

Cold formed steel shear wall design pdhonline com Handbook

cold formed steel shear wall design pdhonline com is a critical topic for engineers and architects involved in the design and construction of resilient, efficient, and sustainable structures. As modern building demands evolve, the use of cold-formed steel (CFS) shear walls has gained popularity due to their lightweight nature, ease of installation, cost-effectiveness, and excellent load-bearing capabilities. This article provides a comprehensive overview of cold formed steel shear wall design, emphasizing best practices, design principles, and resources available through PDHonline.com for continuing education and professional development.

Understanding Cold Formed Steel Shear Walls

What Are Cold Formed Steel Shear Walls?

Cold formed steel shear walls are vertical structural elements constructed from thin gauge steel sheets that are shaped or "formed" at room temperature. They serve as lateral force-resisting systems in buildings, primarily designed to withstand wind, seismic, and other lateral loads. Their primary function is to prevent excessive building sway and structural damage during lateral force events.

Advantages of Cold Formed Steel Shear Walls

- Lightweight and easy to handle, reducing construction time and labor costs
- High strength-to-weight ratio, providing effective lateral resistance
- Corrosion-resistant options available with protective coatings
- Versatile design suitable for various building types and heights
- Compatibility with other structural systems, facilitating flexible architectural design
- Recyclable and environmentally friendly material

Design Principles of Cold Formed Steel Shear Walls

Structural Requirements and Considerations

Designing effective cold formed steel shear walls involves understanding the structural performance under lateral loads, including:

- Strength capacity to resist maximum expected forces
- Deformation limits to prevent excessive sway and damage
- Stability against buckling and local failure modes
- Compatibility with the overall building system

Key Components of CFS Shear Walls

- Sheathing Panels: Typically, steel panels, gypsum board, or engineered wood panels attached to framing members
- Framing Members: Cold-formed steel studs and tracks providing structural support
- Anchorage and Bracing: To transfer lateral loads effectively to the foundation
- Fasteners and Connectors: Bolts, screws, or welds ensuring structural integrity

Design Steps and Methodology

- Determine Load Requirements: Calculate the expected lateral forces based on wind and seismic data.
- Select Appropriate Materials and Components: Choose steel gauge, panel types, and fasteners based on load requirements.
- Design Shear Wall Layout: Optimize wall placement for maximum efficiency.
- Calculate Shear Wall Shear Capacity: Using relevant codes and standards, verify that the wall can withstand the lateral forces.
- Assess Buckling and Local Failure Modes: Ensure that panels and framing resist buckling.
- Detail Connection and Anchorage: Design connections to transfer forces safely to the foundation.

Design Codes, Standards, and Resources

Relevant Building Codes and Standards

Designing cold formed steel shear walls must adhere to accepted standards such as:

- American Iron and Steel Institute (AISI) S100 ? North American Specification for the Design of Cold-Formed Steel Structural Members
- ACI 318 ? Building Code Requirements for Structural Concrete (for anchorage design)
- ASCE 7 ? Minimum Design Loads for Buildings and Other Structures
- IBC ? International Building Code

PDHonline.com Resources for CFS Shear Wall Design

PDHonline.com offers various professional development courses focusing on steel design, lateral load resistance, and cold-formed steel structures. These courses provide:

- In-depth tutorials on design principles
- Case studies and practical examples
- Updates on the latest standards and best practices
- Certification to enhance professional credentials

By utilizing PDHonline.com, engineers can stay current with evolving design methodologies and ensure compliance with industry standards.

Design Challenges and Solutions in Cold Formed Steel Shear Walls

Common Challenges

- Buckling of Thin Steel Members: Due to their slenderness, CFS members are prone to local and global buckling.
- Connection Failures: Improper fastening can lead to failure under load.
- Material Variability: Differences in steel gauge and coating can affect performance.
- Seismic and Wind Load Variability: Designing for unpredictable lateral forces requires careful analysis.

Solutions and Best Practices

- Use of Incorporating Edge Bracing and Stiffeners: To prevent buckling.
- Proper Connection Detailing: Ensuring fasteners and welds are designed to handle the forces.
- Material Testing and Quality Control: To verify material properties meet specifications.
- Advanced Analysis Techniques: Including finite element modeling for complex structures.

Design Examples and Case Studies

Example 1: High-Rise Building Shear Wall Design

A typical design involves calculating the maximum lateral load based on wind and seismic data, then selecting a CFS shear wall system capable of resisting these loads through appropriate panel and framing configurations. The example demonstrates load calculations, component selection, and

detailing.

Example 2: Retrofit of Existing Buildings

Adding cold formed steel shear walls to an existing structure can significantly improve lateral resistance. This case study explores the process of assessment, detailing, and installation.

Conclusion: The Future of Cold Formed Steel Shear Walls

Cold formed steel shear walls represent a modern, efficient solution for lateral load resistance in various building types. As technology advances and standards evolve, their application will continue to expand, offering sustainable and cost-effective options for engineers and architects. Resources like PDHonline.com are invaluable for continuing education, ensuring professionals stay informed about best practices, innovative techniques, and compliance requirements.

References and Further Reading

- AISI S100 ? North American Specification for the Design of Cold-Formed Steel Structural Members
- ASCE 7 ? Minimum Design Loads for Buildings and Other Structures
- PDHonline.com Course Catalog on Steel Design and Lateral Force Resistance
- Building codes: IBC, local amendments

In summary, designing cold formed steel shear walls requires a thorough understanding of structural principles, adherence to standards, and careful detailing. With the increasing demand for resilient structures, mastering CFS shear wall design is essential for modern structural engineers. Utilizing educational resources like PDHonline.com enhances professional competence and ensures designs are safe, efficient, and compliant.

Cold Formed Steel Shear Wall Design pdhonline com has become an increasingly important topic in structural engineering, especially as architects and engineers seek lightweight, cost-effective, and durable solutions for lateral load resistance. As building codes evolve and the demand for efficient seismic and wind-resistant structures grows, understanding the principles, best practices, and design considerations for cold formed steel (CFS) shear walls is essential for professionals in the field. This comprehensive guide aims to provide an in-depth overview of cold formed steel shear wall design, referencing resources like pdhonline.com and integrating current standards, methodologies, and practical tips.

Introduction to Cold Formed Steel Shear Walls

Cold formed steel (CFS), also known as light gauge steel, is a versatile construction material characterized by its thinness, high strength-to-weight ratio, and ease of fabrication. When used as shear walls, CFS panels serve as a key component in resisting lateral loads caused by wind, seismic forces, or other dynamic actions.

Why Use Cold Formed Steel for Shear Walls?

- Lightweight and Efficient: Easier to handle and install compared to traditional steel or concrete walls.
- Cost-Effective: Reduced material and labor costs.
- Design Flexibility: Can be prefabricated and tailored to specific building geometries.
- Sustainability: Often made from recycled steel and recyclable at end of life.

Fundamental Principles of Shear Wall Design

What is a Shear Wall?

A shear wall is a structural element that provides lateral resistance in a building. It transfers lateral loads from the structure to the foundation, preventing excessive sway or failure during events like earthquakes or strong winds.

Key Functions of Shear Walls

- Resist shear forces
- Provide stiffness to limit drift
- Contribute to overall building stability

Design Framework for Cold Formed Steel Shear Walls

Designing CFS shear walls involves adhering to established codes, understanding material properties, and implementing proper detailing to ensure strength, stiffness, and ductility.

Reference Standards and Resources

- ACI 318: Building code requirements for structural concrete (for related design considerations)
- ASCE 7: Minimum design loads and associated criteria
- AISI S100 / S200: North American standards for cold-formed steel design
- PDHonline.com: Offers professional development courses and resources on structural steel

design, including CFS shear walls.

Step-by-Step Guide to Cold Formed Steel Shear Wall Design

- Define Structural Loads and Building Requirements
 - Determine dead loads and live loads
 - Calculate lateral loads based on wind, seismic, or other forces
 - Establish building height, geometry, and occupancy
- Select Appropriate Materials and Components
 - Choose steel gauge thickness based on load requirements
 - Select sheathing materials (gypsum, metal panels, or other sheathing)
 - Determine connection types (bolted, welded, screw-fastened)
- Establish Shear Wall Layout and Dimensions
 - Identify locations for shear walls considering architectural and structural constraints
 - Define panel dimensions, typically using standard sheet sizes (e.g., 4x8 ft)
 - Plan for openings such as windows and doors, ensuring proper detailing
- Structural Analysis and Design
 - Calculate shear capacity of the CFS panel
 - Verify axial and shear forces transferred through framing
 - Ensure ductility and energy dissipation requirements are met, especially for seismic zones

Design Considerations Specific to Cold Formed Steel Shear Walls

Material Properties

- Yield strength (F_y): Typically 33 ksi (230 MPa) or higher for premium gauges
- Modulus of elasticity (E): Approximately 29,000 ksi (200 GPa)
- Thickness: Ranges from 0.015 to 0.075 inches depending on design

Framing and Sheathing

- Use of studs and tracks with appropriate spacing (commonly 16" or 24" on center)
- Sheathing continuity and proper fastening to prevent local buckling
- Incorporation of hold-downs or moment frames at critical points

Connection Detailing

- Bolted or screw fasteners designed to resist shear and tension
- Use of clips or z-girts to enhance panel stability
- Proper anchorage to foundation and framing

Structural Analysis Methods

- Simplified methods: Allow quick assessment based on standardized capacities
- Finite element analysis (FEA): For complex geometries or high-performance requirements
- Load transfer mechanisms: Understanding how shear forces flow through panel, framing, and connections

Shear Wall Design Checks and Verification

- Shear capacity check: Ensure that the wall's capacity exceeds applied shear forces
- Drift limits: Confirm that lateral displacements stay within acceptable limits per code
- Buckling considerations: Evaluate local, distortional, and global buckling modes
- Ductility and energy dissipation: Especially in seismic zones, verify that the system can deform plastically without failure

Practical Tips for Effective Cold Formed Steel Shear Wall Design

- Optimize panel layout: Minimize openings and discontinuities
- Use continuous fasteners: To prevent local buckling and improve load transfer
- Incorporate stiffeners: At high-stress points or openings

- Ensure quality control: During fabrication and installation to meet code requirements
- Consult resources like pdhonline.com: For courses, design guides, and code updates

Common Challenges and How to Address Them

| Challenge | Solution |

| --- | --- |

| Local buckling of thin steel | Use stiffeners, increase thickness, or reduce panel span |

| Inadequate anchorage | Design robust hold-downs and foundation connections |

| Openings weakening shear capacity | Reinforce around openings with additional framing or blocking |

| Seismic detailing | Incorporate ductility and energy dissipation features per code |

Summary: Best Practices for Cold Formed Steel Shear Wall Design

- Follow established building codes and standards (AISI, ASCE, IBC)
- Perform thorough structural analysis considering all load paths
- Design for ductility and energy dissipation, especially in seismic zones
- Prioritize proper detailing, connection design, and quality control
- Utilize professional resources such as pdhonline.com for ongoing education and updates

Conclusion

Cold Formed Steel Shear Wall Design pdhonline com offers a comprehensive approach to creating resilient, efficient, and cost-effective lateral load resisting systems. With proper understanding of material properties, detailing, and analysis techniques, engineers can leverage CFS shear walls to meet modern building demands. As the industry continues to evolve, staying informed through professional development resources and adhering to best practices remains essential for successful design and construction.

References & Resources

- AISI S100-16: North American Specification for the Design of Cold-Formed Steel Structural Members

- ASCE 7-16: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- PDHonline courses on cold formed steel design
- Local building codes and seismic design standards

Note: Always verify your design with current codes and consult with licensed structural engineers. This guide serves as an educational overview and should be supplemented with detailed analysis and professional judgment.

Question What are the key considerations in cold formed steel shear wall design according to PDHOnline resources? Key considerations include understanding the load paths, ensuring adequate shear capacity, proper panel detailing, and adherence to relevant codes and standards to optimize the strength and stability of cold formed steel shear walls. How does PDHOnline recommend calculating the shear capacity of cold formed steel shear walls? PDHOnline suggests using the provisions outlined in AISI S100 and related standards, including considering the material properties, panel thickness, fastener type and spacing, and load transfer mechanisms to accurately determine shear capacity. What are common design pitfalls in cold formed steel shear walls highlighted by PDHOnline courses? Common pitfalls include insufficient fastening, inadequate panel bracing, neglecting local buckling, and not complying with code requirements, which can compromise the wall's performance. Are there specific load combinations for cold formed steel shear wall design discussed in PDHOnline materials? Yes, PDHOnline emphasizes following the load combinations specified in structural design codes such as ASCE 7 and AISI S100, which account for live loads, dead loads, wind, and seismic forces. What methods does PDHOnline recommend for testing or verifying cold formed steel shear wall designs? PDHOnline recommends a combination of analytical methods based on code provisions, finite element modeling, and physical testing to validate the shear wall's performance under various load conditions. How does PDHOnline address the seismic design considerations for cold formed steel shear walls? PDHOnline emphasizes incorporating seismic design provisions from relevant codes, ensuring ductility, detailing to prevent failure modes such as shear or buckling, and considering lateral load-resisting capabilities. What are the advantages of using cold formed steel for shear walls according to PDHOnline? Advantages include lightweight construction, ease of fabrication, cost-effectiveness, high strength-to-weight ratio, and flexibility in design, making cold formed steel an efficient choice for shear walls. Where can I access PDHOnline courses or resources on cold formed steel shear wall design? PDHOnline offers online courses and resources on cold formed steel design through their website at pdhonline.com, providing technical training and continuing education for engineers and designers.

Related keywords: cold formed steel shear wall, shear wall design, cold formed steel framing, lateral load resistance, seismic design, structural engineering, pdh online courses, steel wall analysis, building retrofit, steel framing standards

Charlotte and peter fiell

Charlotte and Peter Fiell are renowned figures in the world of design, architecture, and contemporary visual culture. Their collaborative work as authors, researchers, and curators has significantly influenced how we perceive design history and its impact on modern society. With a keen eye for detail and a passion for uncovering the stories behind iconic objects and movements, Charlotte and Peter Fiell have established themselves as authoritative voices in the field. This article delves into their backgrounds, contributions, notable publications, and their lasting influence on design scholarship.

Who Are Charlotte and Peter Fiell?

Background and Career Overview

Charlotte and Peter Fiell are British design historians and authors celebrated for their extensive work on design history and contemporary design trends. Their collaborative efforts have resulted in numerous influential publications that are widely used by students, professionals, and enthusiasts alike.

Charlotte Fiell's academic background is rooted in art and design history, which she has combined with her keen interest in the cultural aspects of design. Peter Fiell, on the other hand, is recognized for his expertise in design criticism and his ability to contextualize design within broader social and cultural frameworks.

Together, they have spent decades researching, writing, and curating exhibitions that highlight the evolution of design from the early modern period to the present day.

Major Contributions to Design Literature

Key Publications

The Fiells are perhaps best known for their comprehensive and visually engaging books that explore various facets of design. Some of their most influential publications include:

- **Design of the 20th Century** ? A definitive guide that chronicles the development of design over the last hundred years, covering everything from industrial design to graphic arts.
- **1000 Lights** ? An extensive survey of lighting design, showcasing innovations and iconic fixtures from around the world.
- **Furniture Design** ? An in-depth look at the evolution of furniture, highlighting key designers and

movements that shaped modern interiors.

- **Design Culture: An Anthology** ? A collection of essays and case studies that examine the cultural significance of design across different eras and regions.

Their books are characterized by their rich visual content, combining high-quality photographs, detailed illustrations, and insightful analysis, making them invaluable resources for understanding the history and significance of design.

Curatorial and Exhibition Work

Beyond their publications, Charlotte and Peter Fiell have curated numerous exhibitions that have traveled worldwide. These exhibitions often serve as visual narratives that bring their written work to life, engaging audiences with immersive experiences.

Some notable exhibitions include:

- Modern Masters: Design in the 20th Century ? Showcasing key works from influential designers.
- Lighting the Future ? Exploring innovations in lighting technology and design.
- Furniture of the 21st Century ? Highlighting contemporary trends and emerging designers.

Their curatorial work emphasizes the importance of storytelling in design and underscores the social, cultural, and technological factors that influence creative practices.

Their Approach to Design History

Interdisciplinary Perspective

Charlotte and Peter Fiell advocate for an interdisciplinary approach to understanding design. They believe that design cannot be studied in isolation but must be contextualized within cultural, political, and technological frameworks.

This perspective allows their work to:

- Connect design movements with historical events.
- Analyze the societal impact of technological innovations.
- Explore the ways design reflects cultural identities.

Visual Emphasis

A hallmark of their publications is the emphasis on visual content. They understand that design is a highly visual discipline, and their books are often praised for their stunning imagery that complements scholarly analysis.

This visual focus:

- Enhances reader engagement.
- Provides a comprehensive understanding of design objects.
- Inspires designers and enthusiasts alike.

Influence and Legacy

Educational Impact

Charlotte and Peter Fiell's work has become standard reading in design education worldwide. Their books are frequently cited in university courses on design history, industrial design, and visual culture.

Their clear explanations and rich visuals make complex subject matter accessible to students and newcomers to the field.

Inspiring Contemporary Designers

Many modern designers cite the Fiells' publications as sources of inspiration. Their detailed case studies and historical insights help emerging designers appreciate the roots of their craft and the evolution of design principles.

Promoting Design Awareness

Through their exhibitions and writings, the Fiells have helped raise public awareness about the importance of design in everyday life. They emphasize that good design is not only functional but also culturally meaningful and aesthetically compelling.

Notable Awards and Recognitions

Over the years, Charlotte and Peter Fiell have received numerous accolades for their contributions to design scholarship and publishing, including:

- Design awards from major institutions.

- Recognition for their influence in curatorial practices.
- Honorary mentions for promoting design literacy worldwide.

Conclusion

Charlotte and Peter Fiell are pivotal figures in the understanding and appreciation of design. Their work bridges scholarly research and popular engagement, making complex design histories accessible and compelling. Whether through their meticulously researched books, inspiring exhibitions, or educational initiatives, they continue to shape the discourse around design's role in culture and society. For anyone interested in the evolution of design or seeking to deepen their appreciation of creative innovation, exploring the work of Charlotte and Peter Fiell offers valuable insights and inspiration.

Keywords: Charlotte and Peter Fiell, design history, design books, design exhibitions, influential designers, contemporary design, visual culture, design education, industrial design, furniture design, lighting design

Charlotte and Peter Fiell are renowned names in the world of design, architecture, and contemporary culture. Their collaborative work as authors, curators, and commentators has significantly shaped how audiences engage with design history and innovation. This dynamic duo's influence extends across numerous publications, exhibitions, and educational initiatives, making them pivotal figures for anyone interested in the evolution of design and its cultural implications. In this guide, we'll explore their backgrounds, key contributions, notable publications, and the enduring impact they have had on the field of design.

Who Are Charlotte and Peter Fiell?

Charlotte and Peter Fiell are a married couple with a shared passion for design. Their combined expertise spans decades, during which they have authored influential books, curated exhibitions, and contributed to scholarly discussions on design's role in society. Their work often blurs the lines between academic analysis and accessible storytelling, making complex topics approachable for both specialists and general readers.

Backgrounds and Expertise

- Charlotte Fiell: Charlotte has a background rooted in design history and cultural studies. Her focus often emphasizes contemporary design movements and their socio-cultural contexts.
- Peter Fiell: With a robust background in industrial design and architecture, Peter's insights

frequently delve into design innovation, craftsmanship, and technological advancements.

Together, their complementary skills allow them to craft comprehensive narratives that contextualize design within broader historical, technological, and cultural frameworks.

Major Contributions and Notable Works

Influential Publications

The Fiell couple has authored and edited numerous books that have become staples in the fields of design and architecture. Some of their most notable publications include:

- "1000 Chairs" (2002): An exhaustive survey of chair design, exploring its evolution from functional object to icon of style and artistic expression.
- "Design of the 20th Century" (1999): A comprehensive overview of the century's most influential designers, movements, and innovations.
- "The Story of Design" (2012): A richly illustrated narrative tracing the history of design from prehistory to the digital age.
- "Fashion Design": Exploring the trajectory of fashion as an integral aspect of cultural expression and innovation.
- "The FIELL Collection": A series highlighting iconic design pieces, offering insights into their creation and significance.

Curatorial and Exhibition Work

Beyond their writing, Charlotte and Peter Fiell have curated numerous exhibitions showcasing design history and contemporary innovation. Their curatorial approach often emphasizes storytelling, contextualizing objects within cultural and societal shifts.

Educational Impact

Their work has been influential in academic settings, inspiring curricula, lectures, and seminars that

introduce students and professionals alike to the richness of design history.

The Fiell Approach to Design

The Fiell duo's methodology combines rigorous research with engaging storytelling. They aim to:

- Make Design Accessible: Simplify complex concepts without sacrificing depth, making design history approachable for a broad audience.
- Highlight Cultural Contexts: Emphasize how design reflects, influences, and responds to societal changes.
- Showcase Innovation: Celebrate the creative process behind iconic objects, emphasizing craftsmanship, technology, and artistic vision.
- Foster Appreciation for Craftsmanship: Recognize the skill and artistry involved in design, encouraging respect for both historical and contemporary designers.

Key Themes in Their Work

- The Evolution of Design

Charlotte and Peter Fiell trace how design has evolved over centuries, influenced by technological advancements, cultural shifts, and economic factors. From early craftsmanship to mass production and digital design, they highlight pivotal moments and figures.

- The Intersection of Art and Function

Their work often explores how functional objects become symbols of aesthetic movement, reflecting societal values and individual identity.

- Sustainability and Future Trends

Recent writings emphasize the importance of sustainable design and innovation in addressing

global challenges, positioning the Fiell couple as forward-thinking commentators.

- Design as a Cultural Phenomenon

They argue that design is not merely about objects but is deeply intertwined with cultural narratives, politics, and social change.

Influence and Legacy

Charlotte and Peter Fiell have played a crucial role in elevating the discourse around design, blending scholarly rigor with popular appeal. Their publications are widely used in academic courses, while their exhibitions and public talks inspire a broader appreciation for design's role in shaping human experience.

Key Contributions to the Field

- Bridging Academic and Popular Audiences: Their work makes scholarly insights accessible, fostering a wider appreciation.

- Documenting Design History: Their comprehensive catalogs serve as essential references.

- Encouraging Critical Engagement: They challenge audiences to consider design's impact on society and the environment.

Conclusion: The Enduring Impact of Charlotte and Peter Fiell

In sum, Charlotte and Peter Fiell have established themselves as influential voices in the study and celebration of design. Their collaborative efforts have produced a body of work that is both academically rigorous and broadly accessible, shaping how we understand the history, present, and future of design. Whether through their books, exhibitions, or lectures, they continue to inspire new generations of designers, historians, and enthusiasts to appreciate the artistry, innovation, and cultural significance of design objects and movements.

Their legacy underscores the idea that design is not just about aesthetics but a vital part of human culture—an ongoing dialogue between function, form, and society. As the world faces new challenges and opportunities, the insights and enthusiasm of Charlotte and Peter Fiell remain vital sources of inspiration and knowledge in the ever-evolving landscape of design.

QuestionAnswer Who are Charlotte and Peter Fiell in the design world? Charlotte and Peter Fiell are renowned design historians, authors, and curators known for their influential books and contributions to design education and appreciation. What are some notable works by Charlotte and Peter Fiell? Their notable works include 'Design of the 20th Century', 'Furniture Design', and 'The Story of Graphic Design', which are widely regarded as essential references in the field. How have Charlotte and Peter Fiell influenced design history? Through their comprehensive publications and exhibitions, they have significantly shaped the understanding and appreciation of modern and contemporary design worldwide. Are Charlotte and Peter Fiell involved in any design exhibitions? Yes, they have curated numerous exhibitions on design topics, showcasing their expertise and promoting design awareness in museums and galleries globally. What is the focus of Charlotte and Peter Fiell's writing? Their writing primarily focuses on the history, evolution, and cultural impact of design, covering areas like furniture, graphic design, and industrial design. Have Charlotte and Peter Fiell received any awards for their work? Yes, they have received several awards and honors recognizing their contributions to design scholarship and publishing. Are Charlotte and Peter Fiell involved in teaching or academic work? While primarily known as authors and curators, they have also contributed to academic programs and lectures related to design history. Where can I find the works of Charlotte and Peter Fiell? Their books are available in major bookstores, online retailers, and libraries, and their exhibitions have been held at prominent museums worldwide. What impact have Charlotte and Peter Fiell had on design education? They have influenced design education by providing comprehensive resources and inspiring new generations of designers and historians. Are Charlotte and Peter Fiell still active in the design community? As of the latest information, they continue to contribute through writing, curating, and participating in design discussions and events.

Related keywords: design, architecture, interior design, furniture, lighting, visual inspiration, design authors, modern design, Scandinavian design, design books

Read the full article online: [Charlotte and peter fiell](#)