Virtual Reality: A User Perspective

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Content

- Background
- Initial study - technology readiness & acceptance
- Development of a framework for training
- Current status / future direction / other developments

Background

- VR & AR Technologies have been hailed as extremely important in meeting the diverse challenges of modern maintenance problems

- Virtual Reality (VR)

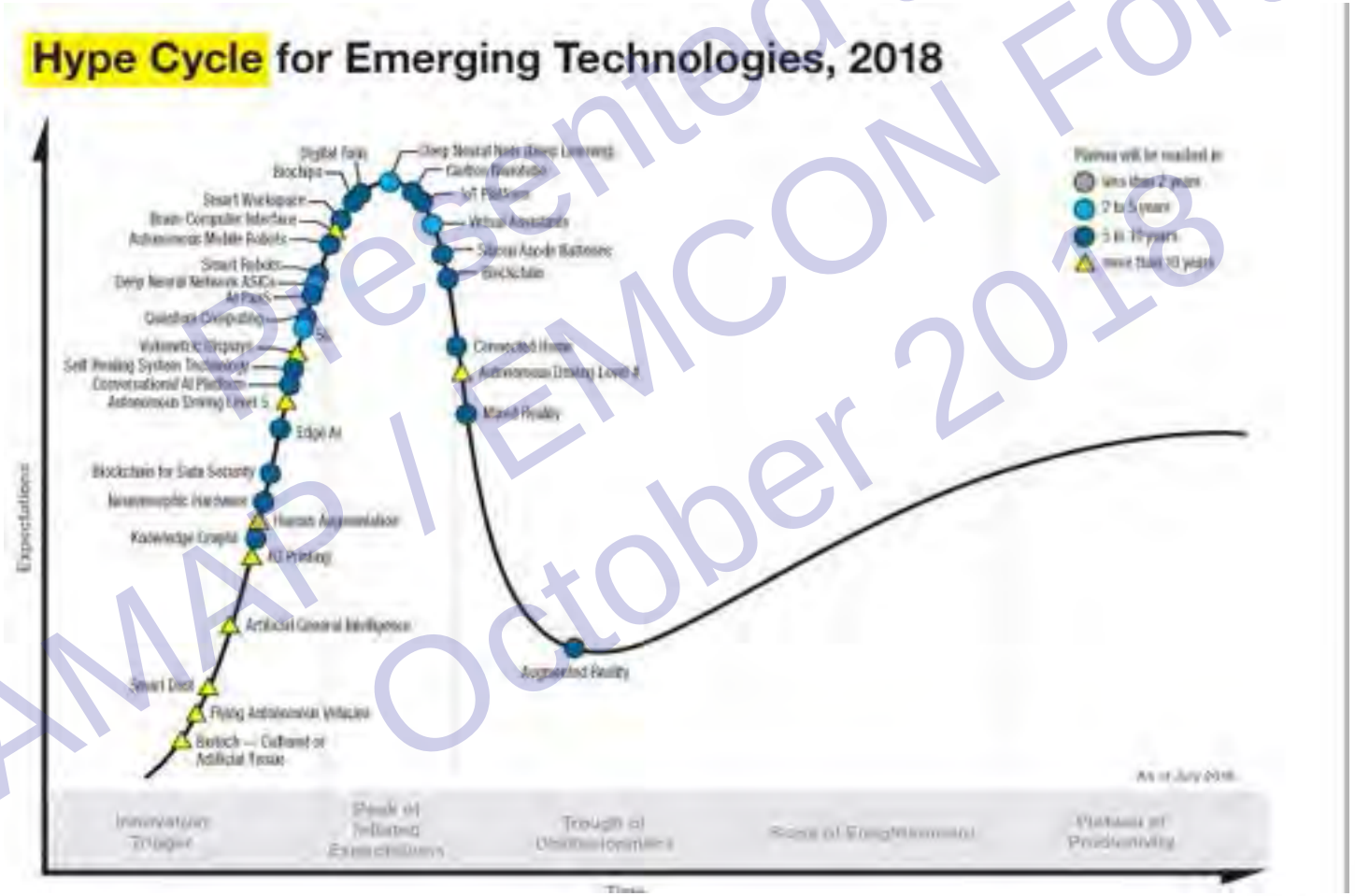
- Augmented Reality (AR)

Applications

Maintenance Training

Performance Support

Gartner Research



Industrial Applications (Examples)

What

- Design/ Development
- Training
  - Assembly
  - Test
  - Maintenance
  - Health & Safety etc.

Who

- Jaguar Land Rover
- Nissan, Ford, SEAT
- Unipres
- AMRC Sheffield

(100+ Industrial Partners)

- Siemens (Varjo/Start-up)
- etc.

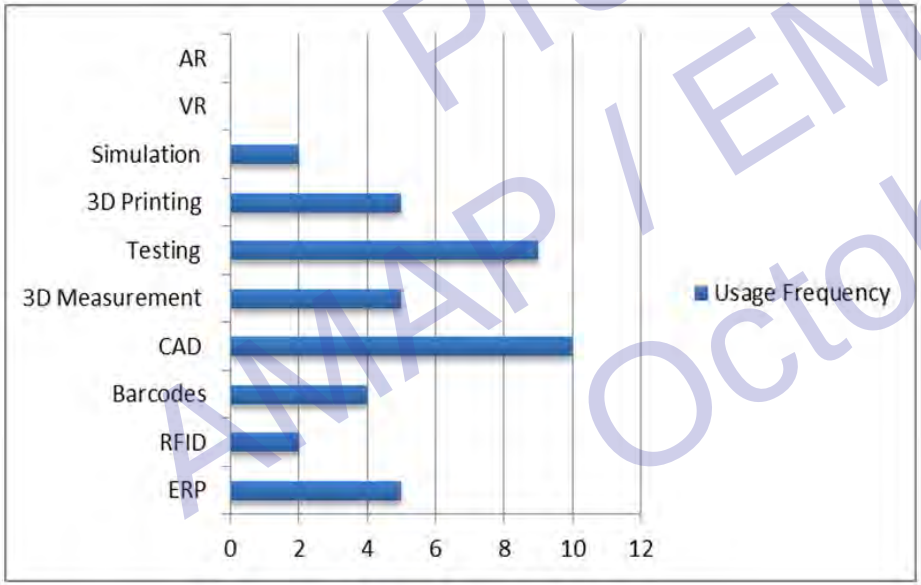
An Investigation of Acceptance and E-Readiness for the Application of Virtual Reality and Augmented Reality Technologies to Maintenance Training in the Manufacturing Industry

Helen Scott, David Baglee, Roger O'Brien, Rita Potts

The Institute for Automotive and Manufacturing Advanced Practice (AMAP), University of Sunderland.

Overview of Results

Current Tools Use



Technology Readiness

- None of the companies interviewed were currently using VR/AR
- Level 1 Technology Readiness Scale (NASA, 1995) basic principles observed

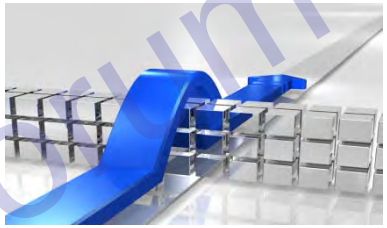
Overview of Results

Perceived Benefits

- Training seen to be the most tangible benefit
- Product development & visualisation
- Perceived as useful for gaining competitive advantage

Applications

Overview of Results



Current Technology Skill Sets

3 - companies indicated that VR/AR would go beyond the skills set of current workers

8 – indicated that some additional training would be needed

All 11– expressed a preference to adopt technology through the training of existing staff

Perceived Barriers

Cost of adoption
- Hardware
- Maintenance infrastructure
- Staff training

(ageing workforce vs younger learners)

Level of reliability & accuracy

'It needs to be simple to use and hard to get wrong'

Cost

VR Intelligence Organisation, 2018 Report claims:

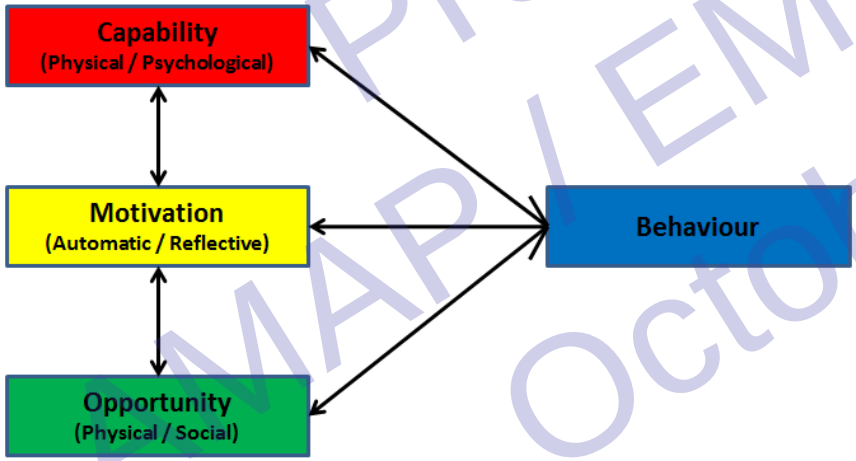
- Renault saves 2 M€ per year by using VR and reduced the conception time of their cars by 20%
- Jaguar Land Rover state that VR helped them save 4 M€ in only 5 weeks
- Lockheed Martin (American Aerospace) save 10 M€ per year by using VR to evaluate designs

Not using VR can cost a lot of money

(Competitive advantage etc.)

Conditions Necessary for Change

Essential Conditions to Change Behaviour



Workforce Demographics

- More than 1 in 10 workers across most industry groups are age 60+
- More than 1 in 5 are over 50

(CIPD Policy Report, 2015)

Diffusion of Innovations (SMEs)

1. Relative Advantage
2. Compatibility with exisiting values/practice
3. Simplicity and ease of use
4. Trialability
5. Observable results
6. Reinvention

‘It needs to be simple to use and hard to get wrong’

(User Design Principles – Neilson/Norman)

1. Visibility of system status
2. Match between system & the real world
3. User control & freedom
4. Error prevention
5. Error recovery
6. Consistency & standards
7. Recognition rather than recall
8. Flexibility & efficiency of use
9. Aesthetic & minimalist design
10. Help & documentation/feedback

A Framework for Training (Age/Experience)

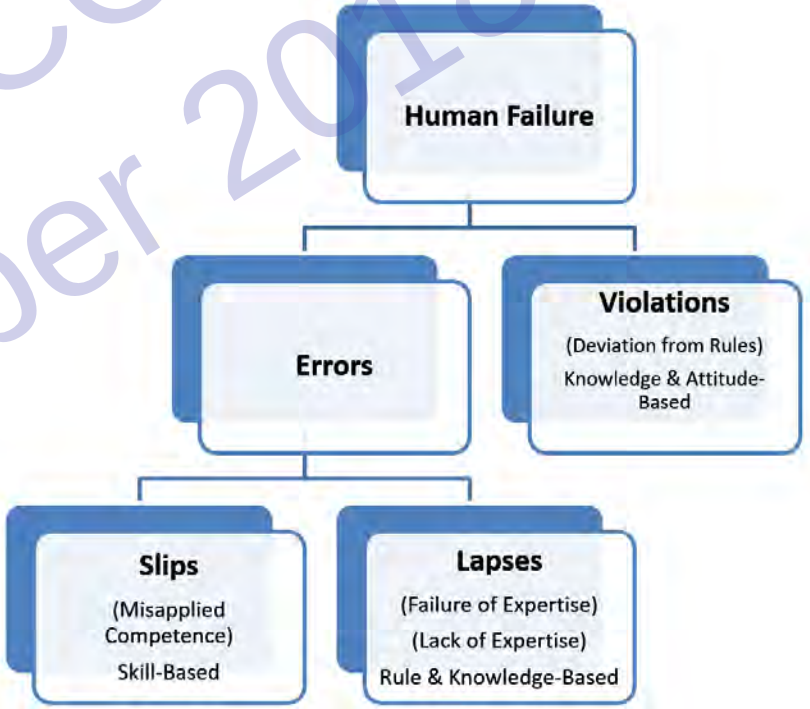
Levels of Processing

(Rassmusen, 1983)

Knowledge- Based
Improvisation in unfamiliar environments No routines or rules available for handling the situation
Rule-Based
Pre-packaged units of behaviour released when appropriate rule is applied: If the symptoms are X THEN the problem is Y IF the problem is Y THEN do Z
Skill Based
Automated routines requiring little conscious attention

Classification of Errors

(Reason, 1990)



Levels of Processing & Errors Framework

Attitude and Self-Evaluation	Causes of error
Importance placed on organizational and personal priorities and goals Attitudes and preconceptions of the technology Self-awareness and control Risk taking factors	Individual tendencies • Cognitive heuristics and biases • Physical and emotional state
Knowledge- Based	
Improvisation in unfamiliar environments No routines or rules available for handling the situation	Lack of expertise • Overload • Manual variability • Lack of knowledge of modes of use • Lack of awareness of consequences
Rule-Based	
Pre-packaged units of behaviour released when appropriate rule is applied: If the symptoms are X THEN the problem is Y IF the problem is Y THEN do Z	Failure of expertise Misapplied rules
Skill Based	
Automated routines requiring little conscious attention	Misapplied competence • Strong habit intrusions • Frequent invoked rule used inappropriately • Situational changes that do not trigger the need to change habits

Current Status

Model & user requirement specification

Evidence based test scenario development

Scenario 2 test application

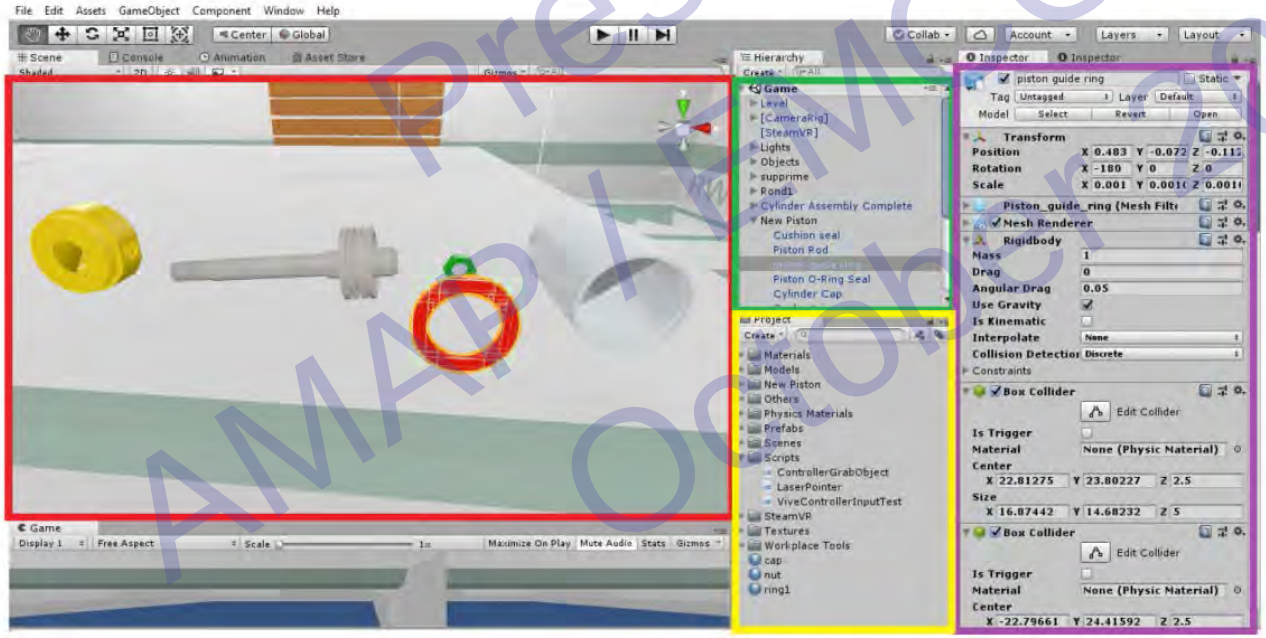
Evaluation research

Current Status

Test Tutorial Development

Development Engine Characteristics

Unity C#



Main Windows

- Scene
- Game
- Project
- Inspector

Future Direction

1. Complete development of initial test/demo application – run further ocus groups & interviews
2. Test and validate proposed framework for maintenance training
3. Pilots with local manufacturer & utilise results
4. Integrate results/feedback into final model/framework
5. Run studies across 4 different manufacturing contexts
6. Evaluate outcomes & report results

Other Developments: Eye Tracking in VR

(Tobii Pro & i Motions)

- Fixation durations/frequency
- Point of gaze and areas of interest
- Analysis of task design
- User processing

Questions