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Die Effizienzmacher.

Boosting Emerging Industries by Innovative Design.
UUX Intelligent Design Assistance
创新设计助力新兴产业——用户体验智能设计工具

2019 International Forum on Innovation and Emerging Industries Development

IEID 2019, Shanghai, China, September 2019

by ***Prof. Dr. Klaus P. Jantke***

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Abstract 摘要

To boost emerging industries, it is necessary to establish innovative design in such a way that it becomes routine. Methodologies and tools are not sufficient. Innovative design needs assistance by intelligent digital systems that are able to learn from prior experience, to make varying suggestions to human designers, developers, and domain experts and to adapt both former solutions from databases and human design artefacts to novel desires and requirements. Digital storyboarding is an original highly innovative design technology that is ready for application in different largely varying industries. Digital storyboarding will revolutionize industrial design by unprecedented precision, effectivity and effectiveness.

为了促进新兴产业的发展，进行创新设计是很必要的，而且创新设计应该成为一种惯例。传统的方法和工具是远远不够的，创新设计需要智能数字系统的帮助，这些系统能够从以前的经验中学习，为设计师、开发人员和领域专家提出各种各样的建议，还能够将数据库中原有设计的解决方案进行调整，来适应新的愿望和需求。

数字化故事板是一种高度原始性创新的设计技术，可以应用于各种不同的行业。数字化故事板将通过前所未有的精确性，有效性和高效性彻底改变工业设计。

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To boost emerging industries, it is necessary to establish innovative design in such a way that it becomes routine. Methodologies and tools are not sufficient. **Innovative design needs assistance by intelligent digital systems** that are able to learn from prior experience, to make varying suggestions to human designers, developers, and domain experts and to adapt both former solutions from databases and human design artefacts to novel desires and requirements. Digital storyboarding is an original highly innovative design technology that is ready for application in different largely varying industries. Digital storyboarding will revolutionize industrial design by unprecedented precision, effectivity and effectiveness.

为了促进新兴产业的发展，进行创新设计是很必要的，而且创新设计应该成为一种惯例。

创新设计需要智能数字系统的帮助。

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Outlook 展望

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创新设计需要智能数字系统的帮助…

This presentation provides the solution to the problem.

这个报告提出了解决方案。

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Interrupt [Begin]

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The Author‘s Goal 我们的目标

- **We aim at novel Chinese-German partnerships.**
- **我们的目标是打造创新型中德合作关系。**

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Interrupt [End]

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Design Processes 设计过程

include Research Methods like
- Interviews,
- Focus Groups,
- Questionnaires,
- Personas,
- Acceptance Testing,
- Requirement Analysis,

and Design Methods like
- Prototyping,
- Card Sorting,
- Design Thinking.

包括研究方法例如
- 访谈法,
- 焦点小组,
- 问卷调查,
- 人物角色,
- 接受性测试,
- 需求分析,

和设计方法例如
- 原型制作,
- 卡片分类,
- 设计思维。

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UUX Design Processes 用户体验设计程序

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All this is time consuming, expensive and error prone.
这一切都耗时、耗财，还容易出错。

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Digital Storyboarding 数字化故事板

is an innovative technology of system design including UUX design that applies to all emerging industries.
数字化故事板是一种系统设计（包括用户体验设计在内）的创新技术，可应用于所有新兴产业。

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Intelligent System Assistance for Digital Storyboarding is the Solution.

It results in

- reduced amount of man power,
- speed-up of knowledge acquisition,
- immediate digital documentation,
- integration of all process steps,
- higher quality of individual contributions and easier conflict resolution,
- evolution of a database of design patterns,
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数字化故事板的智能系统可以有效解决这个问题。

它可以

- 减少人力投入,
- 加速知识获取,
- 归档数字文件,
- 整合处理程序,
- 提升工作质量，简易解决冲突,
- 建立设计模式的数据库,
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The Power of Digital Storyboarding as an Innovative Design Technology is based on its Deep Theoretical Foundation

数字化故事板作为一种创新的设计技术，它强大的功能基于其深层理论基础。

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The Power of Digital Storyboarding
数字化故事板的强大功能

(i) **is based on an original storyboard concept**

以原始串联图版概念为基础

A *storyboard* is a hierarchical family of pin graphs $\mathcal{F} = [\{\mathcal{G}_i\}_{i=1,\ldots,k}, c]$ where c controls the conditions of graph substitution and every pin graph $\mathcal{G}_i$ of the form $[V_i, E_i, \gamma_i, P_i^{in}, P_i^{out}, Ep_i, sub_i]$ meets the following conditions

1.1 $[V_i, E_i]$ is a finite, directed, acyclic graph with the set of vertices V_i and the set of edges $E_i \subset V_i \times V_i$.

1.2 $\gamma_i : E_i \to HL$ assigns to every edge its logical conditions of usage relevant at branching points that may describe either alternatives or parallelism.

1.3 $P_i^{in} \cup P_i^{out}$ contains the pins, i.e., the input and output nodes $P_i^{in}, P_i^{out} \subseteq V_i$ as follows:
$P_i^{in} = \{v \mid v \in V_i \wedge \nexists u \in V_i((u,v) \in E_i)\}$
$P_i^{out} = \{v \mid v \in V_i \wedge \nexists u \in V_i((v,u) \in E_i)\}$

1.4 Vertices in $Ep_i \subseteq V_i$ are called episodes that are to be substituted by other graphs later on. $V_i \setminus Ep_i$ is called the set of scenes that have a semantics in the domain.

1.5 $sub_i : Ep_i \to 2^{\{1,\ldots k\}} \setminus \emptyset$ is a mapping that assings to every episode graphs for potential substitution.

1.6 The mapping $c : \{1, \ldots, k\} \to HL$ assigns to every graph logical conditions of usage in Horn logic HL.

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The Power of Digital Storyboarding
数字化故事板的强大功能

(ii) **is based on an original concept of storyboard expansion**

以串联图板拓展的初始概念为基础

When a certain substitution $\mathcal{G}_i[e \hookleftarrow \mathcal{G}_j]$ takes place, every node $d \in V_j$ is renamed to $e.d$. Accordingly, $e.V_j$ is shorthand for $\{e.d \mid d \in V_j\}$.

Based on this terminology, the expansion of an episode e in some graph $\mathcal{G}_i$ by an admissible graph $\mathcal{G}_j$ results in a pin graph $\mathcal{G}_i[e \hookleftarrow \mathcal{G}_j]$ of the form $[V, E, \gamma, P^{in}, P^{out}, Ep, sub]$ such that the following conditions are satisfied.

2.1 $V = (V_i \setminus \{e\}) \cup e.V_j$

2.2 $E = (E' \setminus E'') \cup E''' \cup E''''$

(a) $E' = E_i \cup e.E_j$

(b) $E'' = V_i \times \{e\} \cup \{e\} \times V_i$

(c) $E''' = \{v \mid (v, e) \in E_i\} \times P_j^{in}$

(d) $E'''' = P_j^{out} \times \{v \mid (e, v) \in E_i\}$

2.3 $\gamma(u, v) = \gamma_i(u, v)$ for $(u, v) \in E \cap E_i$ and $\gamma(e.u, e.v) = \gamma_j(u, v)$ for $(u, v) \in E_j$

2.4 $P^{in} = \begin{cases} (P_i^{in} \setminus \{e\}) \cup e.P_i^{in} & \text{if } e \in P_i^{in} \\ P_i^{in} & \text{otherwise} \end{cases}$

2.5 $P^{out} = \begin{cases} (P_i^{out} \setminus \{e\}) \cup e.P_i^{out} & \text{if } e \in P_i^{out} \\ P_i^{out} & \text{otherwise} \end{cases}$

2.6 $Ep = Ep_i \setminus \{e\} \cup e.Ep_j$

2.7 $sub = (sub_i \setminus \{(e, sub_i(e))\}) \cup \bigcup_{d \in C_j} \{(e.d, sub_j(d))\}$

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The Power of Digital Storyboarding
数字化故事板的强大功能

(iii) **is based on original design patterns and prototyping**

以原始设计模型和原型为基础

Given a digital storyboard $\mathcal{F} = [\{\mathcal{G}_i\}_{i=1,\ldots,k}, c]$, every graph $\mathcal{G}_i$ is a pattern. Patterns represent alternative, sometimes even opposing concepts of didactics, of ludology, of usability, of design, of media impact, and the like. The usage of any particular pattern $\mathcal{G}_i$ is controlled by its substitution condition $c(i)$.

Every storyboard $\mathcal{F}$ determines a rewrite relation $\Rightarrow_{\mathcal{F}}^*$. The elementary steps $\mathcal{G}' \Rightarrow_{\mathcal{F}} \mathcal{G}''$ are node expansions of the form $\mathcal{G}'' = \mathcal{G}'[e \hookleftarrow \mathcal{G}_i]$ and $\Rightarrow_{\mathcal{F}}^*$ denotes the reflexive, transitive closure of $\Rightarrow_{\mathcal{F}}$. It defines a formal graph language as follows:

$\mathcal{L}(\mathcal{F}) = \{ \mathcal{G} \mid \mathcal{G}_1 \Rightarrow_{\mathcal{F}} \mathcal{G} \wedge \mathcal{G} \textit{ irreducible w.r.t. } \Rightarrow_{\mathcal{F}} \}$

The space $\mathcal{L}(\mathcal{F})$ contains formal descriptions of all the possible experiences of human-system interaction.

Exploratory modification of a digital storyboard's substitution conditions is the most intuitive, simple and effective methodology of rapid prototyping.

… Hidden under the Hood
…背后隐藏的模型和算法

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Digital Storyboarding in Practical Application
数字化故事板的实际应用

for Professional Large Scale Training

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应用于

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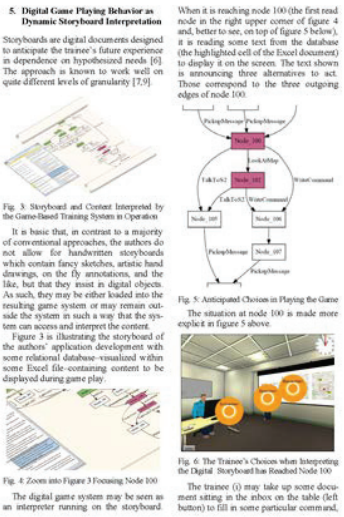

5. Digital Game Playing Behavior as Dynamic Storyboard Interpretation

Storyboards are digital documents designed to anticipate the trainee's future experience in dependence on hypothesized needs [6]. The approach is known to work well on quite different levels of granularity [7,9].

Fig. 3. Storyboard and Content Interpreted by the Game-Based Training System in Operation

It is basic that, in contrast to a majority of conventional approaches, the authors do not allow for handwritten storyboards which contain fancy sketches, artistic hand drawings, on the fly annotations, and the like, but that they insist in digital objects. As such, they may be either loaded into the resulting game system or may remain outside the system in such a way that the system can access and interpret the content.

Figure 3 is illustrating the storyboard of the authors' application development with some relational database-visualized within some Excel file-containing content to be displayed during game play.

Fig. 4. Zoom into Figure 3 Focusing Node 100

The digital game system may be seen as an interpreter running on the storyboard.

When it is reaching node 100 (the first read node in the right upper corner of figure 4 and, better to see, on top of figure 5 below), it is reading some text from the database (the highlighted cell of the Excel document) to display it on the screen. The text shown is announcing three alternatives to act. Those correspond to the three outgoing edges of node 100.

Fig. 5. Anticipated Choices in Playing the Game

The situation at node 100 is made more explicit in figure 5 above.

Fig. 6. The Trainee's Choices when Interpreting the Digital Storyboard has Reached Node 100

The trainee (i) may take up some document sitting in the inbox on the table (left button) to fill in some particular command,

https://www.researchgate.net/publication/266645266_Game-Based_Training_of_Executive_Staff_of_Professional_Disaster_Management_Storyboarding_Adaptivity_of_Game_Play

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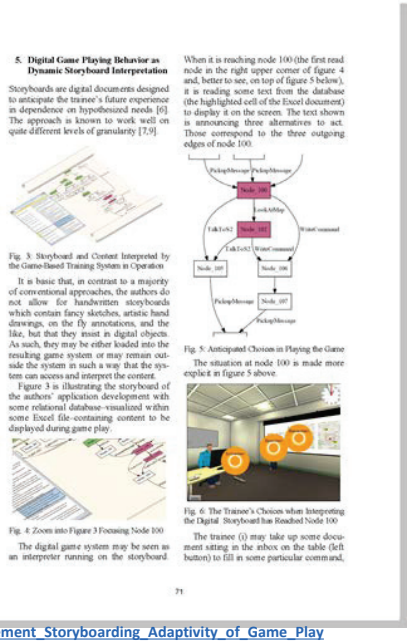

它可以

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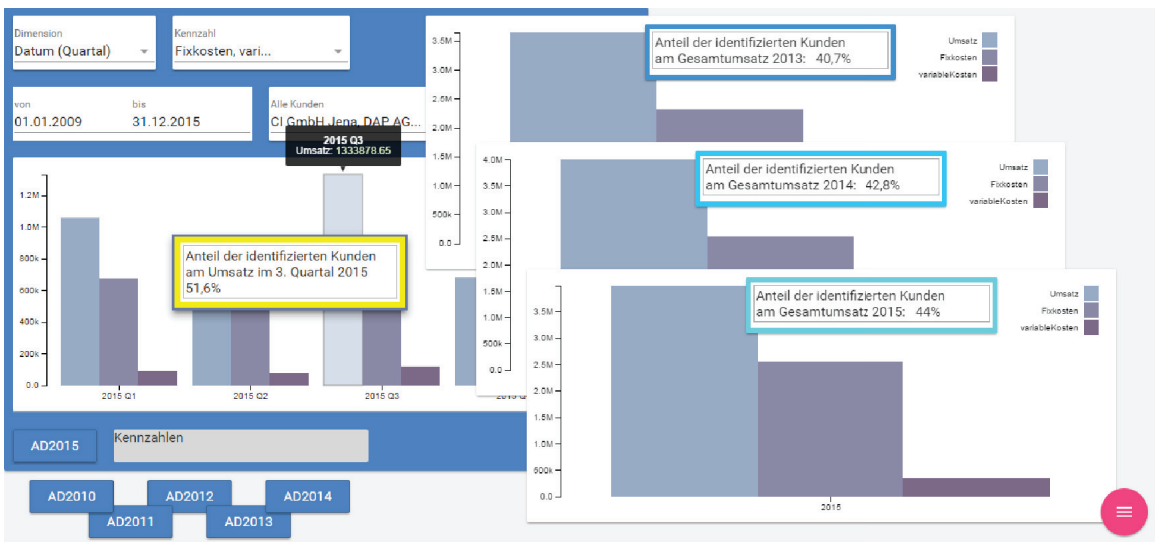

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Digital Storyboarding in Practical Application is a Technology to Boost Emerging Industries
数字化故事板的实际应用将成为繁荣新兴产业的技术手段

It demonstrates in reality

- **the potential to arrive at completely unforeseeable insights**
- **of high economic relevance.**

数字化故事板用事实告诉我们，
它具有巨大的潜力，可以为经济发展带来意想不到的未来。

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Thank you very much for your attention.
感谢您的倾听。

Let's make our dreams come true.
让我们一起变梦想为现实。

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