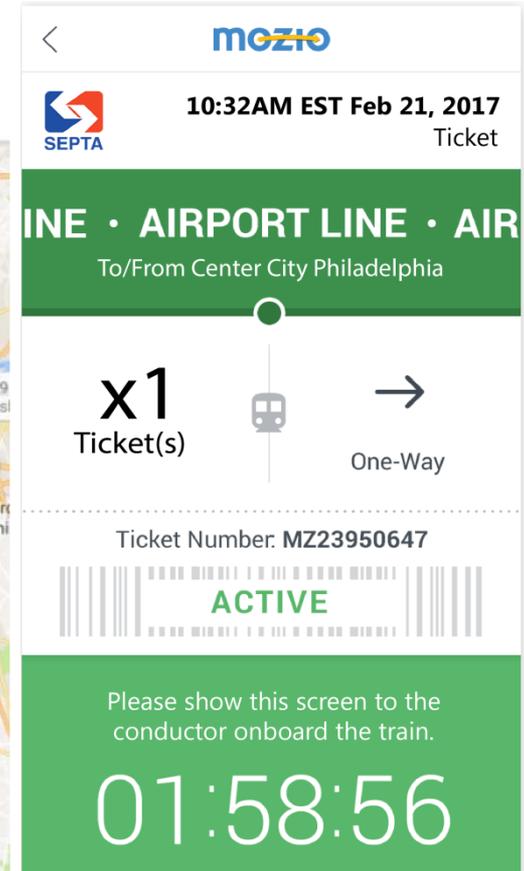
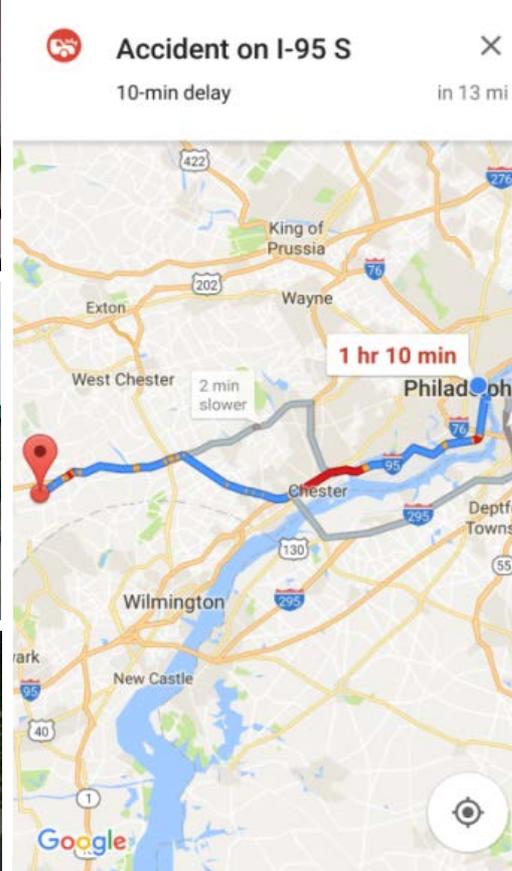
Real-Time Info & E-Payments



Source: Otto Yamamoto via Wikipedia Commons



Source: PA Turnpike Commission



Source: SEPTA

Smart, Connected Cities



Source: Monnit



Source: Renesys



Source: Nexar

Digital Transportation Sharing



Source: <http://www.iphoneincanada.ca/news/turos-peer-to-peer-car-rental-company-launches-in-canada/>

Digital Transportation Services



CAVs & UASs



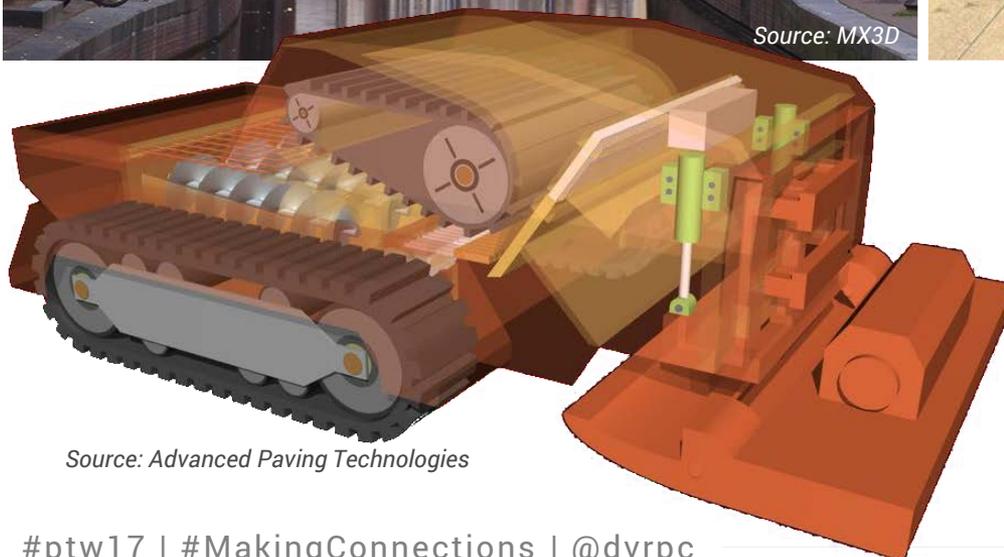
3-D Printing & Robotics



Source: MX3D



Source: Z2z / Wikimedia Commons



Source: Advanced Paving Technologies



Source: Rutgers CAIT

Augmented & Virtual Reality

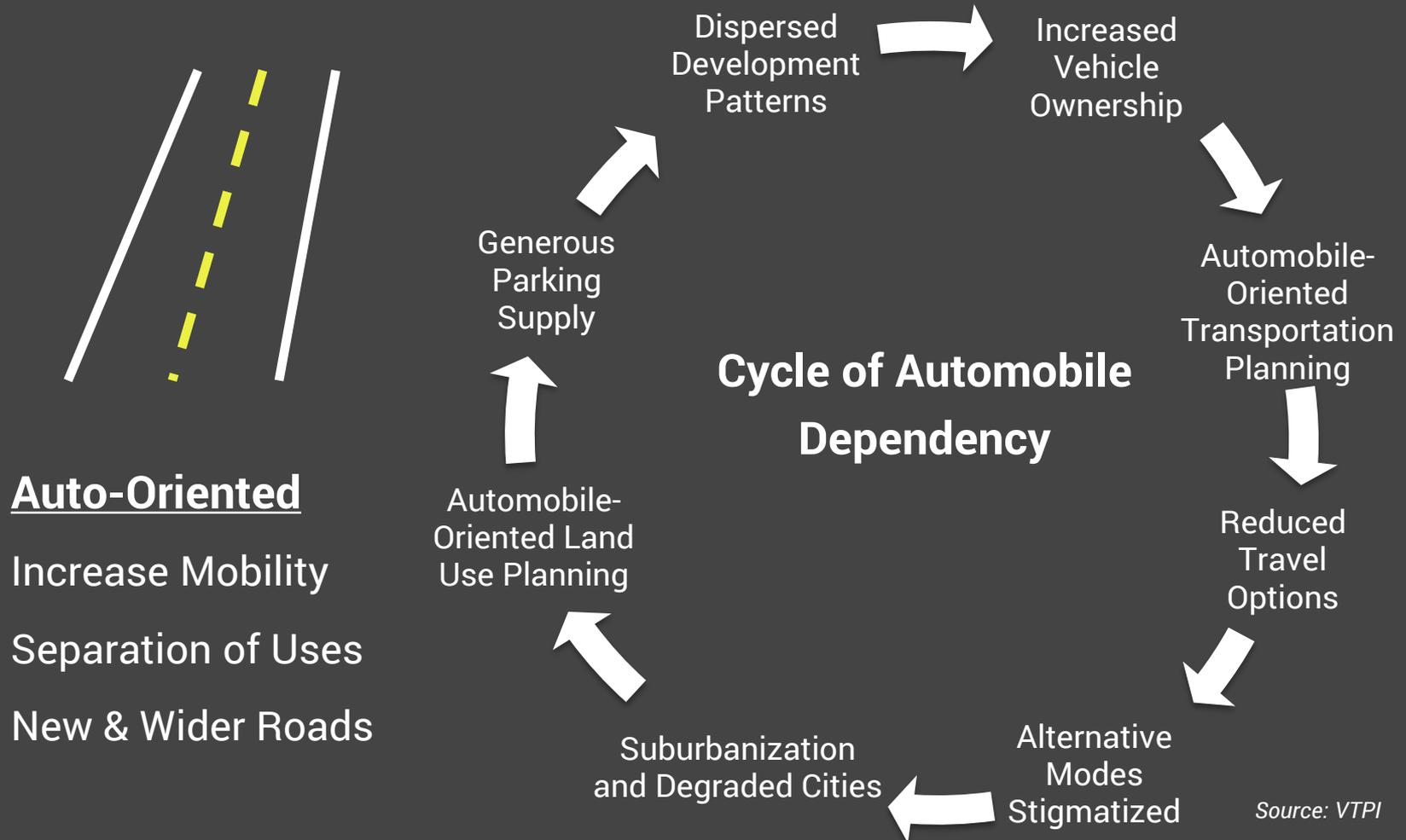


Source: Cisco

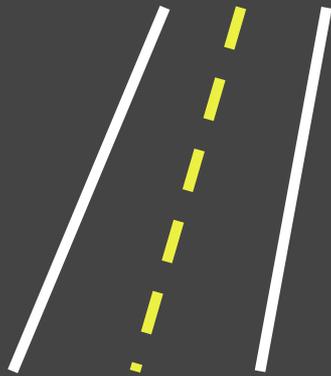


Source: Oculus

Competing Transportation Theories



Competing Transportation Theories



Auto-Oriented

Increase Mobility

Separation of Uses

New & Wider Roads



Active/Sustainable

Increase Accessibility

Mixed Use, High Density

Walking, Biking, Transit



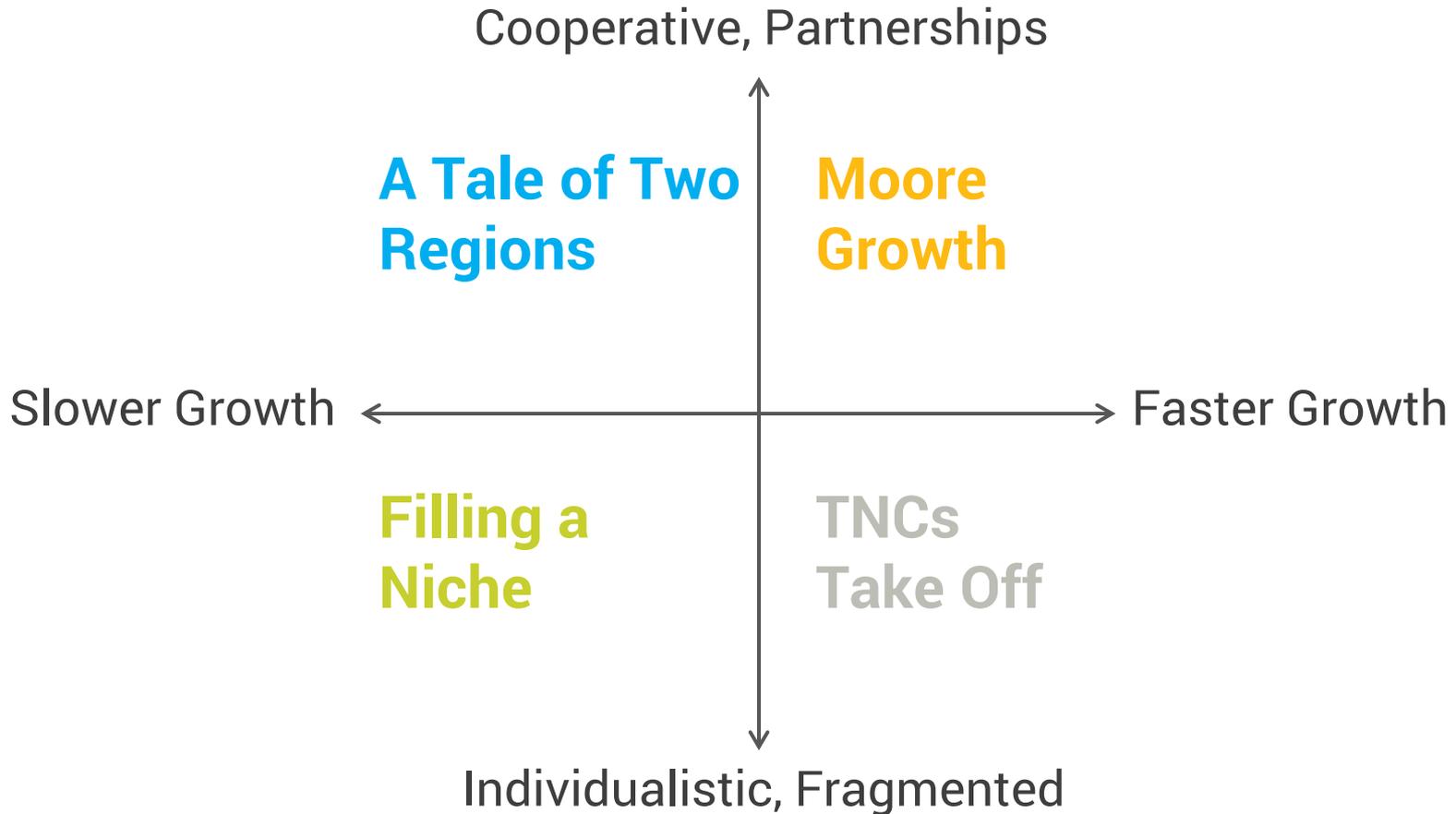
Digital

Increase Information

Live/Work Where You Want

“Smart” Facilities

Future Shared Mobility Scenarios



“In lieu of large civil infrastructure projects, transportation systems are increasingly being augmented with a range of information technologies that make them smarter, safer, more efficient, more integrated.”

- Anthony Townsend, PhD

RE-PROGRAMMING MOBILITY: The Digital Transformation of Transportation in the United States (New York: Rudin Center for Transportation Policy & Management).

Digital Equity Implications

- New Options Can Improve Access to Jobs & Services
 - Provide Subsidies Based on Need?
- Ensure Digital Providers Serve Low-Income Areas
- Prepaid or Digital Banking Options
- On-Demand Rides by:
 - Concierge / Corner Store / Phone Call / Kiosk
- Use Technology to Enhance Paratransit

AN INTEGRATED, MULTIMODAL TRANSPORTATION NETWORK

Real-time info lets people figure out the best way to get around

Big transportation data is becoming abundant

Digital transportation technologies promote **safety & efficiency**

Digitization reinforces **agglomeration economies** & the need for **walkable communities**

Digitization is unleashing creative & **entrepreneurial solutions** to transportation issues

Cybersecurity is a critical new transportation need

PHYSICAL AND VIRTUAL WORLDS ARE MERGING

Digital communications can enrich **community engagement** and services



Thank You!



Brett Fusco
Assistant Manager, Long-range Planning
Delaware Valley Regional Planning Commission
bfusco@dvrpc.org

www.dvrpc.org/connections2045

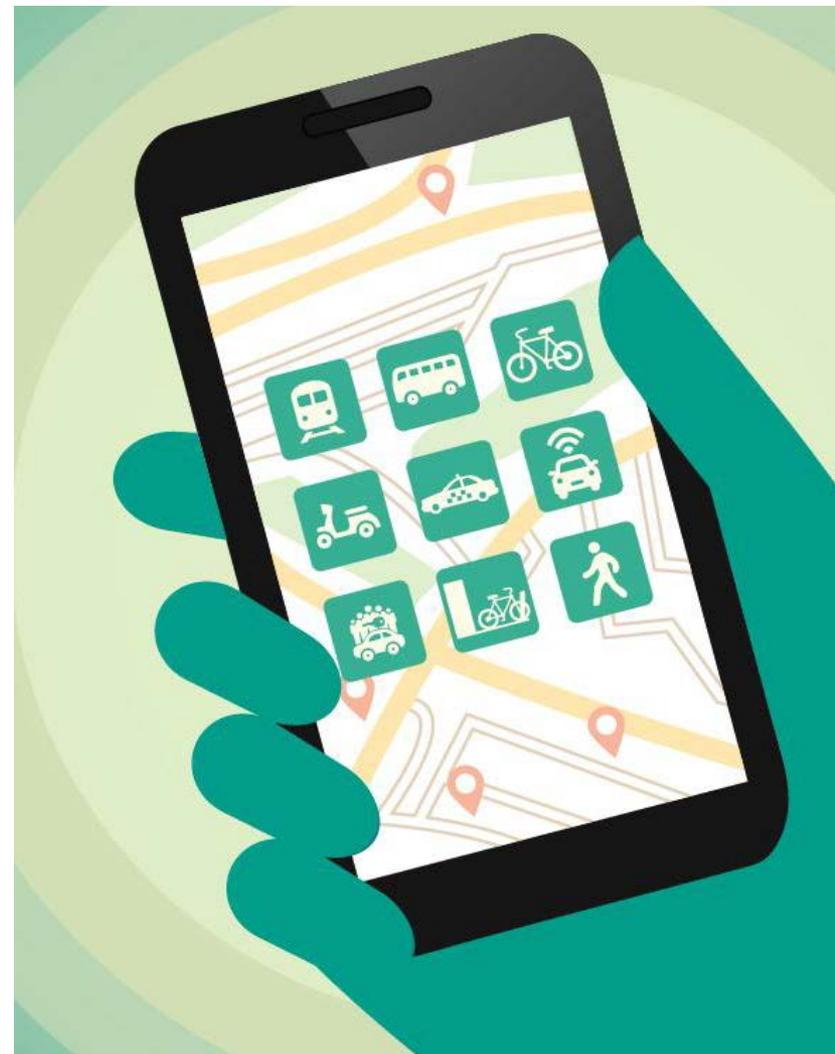


THE SELF-NAVIGATING REGION

PHILLY TECH WEEK

MAY 1, 2017

- Technology and Cities
 - Wildly changing our experience of city living
 - Near unlimited opportunities to make cities better
- Tech in concert with what makes cities work



WHAT MAKES CITIES WORK



- Agglomeration Economics and Density
- 2nd Densest Downtown
- 5th Largest City by Population



IN CENTER CITY BETWEEN 2010 & 2015:

- New Development **Eliminated 2,426** Public Parking Spaces
- Employment in Core Center City Grew from 231,873 to 243,450 **(+5.0%)**
- Population in Core Center City Grew from 58,882 to 63,521 **(+7.9%)**
- Public Parking Occupancy Rates Actually **Declined** from 75.6% to 73.9% **(-1.7%)**
- **Not Possible Without Transit**

COMCAST INNOVATION & TECHNOLOGY CENTER



- **1.33 MILLION** RENTABLE SQUARE FEET
- REPLACED **360-SPACE PUBLIC** PARKING LOT WITH **70-SPACE PRIVATE** GARAGE
- **DIRECT-CONNECT TO SUBURBAN STATION**
- **1,121-FT SKYSCRAPER** (9TH TALLEST IN U.S.)
- **\$1.2 BILLION** COMMERCIAL INVESTMENT

ENDURING URBANISM

62% OF ALL CENTER CITY/
UNIVERSITY CITY WORK TRIPS



**WITH SEPTA:
2ND DENSEST DOWNTOWN IN UNITED STATES**



ENDURING URBANISM

62% OF ALL CENTER CITY/
UNIVERSITY CITY WORK TRIPS



**WITHOUT SEPTA, 923 ACRES OF ADDITIONAL PARKING NEEDED –
28 COMCAST CENTERS OF SQUARE FOOTAGE JUST FOR CARS**



“When we are talking about space, we are talking about geometry, not engineering, and *technology never changes geometry*. You must solve a problem spatially before you have really solved it.”

— Jarrett Walker, Urbanist and Public Transit Consultant

ENDURING URBANISM ENDURING TRANSIT

SPACIAL EFFICIENCY OF MODES



BY BUS



BY CAR



BY RIDE-HAILING CAR



BY DRIVERLESS CAR

WHAT MAKES CITIES WORK



Enduring Urbanism Requires Enduring Transit



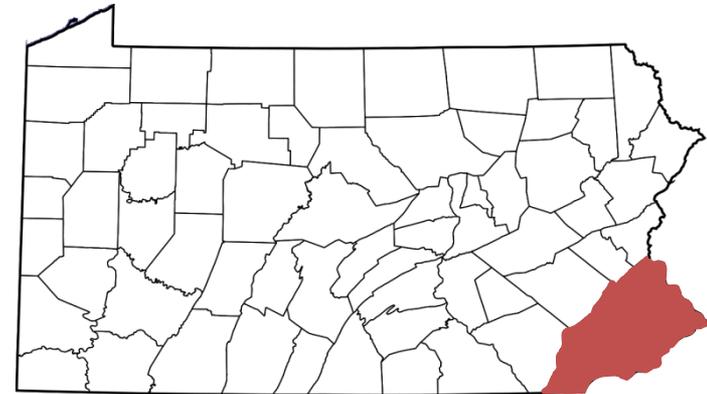
PHILADELPHIA & SOUTHEAST PA REPRESENT:



40% of PA's
Economic Output



32% of PA's
Population



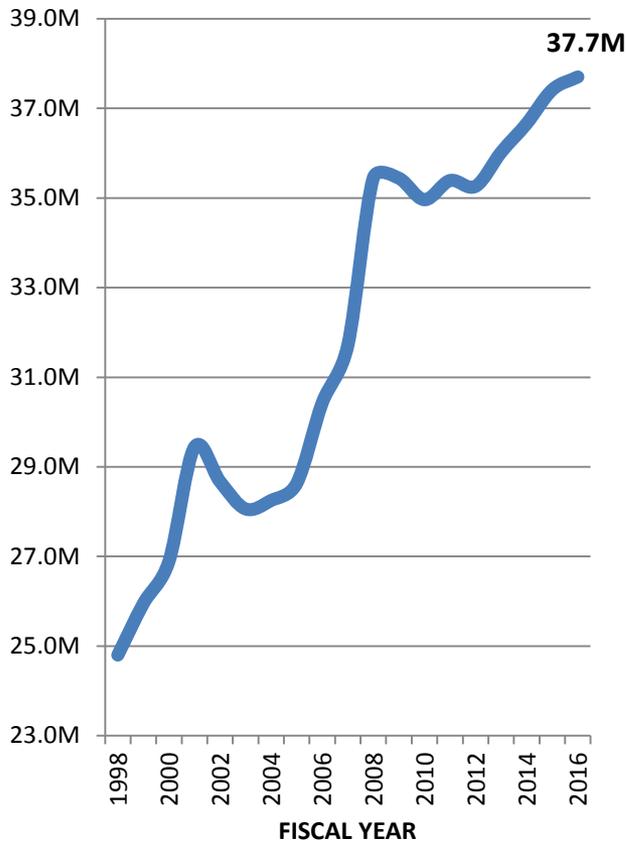
5% of PA's Land Mass

RIDERSHIP IS GROWING

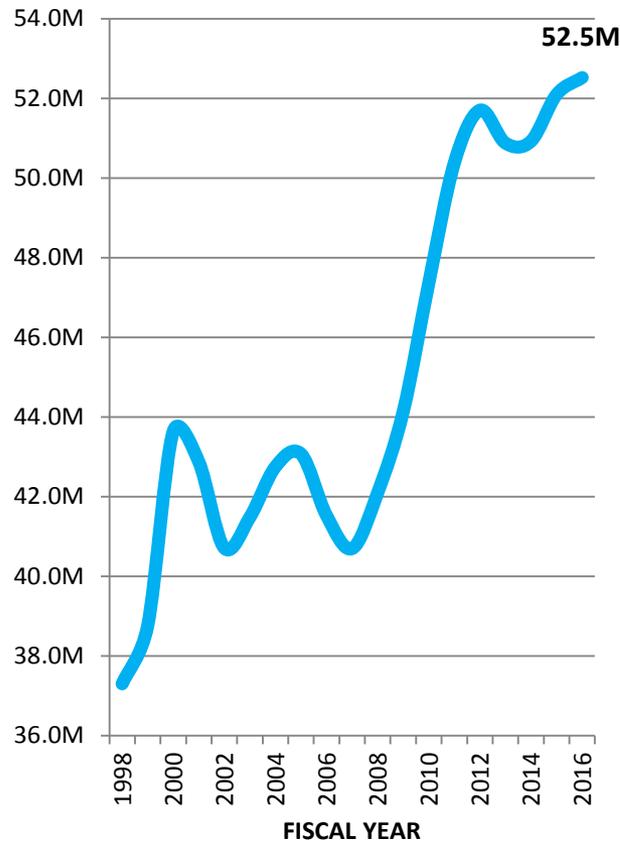
ANNUAL INCREASES
(1998-2016)



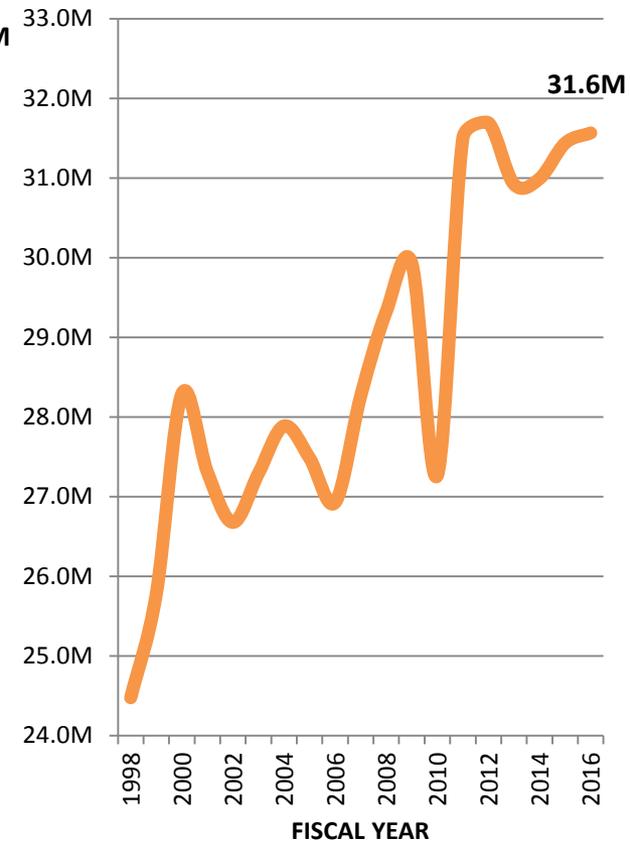
REGIONAL RAIL +52%



MARKET-FRANKFORD +41%



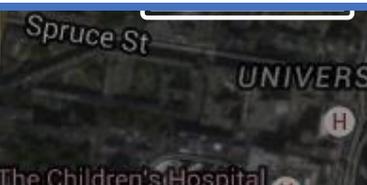
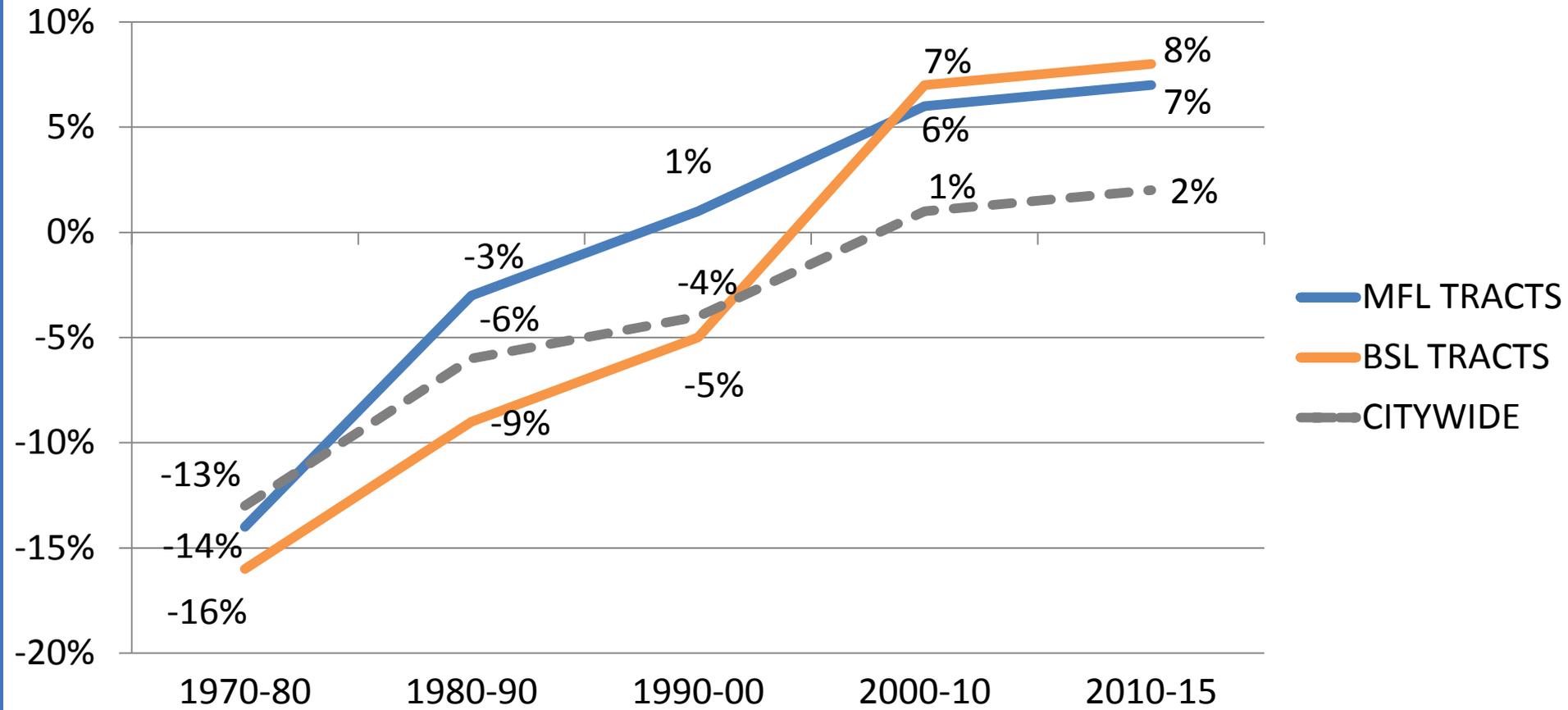
BROAD STREET LINE +29%



TRANSIT ORIENTED DEVELOPMENT UNIVERSITY CITY

9 MILLION SQ FT UNDERWAY OR COMPLETED

Change in Philadelphia Population By Census Tracts



A CHANGING TRANSPORTATION LANDSCAPE



NO LONGER A BINARY CHOICE



THE INFRASTRUCTURE OF MULTIMODALISM

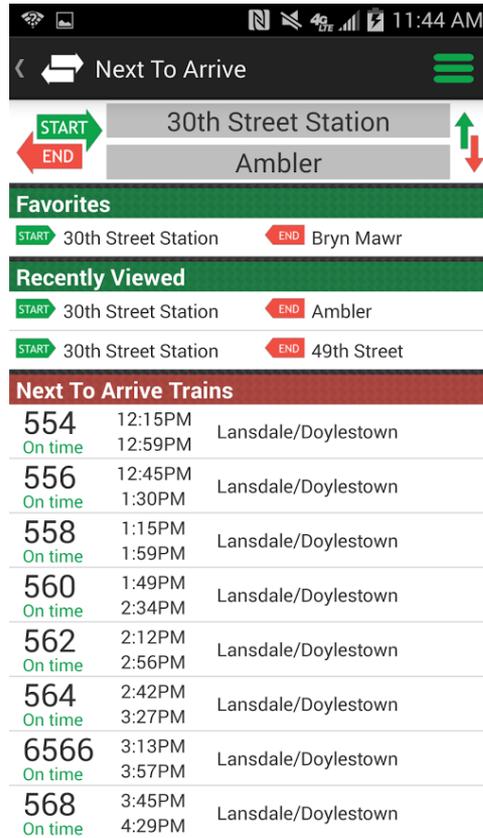
INFORMATION-DRIVEN
TRANSIT EXPERIENCE



An advertisement for SEPTA Key. On the left, a stylized orange and grey train is shown on a yellow track against a dark blue background with a city skyline. The text 'SEPTA Key' is prominently displayed in white and orange, with 'THE ONE. THE ONLY.' in teal below it. At the bottom left, the website 'ISEPTAPHILLY.COM/KEY' is shown. On the right, a teal SEPTA Key fare card is displayed, showing a card number, name, and expiration date. Above the card, the text 'WEEKLY PASS', 'MONTHLY PASS', and 'SINGLE FARE' is listed. At the bottom right, there is a small disclaimer: 'SEPTA Key® card is issued by Metabank®, Member FDIC, pursuant to license by MasterCard® International. Mastercard is a registered trademark, and the device design is a trademark of Mastercard International Incorporated.'

- Not Just a Fare Card
- Banking System
- Backend-Based
- Account-Based
- Open Payment Technology

REAL TIME VEHICLE LOCATION MODEM INSTALL UNDERWAY

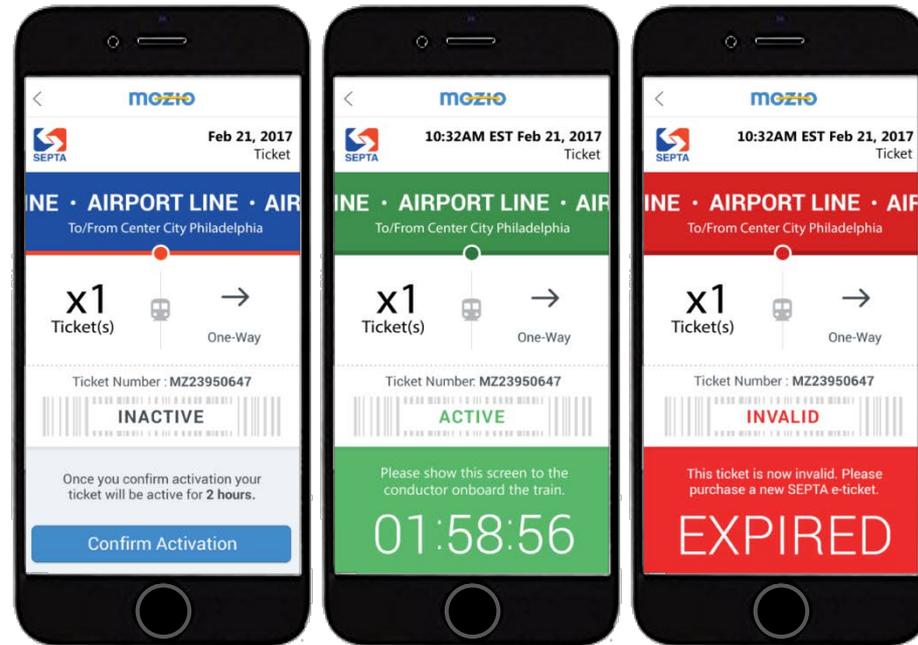




- Prerequisite Infrastructure for the Emerging Transportation Era
- Information Infrastructure
- SEPTA as an Information Company
- Transit as the Backbone of A Multimodal Ecosystem



- Test New Markets and Test Mobile Payment Methods on Transit
- SEPTA Airport Line
- April 3 – Sept 30
- Purchase Tickets Before You Even Land at PHL
- Fully Mobile, Dynamic Tickets
- Mozio is the Ground Transport Engine for Booking.com, Kayak.com, and others
- Business & Leisure Travelers Unfamiliar with PHL



- Big Data as a Civic Resource
 - SEPTA opens data and the Tech community creates tools
- **www3.septa.org**
- Information as Infrastructure
 - Multimodality will increasingly rely on
 - Information Availability to Customers
 - Information Integration with Providers
 - Travel data will help optimize
 - Transportation and City Planning
 - Investments in Physical Infrastructure



“To be livable, cities must have an efficient and attractive transit system.”

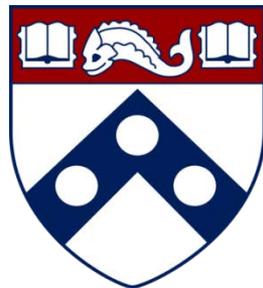
- Vukan Vuchic, Emeritus UPS Foundation Professor of Systems Engineering, School of Engineering, Professor of City and Regional Planning, University of Pennsylvania



Cities, automation, and the self-driving elephant in the room

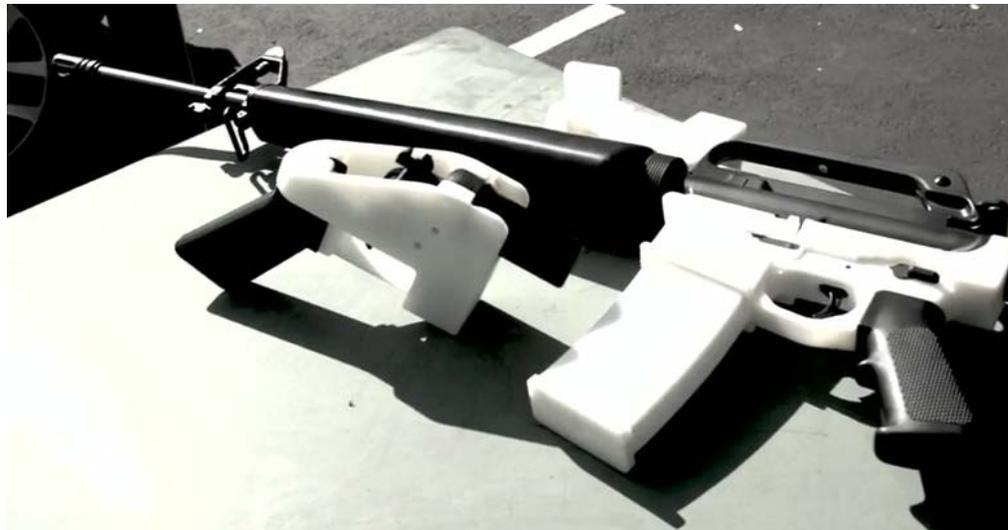
Philly Tech Week
May, 2017

Erick Guerra
Assistant Professor of City & Regional Planning



Penn
UNIVERSITY *of* PENNSYLVANIA

A World of Rapid Technological Change



New Technologies and Transportation



The Self-Driving Elephant in the Room



Rapidly Improving Autonomous Vehicle Technology

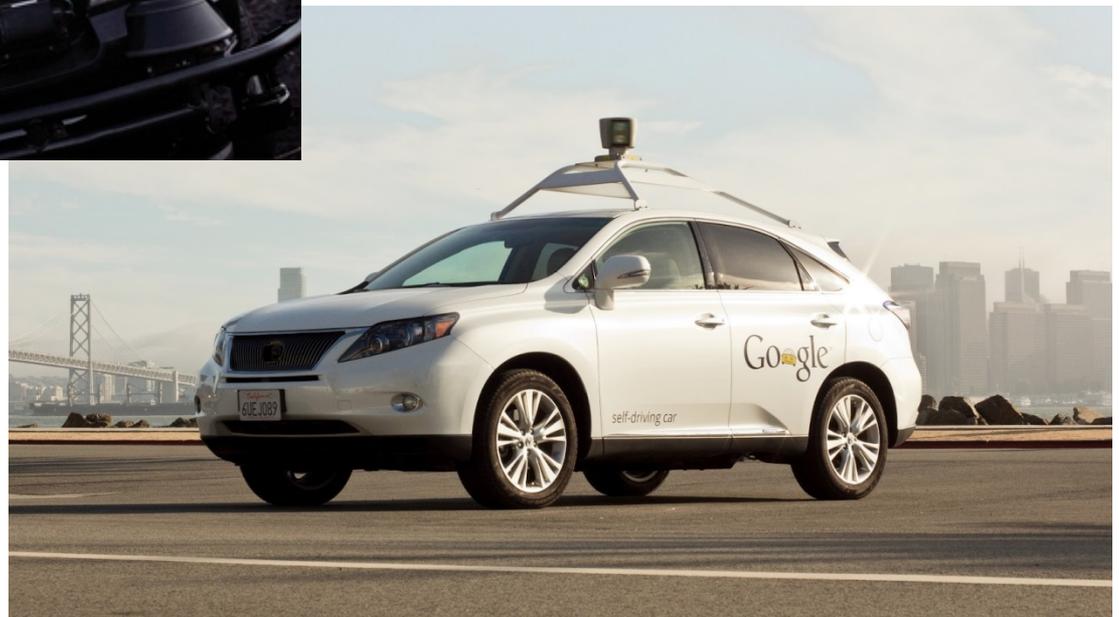
2004: No teams' autonomous vehicles completed DARPA's 150-mile challenge

2005: Six teams completed the challenge (including teams from Stanford, CMU, UPenn, and MIT)

Closed course, no lights, no pedestrians, good weather, daytime hours



Existing Prototypes



Market Ready in 2020?



Two Big Planning Questions

- 1) How will automated vehicle technologies change cities?
- 2) How should an uncertain but potentially transformative technology influence today's planning, policy, and investment decisions?

Autonomous Vehicles and the City

- Primary (non-behavioral) impacts
- Two future scenarios and their likelihood
- Planning for automated vehicles
- Parking and parking policy

Road Safety

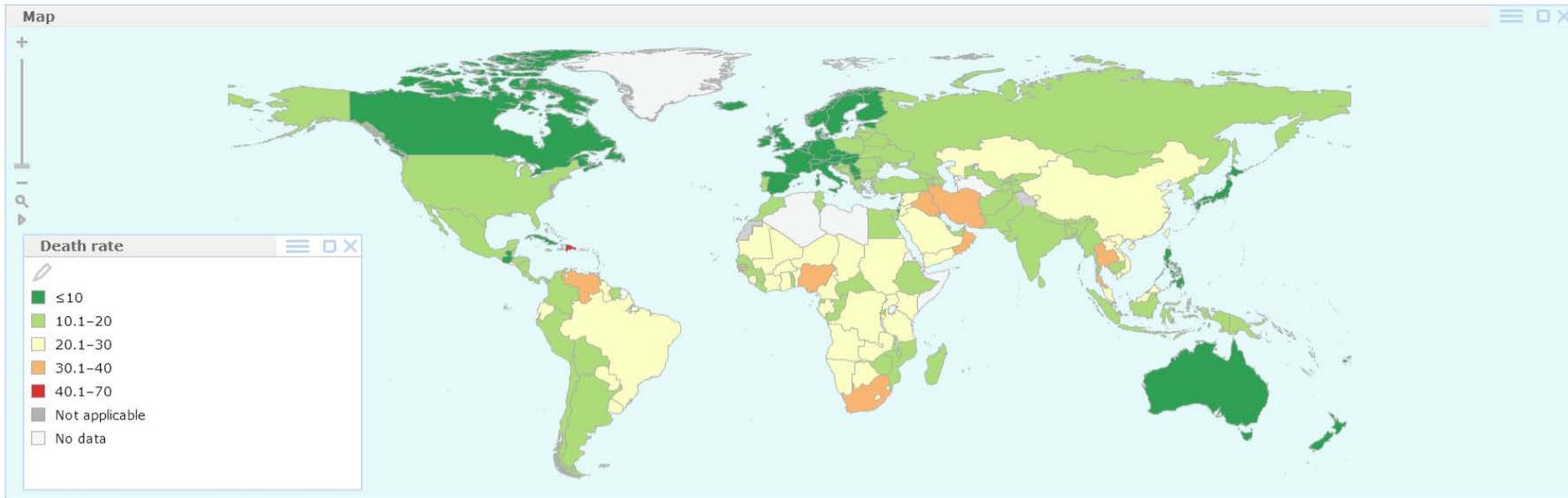
- 1.25 million fatalities per year (number one killer for 15 – 29 year olds)
- Affects poor countries and poor urban residents disproportionately



Road Safety

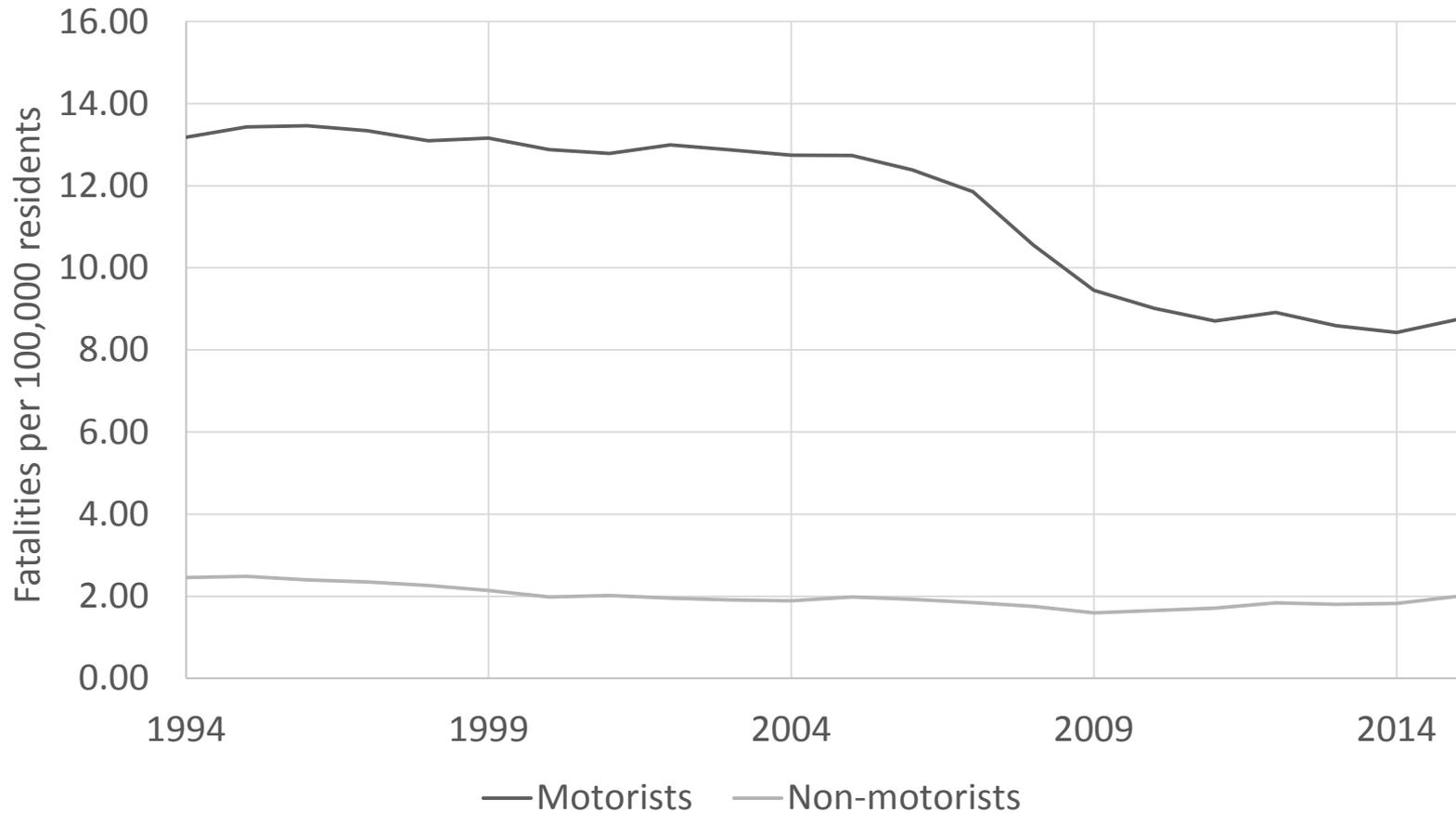
Estimated road traffic death rate (per 100 000 population), 2010

Filter by WHO region or by income level



Road Safety

- Technology has improved in-vehicle safety thus far



Road Safety



- Autonomous are likely to be conservative, law-abiding, and polite drivers.
- This will likely make walking more pleasant and safer.
- More confident and comfortable pedestrians



Road Capacity

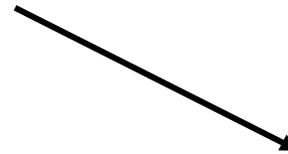
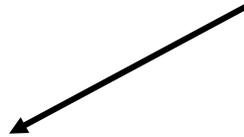


Two Scenarios for Impacts on Travel Behavior and Urban Form

Testing and partial automation (5 to 20 years)



Full automation (no driver needed)



(A) Increased personal mobility

(B) Shared urban mobility



Which scenario do you think is "better"?

Increased
personal
mobility

Shared
urban
mobility

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Scenario 1: Increased Personal Mobility

- Increased car ownership and VMT,
- Mostly privately owned,
- Zero-occupancy vehicles (picking up, dropping off, parking, etc.),
- Continued trend of increased long-duration commutes.



Reduced Travel Costs Lead to More Travel

Summary of MPO estimates (Guerra, 2016)

Region	In vehicle time costs	Road Capacity	VMT change	Key assumptions
Atlanta	Same as car	+50%	+3.6%	
	50% of car	+50%	+12.7%	
	50% of car	+50%	+23.8%	Reduced operating costs
	50% of car	+50%	+23.9%	Reduced operating costs and free parking
San Francisco	Same as car	+100%	+2%	All scenarios: driver present, though interventions rare; no intercity travel; same car-ownership levels and urban form
	High quality rail	+10% to +100%	+4% to +5.2%	
	Half of car	+10% to +100%	+6.7% to +7.9%	
	Zero	+0% to +100%	+13.2% to +14.5%	
Seattle	Same as car	+30%	+3.6%	
	65% of car	+30%	+5.0%	Owned by high income households only
	65% of car	+30%	+19.6%	50% parking cost reduction
	+0%	+0%	-34.5%	No car ownership. Cost is \$1.65 per mile.

Extending Personal Mobility



Video link: <https://www.youtube.com/watch?v=cdgQpa1pUUE>

Nationally 9% of households don't own cars.
And 33% of people do not have licenses.

Scenario 2: Shared Urban Mobility

- Shared point-to-point mobility,
- Limited car ownership,
- Reduced on-street and off-street parking,
- Increased density and urbanity.



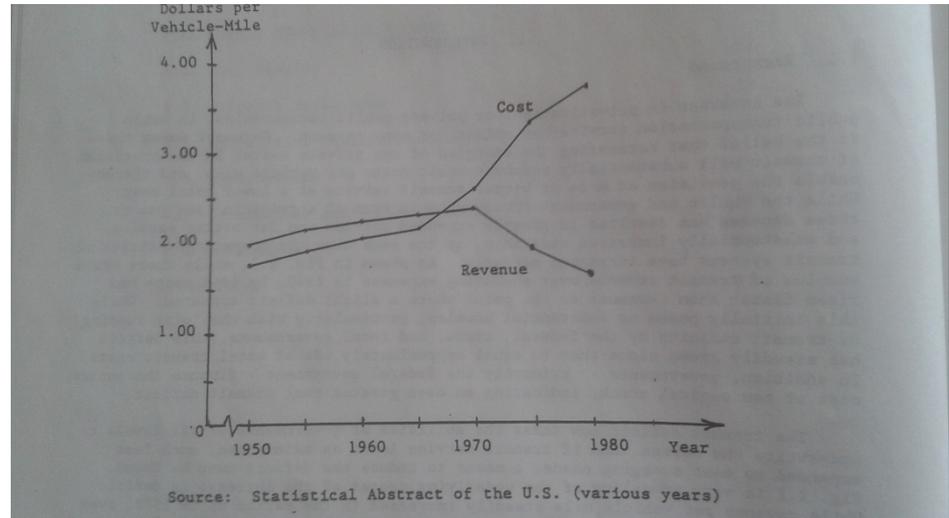
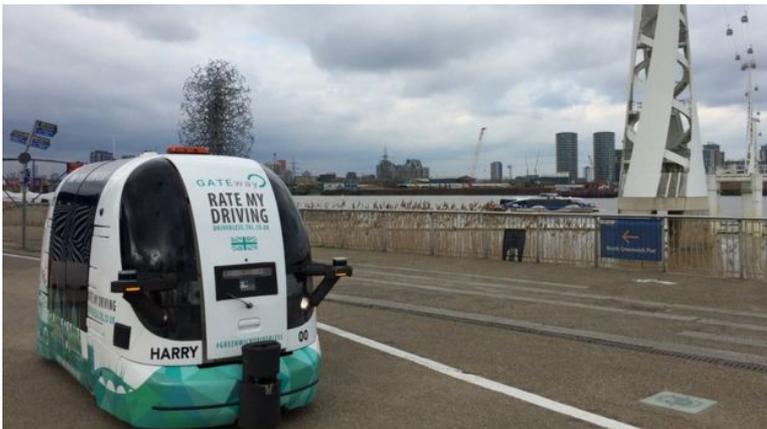
Automated Transit



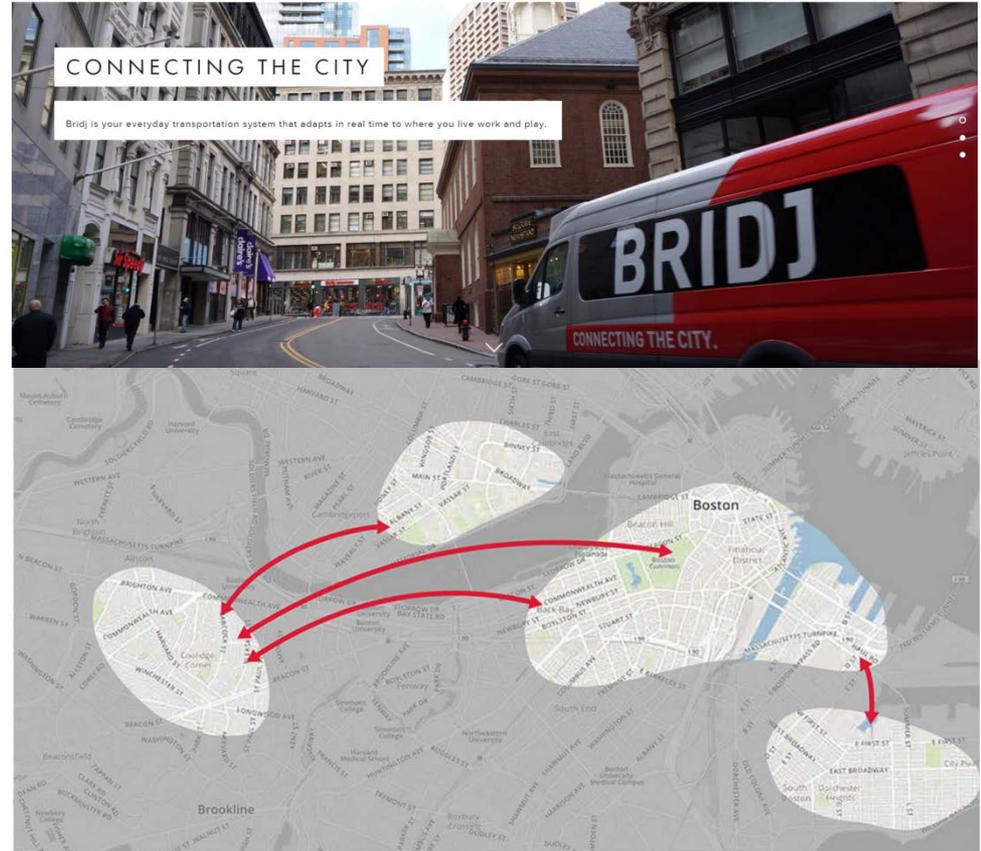
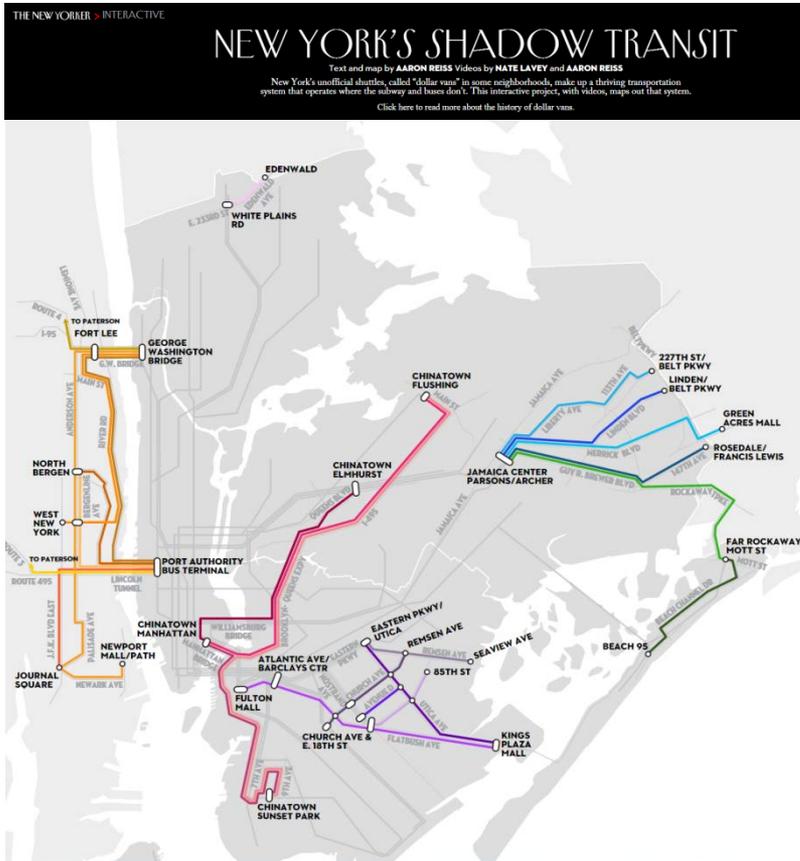
Line 14 in Paris

Private Automated Transit

- Lower operating costs
- Allow for smaller more flexible vehicles
- More frequent service
- If profitable, private reentry



Private Automated Transit



On Bridj you can travel between the connected zones, inbound in the morning and outbound in the evening. When requesting a trip you'll receive directions to your pick-up and drop-off spots.

Which Scenario is More Likely?

Uncertain but likely a mixture of both and a range of outcomes

Preferences Will Matter

Which AV would you choose?

	Shared minibus (A)	Taxi (B)	Shared taxi (C)
Price	\$2.00	\$6.00	\$4.00
Total Travel Time	35m	20m	30m
Walk time	5m	-	-
Wait time (transfer)	5m	-	-
Wait time (home)	-	5m	5m
Wait time (other passenger)	-	-	5m

What other considerations matter?

Of the three options would you prefer to use to get to
this afternoon's event?

Shared
Minibus

Taxi

Shared Taxi

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Geography Will Matter

Features of cities and neighborhoods where each scenario is more likely

	Shared Urban Mobility	Increased Personal Mobility
Density	Medium to high	Low to medium
Transit service	Good	Poor
Land values	High and centralized	Moderate and dispersed
Rent gradient	Steep	Flat
Car ownership	Moderate	High
Parking	Priced or permitted	Free and ubiquitous

Services and Pricing Will Matter



VS.

uberX

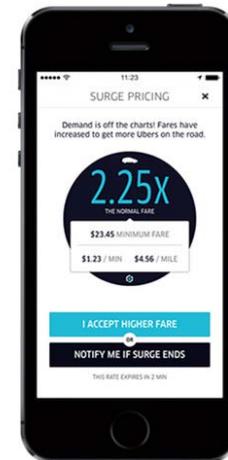
\$12 MIN FARE	+	\$5 BASE FARE	+	\$0.30 PER MIN	+	\$2.70 PER MILE	SEATS UP TO 4 \$10 CANCELLATION FEE
A \$1 safe ride fee will also be included in your fare. For info on this fee, visit blog.uber.com/saferides							

UberBLACK

\$20 MIN FARE	+	\$10 BASE FARE	+	\$0.55 PER MIN	+	\$4.70 PER MILE	SEATS UP TO 4 \$10 CANCELLATION FEE
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UberSUV

\$30 MIN FARE	+	\$15 BASE FARE	+	\$0.80 PER MIN	+	\$6.00 PER MILE	SEATS UP TO 6 \$10 CANCELLATION FEE
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How Should We Plan for Tomorrow's Automated Vehicles?

- Powers are diffuse and agencies have limited mandates

Government level	Primary AV roles
Federal	<ul style="list-style-type: none">• Set standards• Fund research
State/Regional	<ul style="list-style-type: none">• Allocate large public investments• Regulate rules of the road• Manage testing• Manage highways
Local	<ul style="list-style-type: none">• Regulate land use• Manage local roads

How Should We Plan for Tomorrow's Automated Vehicles?

- Widespread disagreement on impacts, timing, and desired outcomes
- The technology is being driven by the private sector and technology and car companies have a big stake
- Already starting to have an influence on policy making

“I absolutely believe that technology is going to transform mass transit in a way that very few people can see ... It'll definitely be within 15 or 20 years, which is right when the light rail system for Greenlight Pinellas would be coming online.”

-Florida State Senator Jeff Brandes (R) arguing against St. Petersburg regional transit plan. (Quoted from [Fortune article](#) by David Morris, November 2, 2014)

Which scenario do you think is "better"?

Increased
personal
mobility

Shared
urban
mobility

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Assertion 1. One scenario is Better than the Other

	Shared mobility	Personal mobility
Benefits	<ul style="list-style-type: none">• Increased mobility• Increased safety• Increased road capacity• More valuable in-vehicle time• Improved transit• Reduced land consumption	<ul style="list-style-type: none">• Increased mobility• Increased safety• Increased road capacity• More valuable in-vehicle time
Costs		<ul style="list-style-type: none">• Increased VMT• Increased land consumption• Increased pollution• Increased segregation• Increased roadway required

Assertion 2. There Will Be Time to Adjust Policy

Despite rapid advances, changes will not happen over night (as with smart phones).

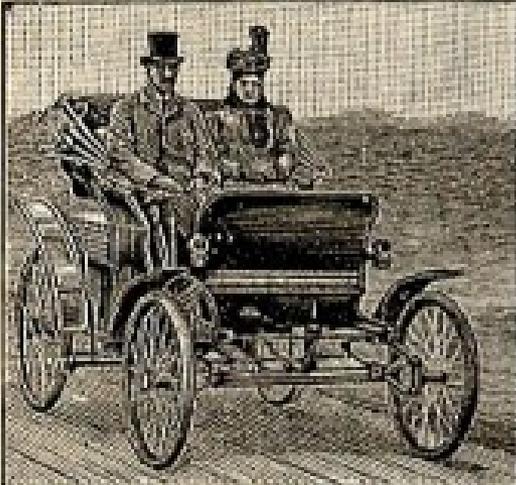
- Impacts uncertain
- Technological and regulatory hurdles remain
- Vehicle fleet takes years to turn over (average personal vehicle is 11 years old)

Likely first movers:

- Taxi, freight, and transit industries
- The mobile office crowd
- Regions building new highway capacity (like HOV or HOT lanes, but for AVs)
- Closed facilities like retirement communities, tech campuses, and airports

Assertion 3: Beware the Rosy Future

DISPENSE WITH A HORSE



and save the expense, care and anxiety of keeping it. To run a motor carriage costs about $\frac{1}{2}$ cent a mile.

**THE WINTON
MOTOR
CARRIAGE**

is the best vehicle of its kind that is made. It is handsomely, strongly and yet lightly constructed and elegantly finished. Easily managed. Speed from 3 to 20 miles an hour. The hydrocarbon motor is simple and powerful. No odor, no vibration. Suspension Wire Wheels. Pneumatic Tires. Ball Bearings. *Send for Catalogue.*

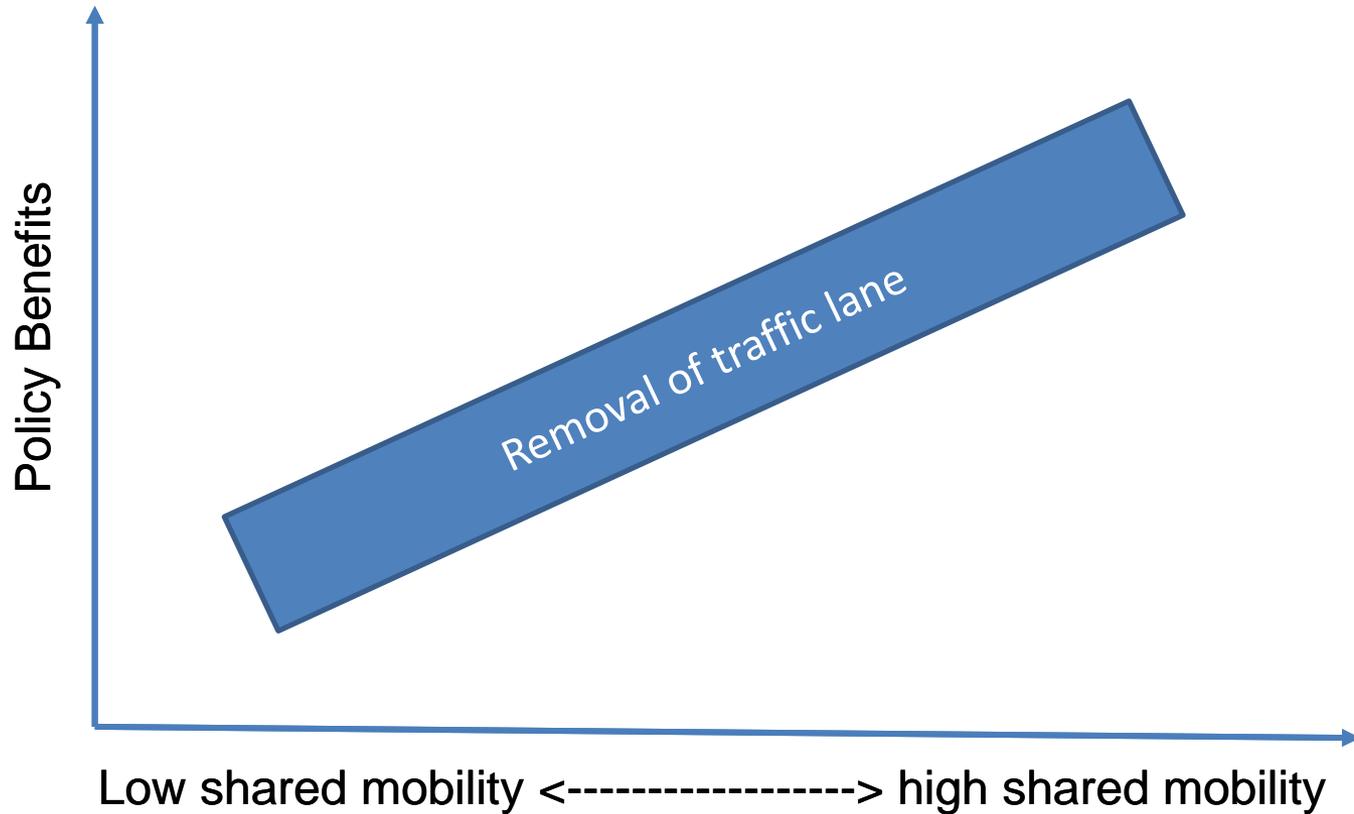
Price \$1,000. No Agents.

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

A short sample of questionable assumptions:

- Shared mobility is inevitable
- Pollution and GHG will decrease
- Congestion will decrease

Assertion 4: Consider Both Scenarios



Assertion 5: Focus on What Already Makes Sense

Example: Widen suburban freeway

AV argument:

- AVs likely to increase road capacity, especially on freeways.

Other arguments:

- Expensive and unlikely to reduce congestion.
- Locally desired, but regionally unwanted.
- Induced demand.

The Self-Parking Elephant in the Room



Parking Policy Matters

Total cost of all parking in the United States is higher than the total value of the private car fleet (Shoup 2005)

Increases lifecycle emissions by 25% to 90% for many local pollutants and greenhouse gases (Chester et al. 2010)

Consumes between 8,000 and 17,000 square miles of land nationally (Chester et al. 2010). All of New Jersey is 7,500 square miles.

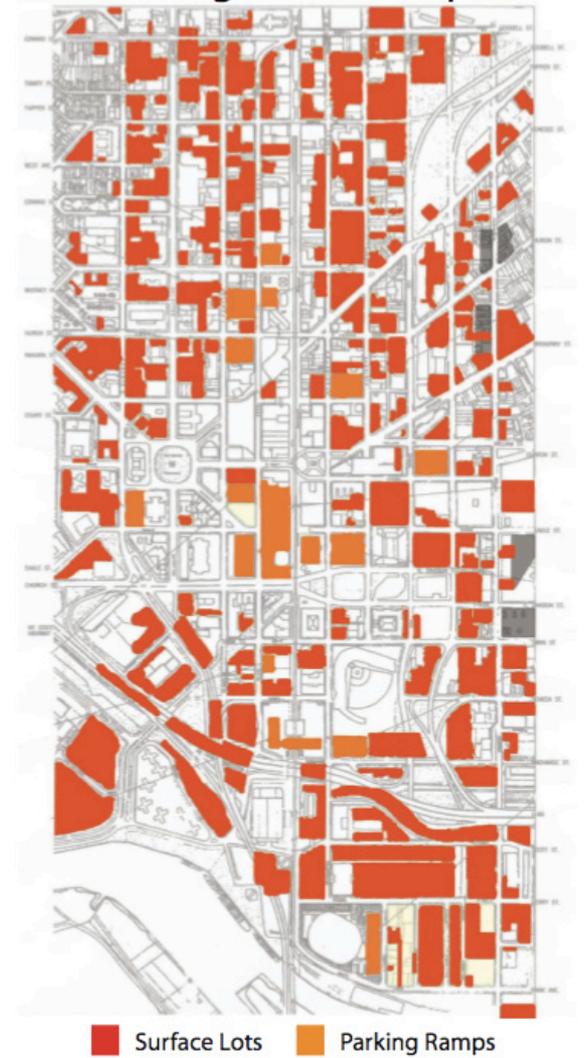
“[P]arking influences the way cities look, and how people travel around them, more powerfully than almost anything else.”

- The Economist

Parking Policy Matters



Downtown Buffalo
Parking Lots & Ramps



Parking will change under either scenario

Redevelopment / expansions of properties where parking is a regulatory or market constraint



Parking will change under either scenario

Commercial on-street



Parking will change under either scenario

Commercial on-street



Parking will change under either scenario

Residential on-street



Parking will change under either scenario

Residential off-street



Local planners control parking

A sample of local off-street requirements

Barber shop	2 spaces per barber
Beauty shop	3 spaces per beautician
Nunnery	1 space per 10 nuns
Rectory	3 spaces per 4 clergymen
Sex novelty shop	3 spaces per 1,000 square feet
Gas station	1.5 spaces per fuel nozzle
Swimming pool	1 space per 2,500 gallons
Mausoleum	10 spaces per maximum number of interments in a one-hour period

Strong Argument to Reform Now



The High Cost of Free Parking

DONALD SHOUP

Two parking policy mistakes

1. Require lots of off-street parking spaces
2. Keep curb parking free or cheap

Result in “Great Planning Disaster”

- Distorted urban form
- Degraded urban design
- Higher housing costs
- Limits on homeownership
- Difficulty in reusing buildings
- Damage to the urban economy
- Harm to the central business district
- More driving and pollution
- Higher prices of goods and services
- Lower wages

Thank You

erickg@upenn.edu



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