



The background features a dark blue field with several interlocking gears in a lighter blue and teal color. A large, thin blue arc is positioned on the right side of the slide, partially overlapping the gears.

# Psychology of the Automatic Transmission

PSY 255 / CIV 255  
Harris Yong

# Purpose of the AT

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- Eliminate gear shifting
  - Gear shifting is the most difficult task to master
- First automatic transmission in 1937
- In 1967: “This type of [automatic] transmission cannot take the place of a good driver, because it cannot think for itself...” (Kantowitz)

# Some complaints of the AT

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- Less control
- More difficult to engine brake
- “Never” downshifts
- Difficult to hold gear
- Unpredictable on slippery surfaces
- Less smooth than a well-driven manual

# Prevalence of the AT

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- 25% of cars in Europe
- 85% of cars in U.S.A and Japan
- Valued for convenience and ease (especially in stop-and-go traffic)

## "Market Share" of the AT

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- 11 out of 52 nameplates (23%) do not offer MT
- 94 out of 222 models (42%) do not offer MT

# Nameplates without MT

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- AM General
- Bentley
- Buick
- Cadillac
- GM (EV1)
- Jaguar
- Land Rover
- Mercedes Benz
- Oldsmobile
- Range Rover
- Rolls Royce

# Nameplates with MT on all models

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- Callaway (Corvette)
- Daewoo
- Ferrari
- Hyundai
- Kia
- Lamborghini
- Lotus
- Panoz
- Porsche
- Saleen (Mustang)
- Shelby
- Subaru



# Models not offering MT

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Acura  
TL

AM General  
Hummer

Audi  
A6  
A8

Bentley

BMW  
7 Series

Buick  
Century  
LeSabre  
Park Avenue/Ultra  
Regal  
Riviera  
Catera

Cadillac  
Catera  
DeVille  
Eldorado  
Seville

Chevrolet  
Astro  
Lumina  
Malibu  
Monte Carlo  
Suburban  
Tahoe  
Venture

Chrysler  
300M  
Cirrus  
Concorde  
LHS  
Town & Country

Dodge  
Durango  
Intrepid  
Ram Van/Wagon

Ford  
Crown Victoria  
Econoline Van  
Expedition  
Explorer  
Taurus  
Windstar

GM  
EV1

GMC  
Safari  
Savana  
Suburban  
Yukon

Honda  
EV Plus  
Odyssey

Infiniti  
Q45  
QX4

Isuzu  
Oasis  
Trooper  
VehiCROSS

Jaguar  
XJ  
XK8

Land Rover  
Discovery

Lexus  
ES 300  
GS  
LS 400  
LX 470  
RX 300

Jeep  
Grand Cherokee

Lincoln  
Continental  
Navigator  
Town Car

Mazda  
Millenia  
MPV

Mercedes Benz  
C Class  
CL Class  
CLK  
E Class  
S Class

Mercury  
Grand Marquis  
Mountaineer  
Sable  
Villager

Mitsubishi  
Diamante

Nissan  
Quest

Oldsmobile  
Alero  
Aurora  
Bravada  
Cutlass  
Eighty-Eight  
Intrigue  
LHS  
Silhouette

Plymouth  
Powerler  
Voyager

Pontiac  
Bonneville  
Grand Prix  
Montana

Range Rover  
4.0 SE  
4.6 HSE

Rolls Royce

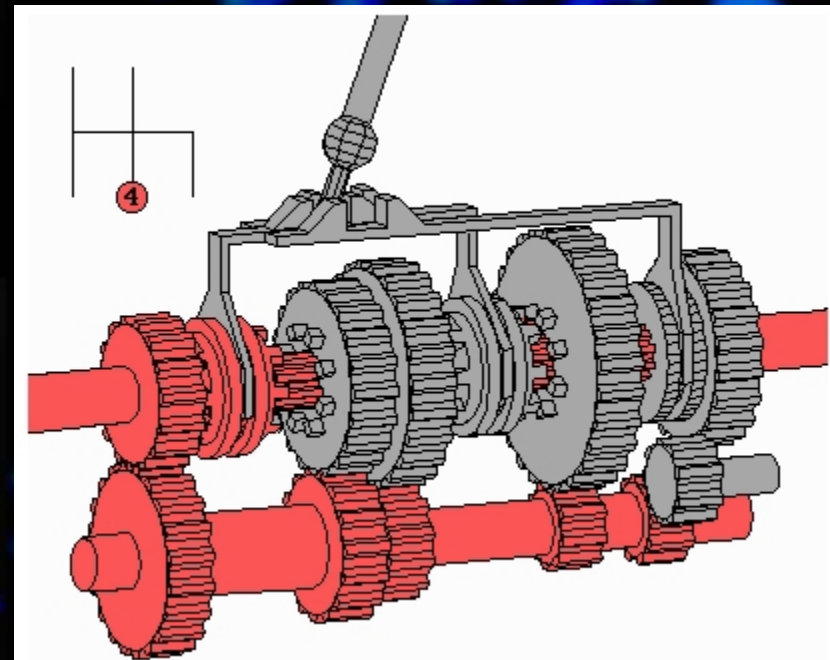
Toyota  
Avalon  
Land Cruiser  
Sienna

Volkswagen  
Euro Van

# Manual transmission design

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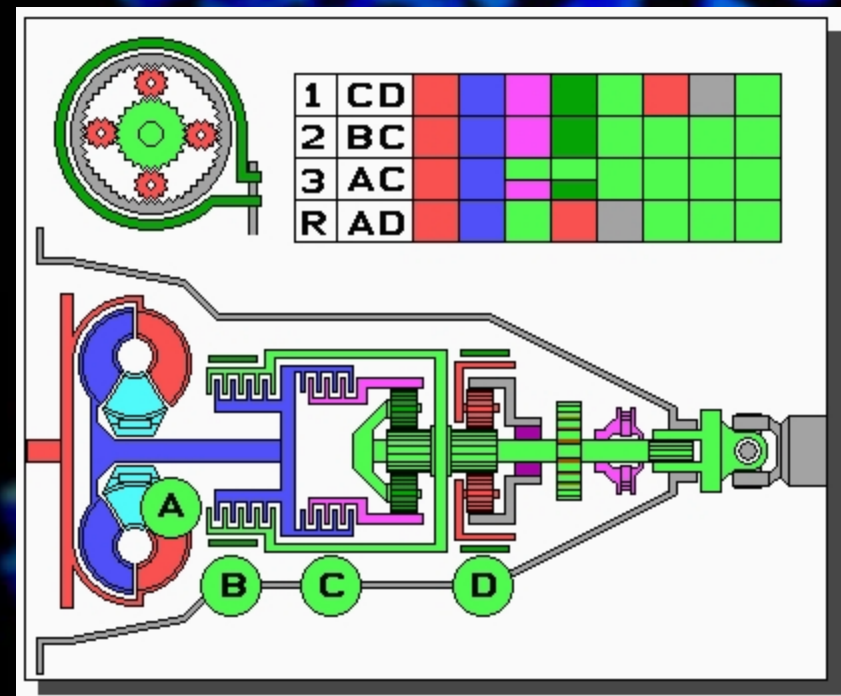
- Foot pedal clutch and gears actuated by a shift lever



# Automatic transmission design

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- Fluid torque converter replaces clutch
- Electro-hydraulic-computer controlled planetary (epicyclic) gearset



# The AT decision process

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- Mechanical hydraulic control system
  - Balance of 2 fluid pressures (speed and demand)
- Information based on accelerator pedal position and vehicle speed
- Vehicle dynamics (accelerometer)
- Adaptive/learning systems

- Continuous input parameters to discrete (3, 4 or 5) output gears
  - Too few gears -- hard to optimize for performance or efficiency
  - Too many gears -- “hunting” among gears to choose appropriate gear
- Difficult to predict fluid pressures for smooth shift
  - Mechanical finesse

# Conflicting goals

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- Economy and efficiency
- Control and driver command
- Convenience
  - Most buy AT because of convenience

# The AT's multiple personality

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- Voluntary Vs. involuntary mind
- Involuntary: mechanical limits, efficiency, smoothness, inconspicuous
- Voluntary: driver command (such as downshift, holding gear selection, etc.)

- Wide range of driving style puts the AT at a disadvantage
- “...whereas a good driver can see the road ahead and can anticipate what action to take at the right time.”
- Can we make the AT have road-sensing ESP?



- Limited number of driver inputs:
  - accelerator pedal
  - gear “selector”/limiter
  - brake pedal (new)
- Frequently misreads:
  - lift throttle commands

# Economy and efficiency

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- Small differences in efficiency are important
- MT: 96.3%
- AT: 85.3%
  - improving significantly
  - easier to meet emissions control

- Limited interface
- Increase driver command by offering more channels of communication

- AT with manual control
  - BMW Steptronic (lever)
  - Chrysler Autostick (lever)
  - Honda/Acura (steering buttons or lever)
  - Lexus (steering paddles)
  - Mercedes Benz Touch-Control (lever)
  - Porsche/Audi Tiptronic (lever/steering buttons)
  - Vector (lever)

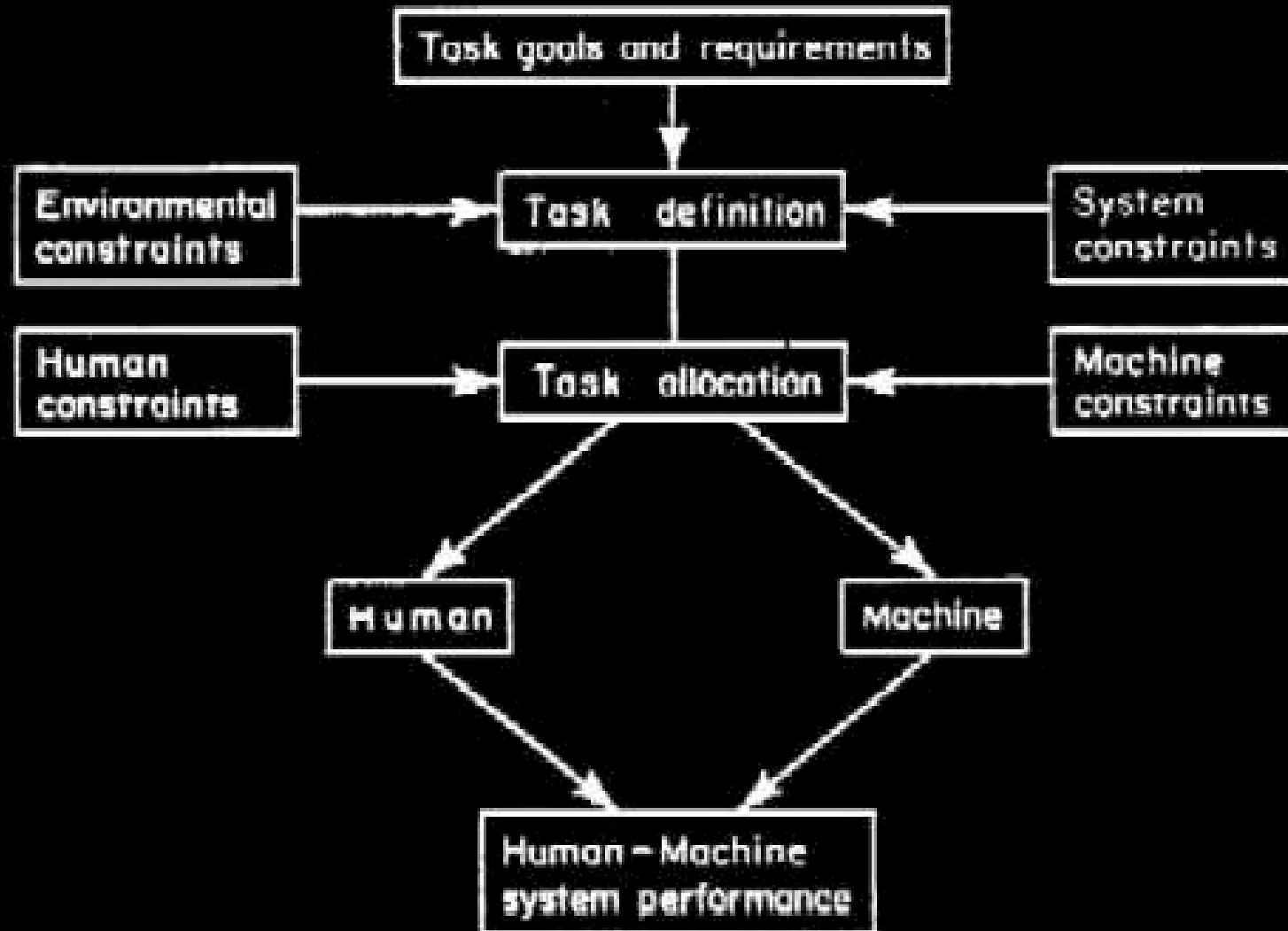
- MT with automatic control (borrowed from racing)
  - Electronics replace clutch pedal
  - Saab Sensonic (not available in the U.S.A.)
  - BMW Sequential M (not available in the U.S.A.)
  - Ferrari F1
    - Offers higher efficiency and control
- Reliability and consistency (new technology)

- Optimized engine for all loads and speeds
- Continuously Variable Transmission
  - no discrete gear ratios or gear selection
- Automated manual transmissions
- Adaptive systems

- Accounts for changes in internal mechanical conditions and driver characteristics
- Requires
  - Internal model of the system
  - Feedback
  - Time-action history

# Adaptive system flowchart

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- A perfect automatic transmission?
  - Difficult to meet conflicting goals
  - Dual personality
- Increase interface
- Adaptive systems
- Neural network training
- Knowledge of mechanics

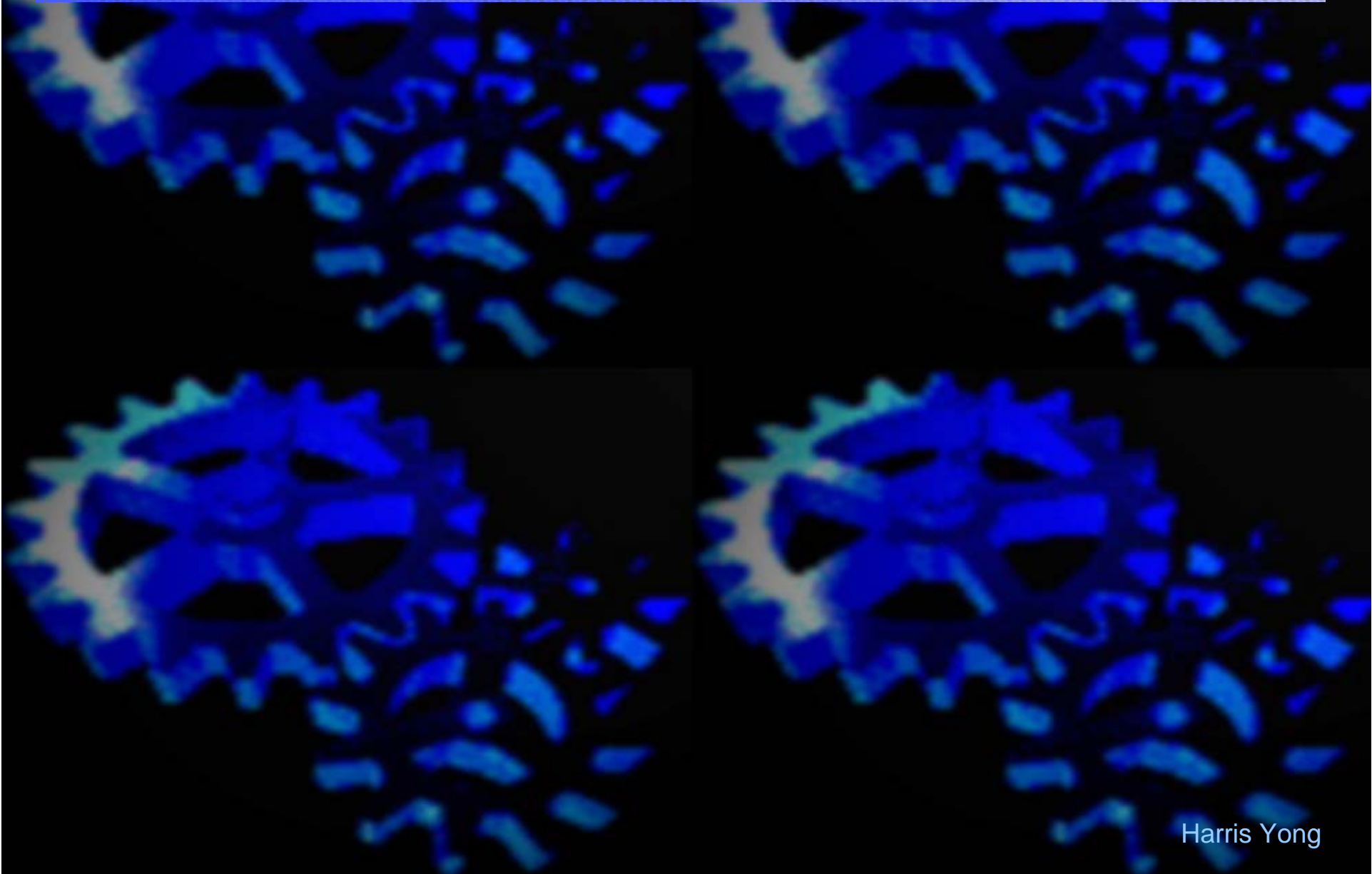
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# Questions?

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