Computer-Assisted Lighting Design

The project aims at studying how light, matter and shape act together in synergies, at the convergence of Optical Science and Computer Graphics providing for more powerful representations of appearance. Such a high-level approach is in contrast with the main trend of modern Computer Graphics that study these light, shape and matter separately. The project aims also to take into account the communication processes from real world to virtual world (acquisition), from computer to observer (restitution). The resulting representations, algorithms and unified optimal/digital systems decrease the required computational resources in order to provide fast communication between the real world (original data, human users and sensors) and the digital 3D world and in order to develop new uses of Computer Graphics for scientists (mostly from Optical Science), artists, and industrial.

Contexte et atouts du poste

Full PDF (with pictures)

Keywords
Lighting, shape, material, photography, computer graphics, perception

Scientific research context
Lighting design finds its roots in traditional painting, and has been expanded as an art form of its own with the advent of photography, modern theater and cinema. Practitioners routinely use an extensive set of tricks and technical know-how to better communicate shape, materials and space on either print, stage or film [1]. One could have thought that with the introduction of computer graphics, this practice would have been deeply changed. Yet most of the traditional knowledge is still widely applied as is to synthetic image production.

Only a few computer graphics methods have investigated lighting design per se. Some methods focus on artistic control rather than physical plausibility by bending light rays [2]. Other approaches manipulate existing environment lighting in a plausible manner to either comply to user annotations [3] or photographer tricks to depict materials [4].


Mission confiée

Informations générales
- Thème/Domaine : Interaction et visualisation
- Ville : Talence
- Centre Inria : CRI Bordeaux - Sud-Ouest
- Date de prise de fonction souhaitée : 2019-10-01
- Durée de contrat : 3 ans
- Date limite pour postuler : 2019-04-14

Contacts
- Equipe Inria : MANAO
- Directeur de thèse : Barla Pascal / pascal.barla@inria.fr

A propos d'Inria
Inria, l'institut national de recherche dédié aux sciences du numérique, promeut l'excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l'interface d'autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir
Curiosity about animation, sketching, computer graphics.

Personal interest for drawing and 2D animation would be a plus.

Consignes pour postuler
Thank you to send:
- CV
- Cover letter
- Master marks and ranking
- Support letter(s)

Sécurité défense :
Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité,
Work description

The main objective of this PhD is two-fold: understand how 3D shape and material are efficiently communicated using clever lighting designs; and develop new tools to semi-automatically control lighting in synthetic 3D scenes. The developed methods may be static (as in product or environment design) or dynamic (as with visual effects and games), and possibly constrained (as in museography or theater). Depending on the final application, the results may be non-physical to some extent, or predictable if they are to be reproduced with real-world lighting.

In contrast to previous work, the goal of the thesis is to provide explanatory models that both rely on the physics of the imaging process and its perception by the human visual system.

The method we would like to pursue is organized in two stages: first establish relationships between image properties, and properties of shape and materials in a 3D scene; second, provide tools that assist artists in producing lighting environments that exploit these relationships to best convey shape and materials in rendered images. We took that approach in previous work in the restricted context of objects made of anisotropic materials (e.g., brushed metals) lit by a single directional light source [6]. We made use of a differential analysis of image formation to establish image-scene relationships, and optimization to automatically find the lighting direction that produces highlights of a desired shape on a given 3D object.

In this thesis, we intend to go farther by considering a much wider class of materials (plastics, metals, matte, skin, etc), by analyzing larger surface regions, and by expressing the result of the analysis in 3D space so that it may be used to directly guide artists in the lighting design task. We prefer such a computer-assisted approach over a fully automatic one as lighting design solutions may vary depending on the target application and artist's style. This variability is precisely what makes lighting design a difficult endeavor, and computer assistance a promising improvement. Validation will likely require to work with colleagues in Human Vision such as Sylvia Pont from TU Delft, with whom we have an ongoing collaboration on the topic.


Principales activités

- Perform bibliographic study
- Develop a prototype application
- Write research papers
- Present at conferences

Compétences

The successful post-doc candidate should have taken courses in Computer Graphics and/or Computer Vision, and have a good experience in C++ programming. An experience in either sketch-based
techniques or expressive rendering is required.

Languages:
French or English

Avantages
- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération
1982€ / month (before taxes) during the first 2 years, 2085€ / month (before taxes) during the third year.