



Engineering a Roadmap for Successful Development and Adoption of New Science and Technologies

Michele J Grimm, PhD

Wielenga Creative Engineering
Endowed Professor

Michigan State University



Future Back Vision of Healthy Longevity



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Role of Technological and Scientific Advances

Societal

Infrastructure
Communication



Point-of-Care

Diagnosis
Treatment
Preventive activities



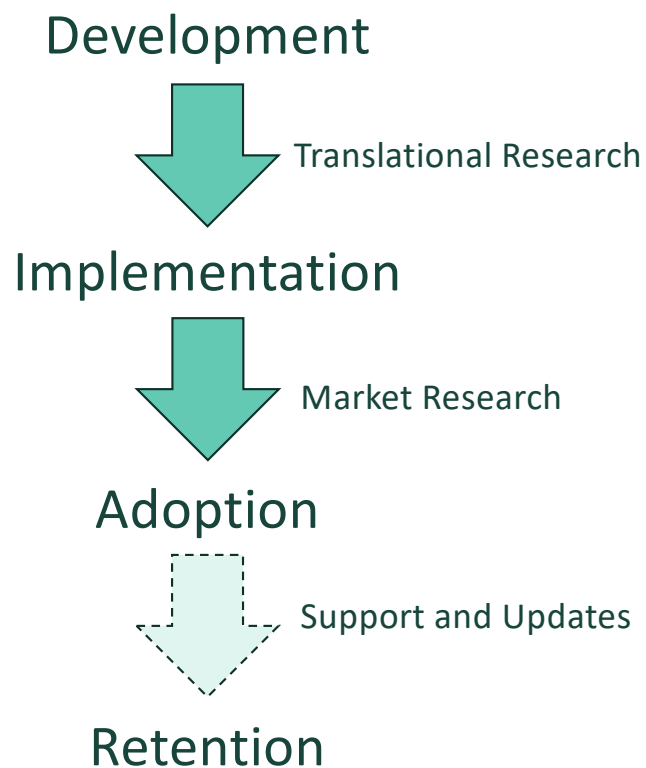
Individual

Communication
IADLs
Preventive activities
Enjoyment

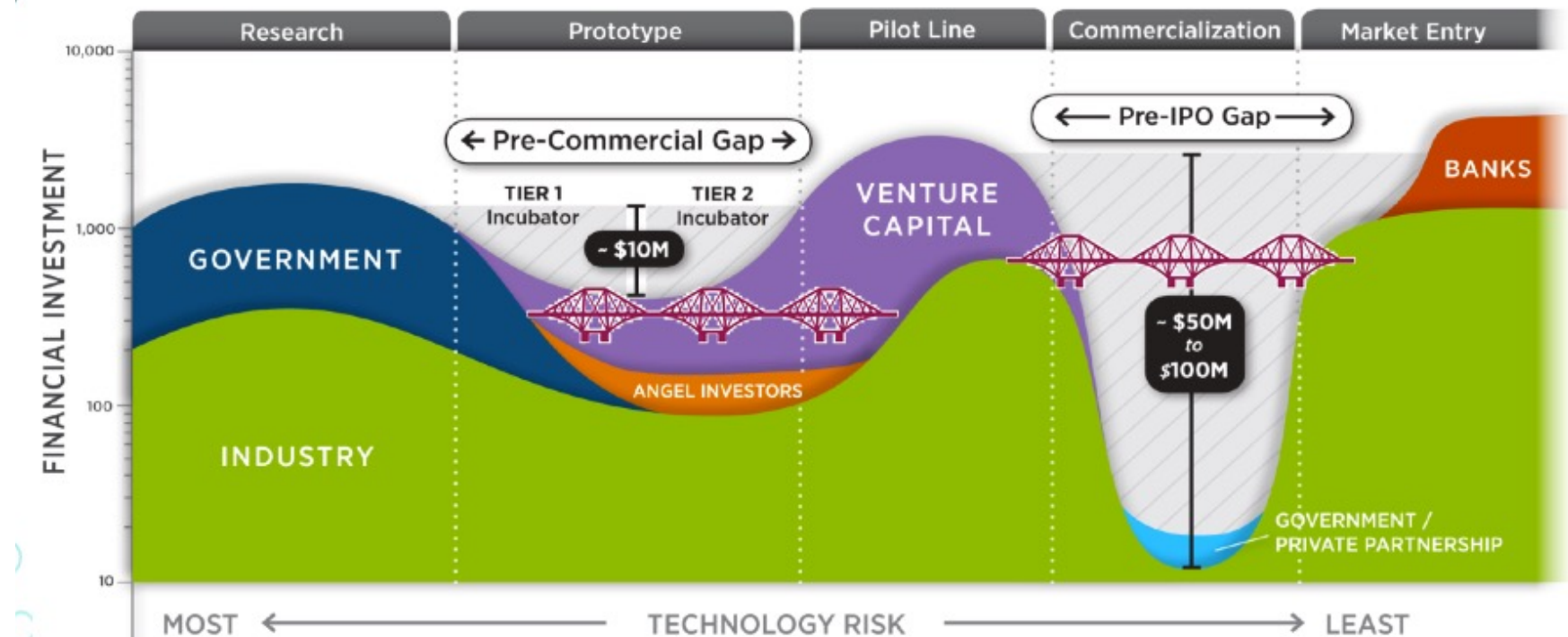


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Role of Technological and Scientific Advances



Adoption of Technological and Scientific Advances



<https://www.stateofmatter.co.uk/>

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Case Studies – Technology Adoption

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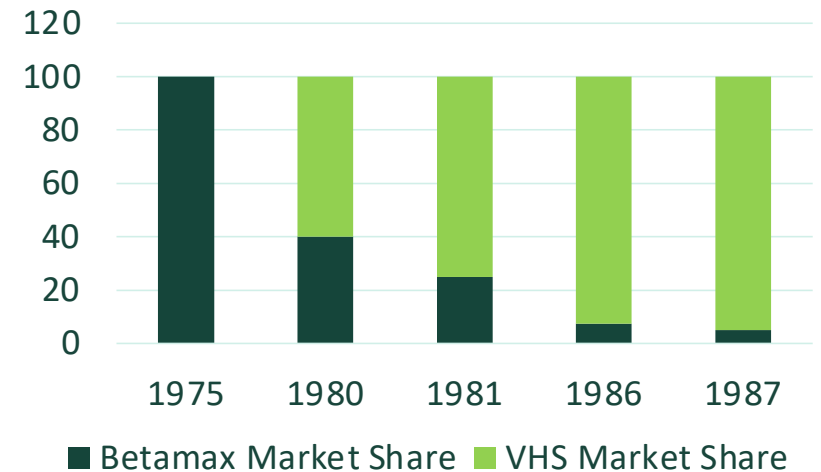


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Beta vs VHS

- 1971 – Sony U-Matic video recorder
- 1972 – Phillips N1500
- 1975 – Sony Betamax released
- 1975 – JVC opts to pursue new format rather than licensing Betamax
- 1977 – Video Home System (VHS) introduced by JVC

Decline of Betamax



<https://medium.com/swlh/vhs-vs-beta-the-story-of-the-original-format-war-a5fd84668748>

Beta vs VHS

- Beta

- Hand sized

- 60 minutes

- Limited recording space

- Higher resolution

Could not record a football game

- VHS

- Shared standard (initiated by JVC) – manufacturing competition

- Lower prices for VCRs

- 120 minutes of recording – extended to 6 hours under SLP



Medical Device - Flop



- Microsoft Health Vault
 - Introduced in 2007
 - Cloud-based storage of personal health and medical information
 - Focus on traditional health records from providers
 - Low adoption rate – terminated in 2019
 - Poor integration with wearables
 - Limited inclusion of patient-entered data
 - Not designed for mobile apps

Medical Device – Success(?)

- Eargo – internal hearing aid
 - Rechargeable
 - Audiologist interaction via telehealth
 - Tuning if necessary
 - No prescription required
 - 45-day trial period
 - New model waterproof
- Company history
 - Founded 2013
 - IPO 2018
- 66% increase in units delivered Q1-20 to Q1-21



www.eargo.com

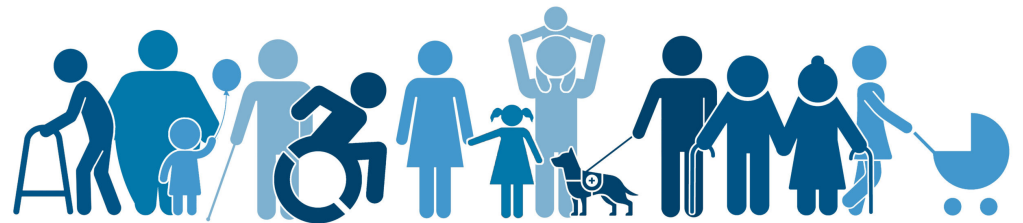
Challenges to Adoption of New Technology

- Provider skepticism
 - Does it work?
 - Will it make my job more difficult or take more time?
 - How will it affect my bottom line?
- User skepticism
 - Is it hard to learn to use?
 - Does it have an unfamiliar interface?
 - Is it better than what I have?
- Infrastructure readiness
 - Does my town/block/building have the needed broadband and Wi-Fi access?
 - Are there policies in place that support me using this?



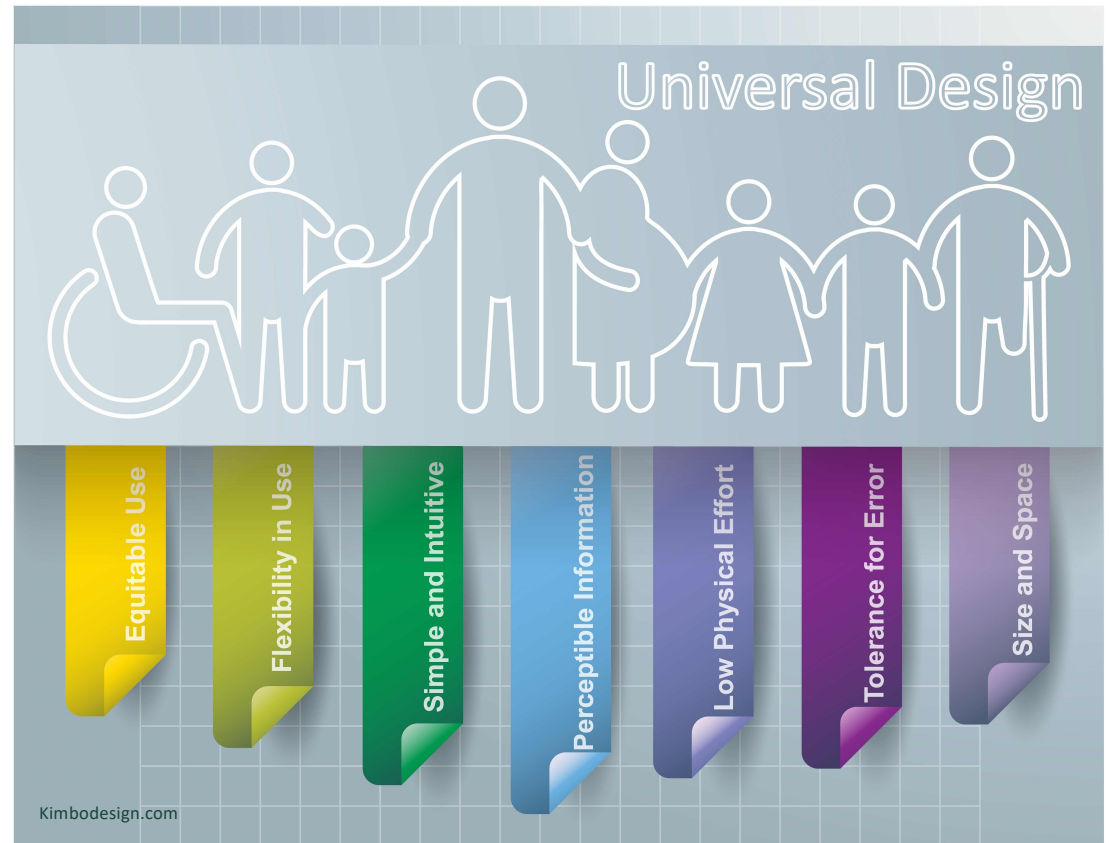
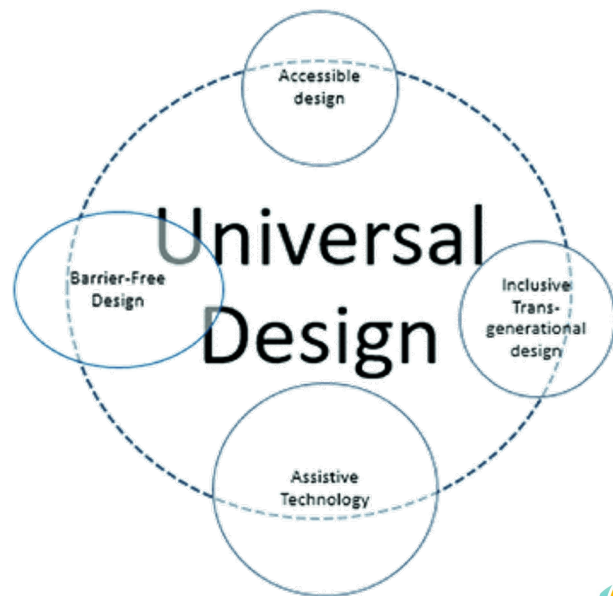
Who are the Intended Users?

- Don't assume that all intended users are the same
- Expected differences due to
 - Demographics
 - Physical abilities
 - Cultural considerations
 - Economic status of individual or country
 - Prior expertise and exposure to technology



Design Framework I – Universal Design

- Universal design – a single design will work for everyone



Aarhaug, Universal Design as a Way of Thinking about Mobility, 2018

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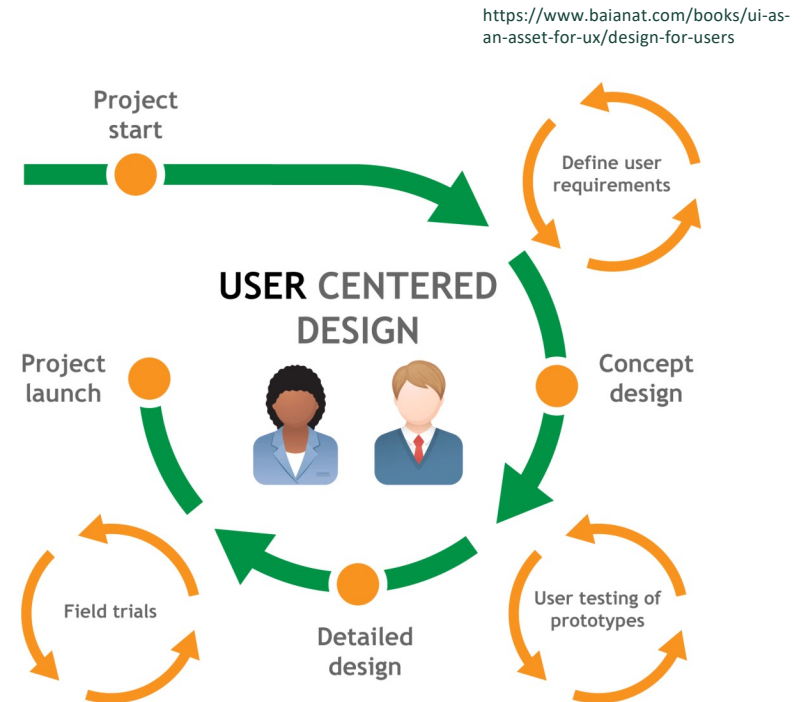
Avoiding the Fate of the Expensive Paperweight

- Cool product
- Works as designed
- Not widely adopted



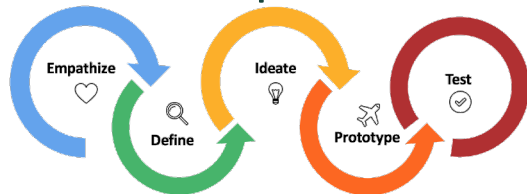
Design Framework II – User Centered Design

- User-centered design
 - Consider the intended user throughout the design process
 - Needs finding
 - Design reviews
 - Prototype validation
- Systems design
 - Consider needed changes in infrastructure and policy
- “Personalization” of devices and systems
 - Adjustable systems that can “grow” with user



Improving User-Centered Design

- Communication with intended users throughout design and implementation process
 - Interviews
 - Focus groups
 - Ethnography and task analysis
- Strive for empathetic design



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Improving User-Centered Design

- True collaboration between scientists, engineers, and social scientists
 - Move beyond a set of silos
 - Learn each others' languages
 - Value all contributions
 - Work together throughout project



Improving User-Centered Design

- Need to integrate societal factors that impact the implementation and adoption
 - Acceptance of innovations
 - Equitable access
 - Ethics
 - Economics
 - Policy



Catalyzing Translation to Support Healthy Longevity



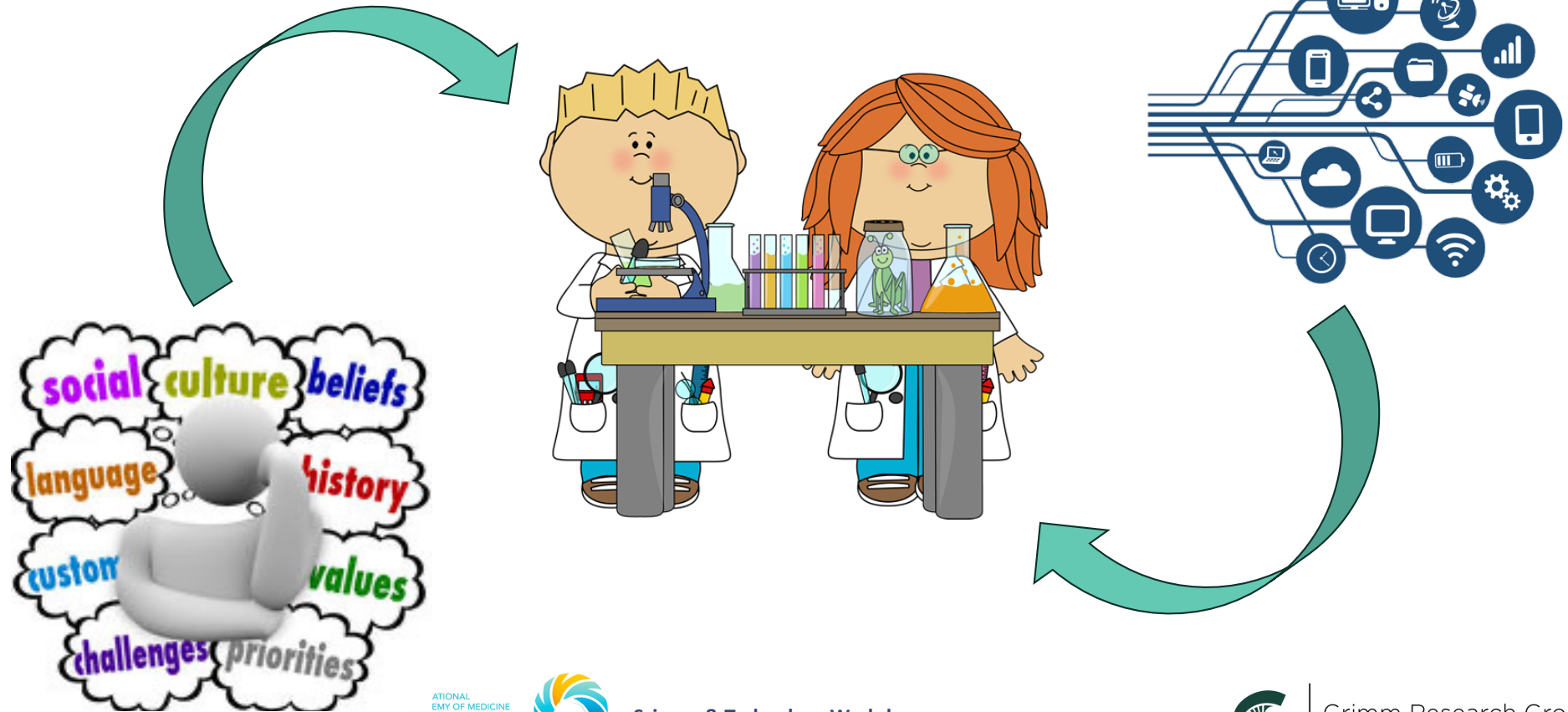
Roadmap to Effective User Centered Design



Limits to Domains of Application?

- Can what we know and do as engineers be applied to the domains of biomedical science and health?
- Engineering has not figured it out
 - Individuals trained in biomedical engineering may be a bit better at maintaining a user-centered focus – but only a bit
- Design process = problem solving
 - Can be applied to all fields of science and medicine

Limits to Domains of Application?



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Supporting the Future of Healthy Longevity



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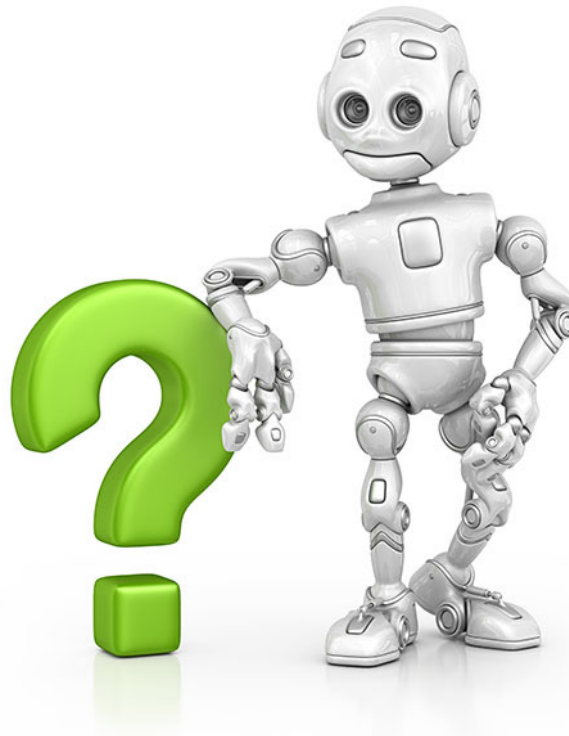


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Questions, Answers, and Discussion



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